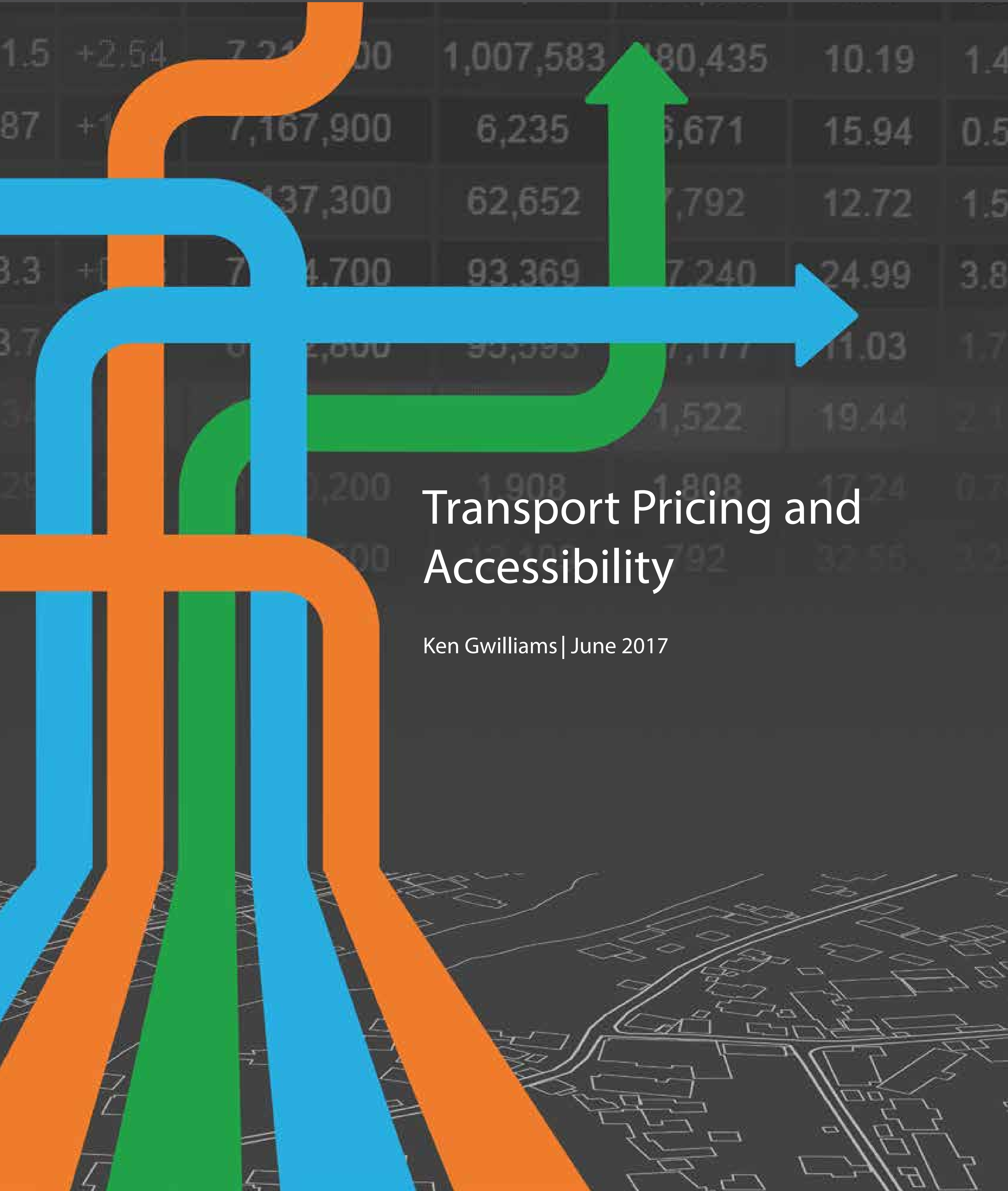
MOVING TO ACCESS
BROOKINGS



Transport Pricing and Accessibility

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Table of Contents

Executive summary 3

Introduction 4

1. Accessibility, investment, and transport pricing 7

2. Transport pricing interventions and cash transfers..................6

3. The complex objectives of transport pricing..................12

4. Appraising subsidies..................18

5. Subsidizing ‘goods’: supply-side interventions..................23

6. Subsidizing ‘goods’: Demand-side interventions..................29

7. The effects of taxing ‘bads’..................33

Conclusion 37

References..................41

Endnotes..................45

Executive summary

A common criticism of urban transport strategies is that they are unduly concerned with mobility or the ability to move rather than accessibility in which a desired journey purpose can be satisfied. It is often further argued that a consequence of this focus on mobility, particularly motorized mobility, is that transport is not affordable to the poor, and that this exclusion justified the use of subsidies to remedy the situation. A key element of "Moving to Access" is thus concerned with increasing the affordability of transport for the poor. The objective of this paper is to explore the relationships between mobility, accessibility, affordability and transport prices and subsidies in more detail with a view to better reconciling the economic efficiency of the urban transport systems with the welfare of the poor. That generates three main areas of inquiry, namely:

- The approach to accessibility
- The approach to affordability through transport subsidy
- The reconciliation of efficiency pricing with equity considerations.

While there is a long history of theoretical and practical discussion of transport pricing and subsidies, there are a number of factors that call for further review and reconsideration. Among those factors are the increasing use of cash transfers and conditional cash transfers as a redistributional mechanism and the advances in information technology that enhance targeting of subsidies. In addition, the uptake of pricing strategies to address congestion and environmental effects raises concerns regarding equity and the impact on accessibility of low-income households.

This paper takes these factors into consideration in updating the theoretical as well as practical application of pricing instruments. It offers a framework for assessing alternative pricing strategies and indicates areas for further investigation.

The policy conclusions may be briefly encapsulated. First, accessibility is preferable to mobility as a policy objective but it is not necessarily more pro-poor than focusing on mobility, unless accompanied by other measures such as land use changes and revolutionized investment criteria, to make it so. Second, assistance to the poor is more efficiently delivered through direct cash transfers than through service subsidies. Subsidizing transport services, either on the supply side or demand side, is likely to be the best policy for assisting the poor only in the case of merit goods where the consumer may not make the socially optimal use of the normally preferable direct cash transfers. Third, however, this does not mean that transport pricing is unimportant for welfare distribution, as there are many applications of pricing policy aimed at improving the overall efficiency of the transport sector that may have very significant impacts on the welfare of the poor. Formally analyzing the distributional effects of these policy applications, and seeking acceptably pro-poor variants can be very important.

Introduction

Objective of the paper

A common criticism of urban transport strategies is that they are unduly concerned with motorized mobility. Litman (2014) presents this as a "mobility/productivity paradox," arguing that mobility per se does not necessarily contribute to increased productivity. It is further argued that a consequence of focusing on mobility is that transport is not affordable to the poor, and that this exclusion justifies the use of subsidies. "Moving to access" is thus seen as synonymous with increasing the affordability of transport for the poor. The objective of this paper is to explore these relationships in greater detail, and particularly to understand how transport prices and subsidies impact accessibility and the welfare of the poor.

Concepts

Some terms in the transport strategy process are used very loosely, and often inconsistently, in public discussion. For the sake of clarity, we commence with definitions of how the focal terms of mobility, accessibility, affordability, and subsidy are used in this paper.

Mobility

The term mobility is used in two related but slightly different ways. First, mobility may refer to the ability to move—which we refer to as potential mobility. Potential mobility may be constrained by the speed at which it is possible to travel, the cost incurred as a result of traveling, and any other characteristic (for example, comfort) that affects the individual's desire to travel. These elements may be combined to give what is called the generalized cost of travel. A reduction in average generalized costs may thus be referred to as an increase in potential mobility.

Second, mobility may refer to the total amount of movement, which we refer to as aggregate mobility. A reduction in average generalized costs may lead to increased trip lengths or number of trips, so that the total amount of movement may be increased. That increase may be a good thing, as it broadens the range of trip opportunities for the individual, allowing new or better activity locations to be accessed. However, if there are any unpriced negative externalities of consumption, such as congestion or environmental degradation, then the increase in mobility may lead to increased total social cost.

Accessibility

Accessibility is also used in two ways. In its narrowest sense—which we refer to as potential accessibility—it concerns the ease with which a desired journey purpose or set of journey purposes can be satisfied by an individual, as well as the quality of the facilities that may be accessed. Potential accessibility is also affected by the generalized costs of travel, including time, money, and comfort costs. However, because it is concerned with satisfying specific journey purposes, accessibility is also critically dependent on the relative location of the desired set of destinations and the journey origin. The measure of accessibility would be the average of the generalized cost of satisfying the total range of trip desires. Changes in activity location may increase accessibility in this strict sense while reducing aggregate mobility as defined above. Accessibility, rather than mobility per se, is likely to be what people really want.

The broader term "system accessibility" concerns the general ease of access to the system. In this sense, it is the opposite of exclusion. It applies particularly when there is an expensive connection cost for the household, as in water, electricity, and gas sectors. The equivalent in the urban transport sector might be the affordability of public transport fares or the initial cost involved in car ownership.

Affordability

Affordability is a slippery concept. There may be some goods or services, like ownership of a private jet aircraft, that are absolutely unaffordable to an individual. There will be other goods or services, perhaps like first-class air travel, that an individual might define as unaffordable not in any absolute sense but in the sense that they could be acquired only at the expense of foregoing some other thing that the consumer values highly. If my income were lower, I might consider air travel in any class to be unaffordable because of the sacrifice of health service, or whatever else I would have to forgo. And if I were very poor the same might be said about any form of mechanized transport. I may walk rather than ride for the same reason that I am poorly clothed or inadequately fed—namely that I am poor.

The concept was originally put in quantitative form by Armstrong Wright and Thiriez (1987), who defined transport as unaffordable if more than 10 percent of a population spent more than 15 percent of its income on it. It has been developed more recently by Carruthers, Dick, and Saurkar (2005) in an "affordability index," which measures the proportion of monthly income required to make 60 single journeys to work per month. The index can be calculated for different sections of the distribution (by quartile or by decile, for example). The raw index is easy to construct, and international data are available for a large number of cities (see Table 1). An affordability target has been adopted in the national urban transport strategy in South Africa (South Africa DoT, 1996).

Table 1 juxtaposes average and bottom quintile affordability indices with indicators of city location, size, income, housing, and public transport conditions. It shows that the skew of income distribution, indicated by the ratio of the bottom quintile's affordability to the average, is greatest in southern Latin America. While an employer subsidy makes the journey to work affordable for formal sector employees in Brazilian cities, low-income informal sector workers face unaffordable transport. This contributes to the high proportion of inner-city slum dwellers in those cities. A similar problem exists in some South Asian cities. For example, although the bottom-quintile index for Mumbai is 23 this assumes a 10-kilometer commute. In practice, partly because of the shape of the city and its high central area land values, low-income commuters would face a much higher transport cost burden, hence contributing, as in Brazil, to a high proportion of inner-city slum dwelling. In contrast, this is not the case in some Chinese cities, where low-income workers are still heavily dependent on walking and cycling and hence have low expenditures on journeys to work.

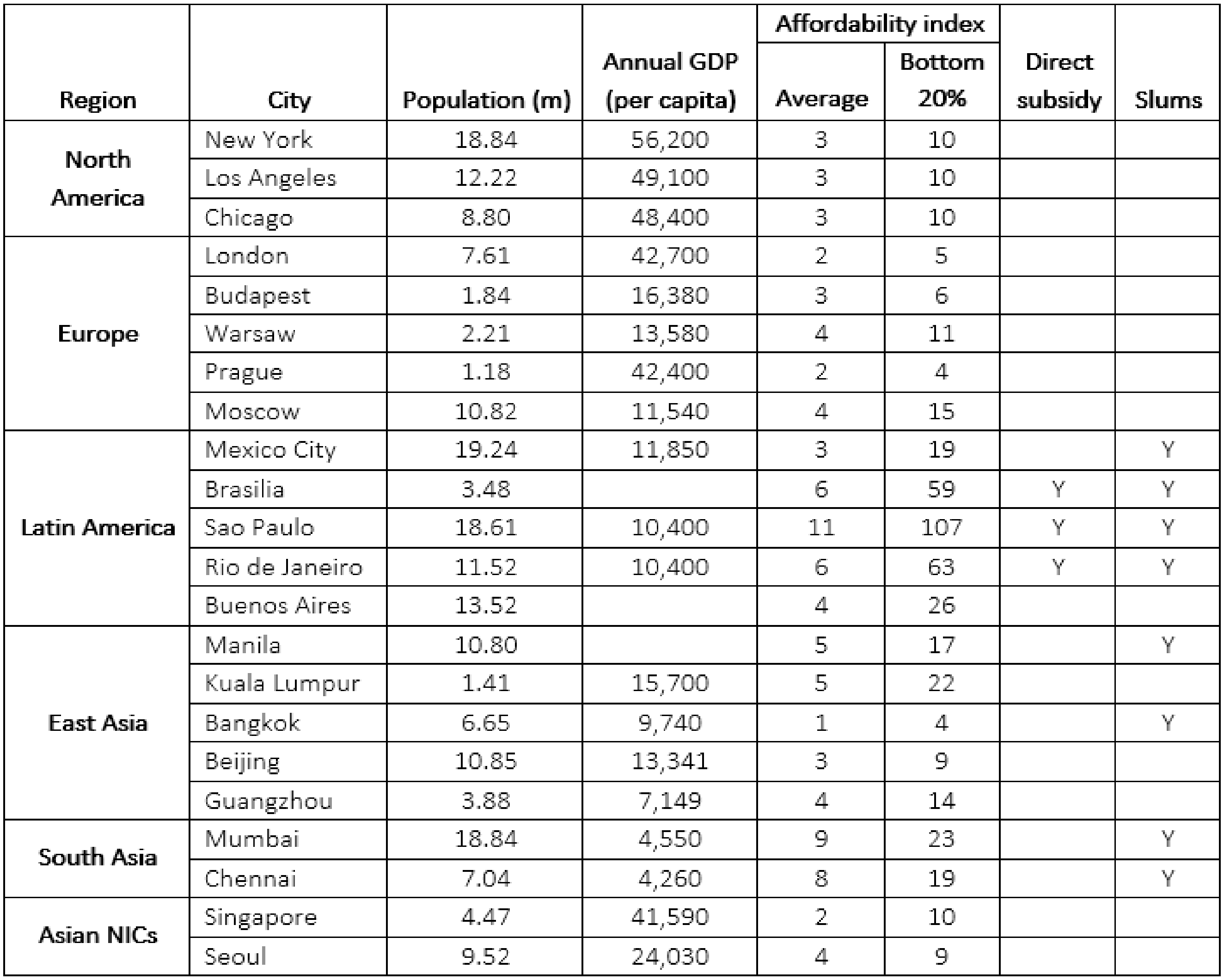
Subsidy

Subsidy also needs to be defined carefully. When looking at a whole system, or the accounts of an operator, the level of subsidy may be measured as the excess of total costs over total revenues. However, where there are indivisibilities in supply, the average cost is not the same as the marginal cost (the extra cost incurred in adding one unit of output). The simplest and most common context in which this arises concerns the peak in public transport. It is the peak demand that determines the amount of capacity that is required—for example, the number of buses in the fleet. To provide for an increment of demand at the peak will impose extra capacity costs, while providing for an increment of demand off peak, when there is available unused capacity, will not. So long as an off-peak demand increment yields a revenue greater than the avoidable costs of operating an unutilized unit of capacity off peak, the profit of the enterprise will increase (or its net loss will decrease), even though the price is below the average cost overall. Hence, when looking at individual services, the policy-relevant definition of subsidy is not the difference between average revenue and average cost, but the difference between incremental revenue and incremental cost for the specific tranche of demand concerned.

How do the concepts interconnect?

The interpretation of the four basic concepts above suggests a relationship between them rather different from that suggested by Litman. Accessibility is certainly preferable to mobility as a transport planning objective, since it is free from the adverse external effects of increased mobility, which, as Litman rightly argues, can adversely affect productivity. Adopting accessibility as a fundamental objective will bring attention to land use disposition, leading to shorter trips that may facilitate walking and cycling. This shift may itself favor poorer people. However, it is not self-evident that focusing on accessibility per se will always be significantly pro-poor. Conventional cost-benefit analyses may still favor road investments over public transport investments, which are presumed to make public transport more affordable to the poor. Moreover, affordability is not an absolute concept, but simply reflects the relationship between the costs of the service and the income of the customer. Public transport may seem unaffordable to a household not because its price is excessive in relation to its costs of provision, but simply because the household income is so low. Poverty, rather than transport pricing, is the culprit. And if that is so, it is not self-evident why transport subsidies, rather than income supplements or subsidies to some other goods or services, are the most effective solution. Moreover, subsidies and taxes in the urban transport sector often have efficiency-oriented rather than affordability-increasing objectives but may have significant redistributive effects.

Table 1. Affordability indices for major world cities, 2005



Region	City	Population (m)	Annual GDP (per capita)	Affordability index		Direct subsidy	Slums
				Average	Bottom 20%		
North America	New York	18.84	56,200	3	10		
	Los Angeles	12.22	49,100	3	10		
	Chicago	8.80	48,400	3	10		
Europe	London	7.61	42,700	2	5		
	Budapest	1.84	16,380	3	6		
	Warsaw	2.21	13,580	4	11		
	Prague	1.18	42,400	2	4		
	Moscow	10.82	11,540	4	15		
Latin America	Mexico City	19.24	11,850	3	19		Y
	Brasilia	3.48		6	59	Y	Y
	Sao Paulo	18.61	10,400	11	107	Y	Y
	Rio de Janeiro	11.52	10,400	6	63	Y	Y
	Buenos Aires	13.52		4	26		
East Asia	Manila	10.80		5	17		Y
	Kuala Lumpur	1.41	15,700	5	22		
	Bangkok	6.65	9,740	1	4		Y
	Beijing	10.85	13,341	3	9		
	Guangzhou	3.88	7,149	4	14		
South Asia	Mumbai	18.84	4,550	9	23		Y
	Chennai	7.04	4,260	8	19		Y
Asian NICs	Singapore	4.47	41,590	2	10		
	Seoul	9.52	24,030	4	9		

Outline of the paper

That analysis generates three main categories of issue, to be addressed in this paper, namely:

- The approach to accessibility.
- The approach to affordability through transport subsidies.
- The reconciliation of efficiency pricing with equity considerations.

The logical framework in addressing these issues is as follows. Section 2 presents the approach to accessibility. The implications of current transport investment appraisal methodologies and the means of improving accessibility through land use management are discussed and the significance of transport pricing brought out in both cases.

Section 3 deals with the approach to affordability through urban transport subsidies. It follows the conventional wisdom that concern with income distribution is best handled through direct cash transfers. It concludes that redistribution-oriented transport subsidies are likely to be optimal only in special cases where individuals' decisions ignore broader social benefits.

The rest of the paper is concerned with the reconciliation of efficiency pricing with equity considerations. In practice, subsidies and taxes in the transport sector are not only or even primarily concerned with improving accessibility or redistributing welfare. The reason for that is the existence in the urban transport sector of several dimensions of what economists call "market failure." These market failures may be used to justify pricing interventions on the basis that they improve the efficiency of the sector as a whole. Our particular interest in this analysis is to identify the ways in which, and the extent to which, any departure from full-cost pricing impinges on the poor; this examination will allow us to assess later in the paper the way in which pricing instruments affect the access by the poor to efficient transport markets.

This efficiency/equity presentation proceeds as follows. Section 4 sets out the different objectives of prices and pricing interventions in the urban transport sector. Section 5 considers how instruments to satisfy these objectives can be formally appraised in economic and distributional terms. The following sections then identify the main categories of pricing interventions and discuss how they relate to the fundamental objectives. In doing this, one should note the symmetry between taxes and subsidies as forms of interventions in the price mechanism. The former are appropriate where the market prices fall below the socially optimal price, and the latter where the market price exceeds the socially optimal price. Stated simplistically, this suggests taxing "bads" and subsidizing "goods." In considering instruments subsidizing goods, the conventional distinction is made between supply-side subsidies, in which it is the service that is subsidized (Section 6), and demand-side subsidies, in which the subsidy is linked to the characteristics of the transport user (Section 7). Section 8 considers the distributional implications of some more common methods of taxing bads. Section 9 summarizes the main conclusions of the paper.

1. Accessibility, investment, and transport pricing

Much of the concern that has been expressed about mobility-based transport planning has been about the infrastructure investment process rather than about pricing. This section considers the extent to which changes in process might improve accessibility and benefit the poor. It deals first with planning and appraisal of transport infrastructure and then with the planning of land use.

1.1 Accessibility and transport infrastructure investment

It is often argued that the problem of transport accessibility and affordability for the poor is rooted in a prevailing single-mode "predict and provide" approach to transport infrastructure investment. For example, Sclar and Lonnroth (2016) assert "the present dominant mobility paradigm—the network efficiency model—is socially blind," implying that it is regressive, with most of the benefit going to relatively wealthy car users. They go on to question why equal weight should be given to time savings for all different types of trips in using cost-benefit analysis to test the desirability of specific investments. They do accept, however, that "timesaving is in fact the natural unit of measurement of accessibility planning.

The key difference between mobility and access planning lies in the disaggregation of travel into social groups and geography."

This view implies that the main ingredient of an accessibility focus in transport infrastructure investment appraisal should be the use of differentiated values of time in cost-benefit analysis. In fact, as shown in Box 1, current practice in the treatment of time in cost-benefit analysis does involve some differentiation and does not value the time of rich people more highly than that of the poor. If data were available on the income of users of a proposed investment, it would be technically easy to vary the equity value of time to weight the time savings of poor users more highly than those of richer users. The same approach might also be applied to money savings, on the presumption that the marginal utility of money is higher for the poor than the rich. If applied consistently across all modal programs, this approach certainly might change the composition of transport infrastructure investment. The constraint on doing this is political rather than technical.

Box 1. Values of time in transport planning

Three concepts of value of time are commonly adopted—the behavioral value, the resource value, and the equity value. The behavioral value is the value exhibited by individuals in making their travel decisions. It varies by income group and by other dimensions such as journey purpose, mode used, etc. It is important in making estimates of the impact of an infrastructure on travel decisions. The resource value of time is the behavioral value stripped of any non-resource elements such as taxes or subsidies. Estimates of these would be equally necessary for an accessibility analysis. The equity value is the value used for quantification of benefits within a cost-benefit analysis, and is usually a constant rate irrespective of the income and behavioral value of time of the traveler. Thus, time savings for richer travelers are given equal weight per unit of time saved with those of poorer travelers.

In practice, the regressive effect of road infrastructure investment policy arises from a much simpler pricing issue. Whatever the structure of the implied price of time in investment appraisal, a regressive impact would continue to exist because richer people tend to travel more by road and obtain the advantages of improved infrastructure without paying for it. But that is a weakness of pricing strategy, to which we return later, rather than a defect in investment appraisal.

1.2 Land use strategies to increase accessibility

As discussed in Section 1, potential accessibility depends on the relative location of households and the activities with which they are concerned—work, education, health, shopping, leisure, etc. Potential accessibility can thus be enhanced by land use strategies in two main ways. First, zoning regulation can be used to encourage a mix of land uses. Second, floor space area regulation can be used to encourage densification. Both reduce the overall aggregate mobility requirement for a given potential accessibility level.

An important caveat must be entered here. "Good" urban form is difficult to define precisely in practice. For example, Newman and Kenworthy (1999) focus on fuel consumption per capita associated with densification as an indicator of good urban form, despite the demonstrated preference of many households for more internal and external space. While it is clear that good urban design can enhance the acceptability of high-density residential location, it is not clear that high-density solutions are acceptable to all, or even to a political majority.

Greater mixing of land uses, while increasing potential accessibility, may also come at some cost. Some heavy industrial activities exhibit such strong economies of scale that they have to be concentrated in a single location. Localizing health or education services may similarly imply the loss of some scale economies—particularly for specialized facilities and services. Where that is the case, improvements in accessibility to services will have to be weighed against losses in the quality of services available. The information requirements for any formal cost-benefit analysis on the

Box 2. Integrated land use and transport planning: the case of Curitiba

The metropolitan area of Curitiba, the capital of Parana state, Brazil, comprises 26 municipalities with a total population in 2006 of over 3.2 million. In its first Master Plan, published in 1965, it established the main goals of limiting central-area growth and encouraging commercial and service sector growth along two structural arteries, radiating out from the city center. The Master Plan also aimed to limit the establishment of heavy industrial zones to the periphery while encouraging local community self-sufficiency by providing all city districts with adequate education, health care, recreation, and park areas. The plan called for the integration of traffic management, transportation, and land use planning to achieve its goals, and it maintained flexibility in its regulations to allow for different future development scenarios. Two planning instruments were combined in implementation of the plan.

First, development control was used very pro-actively. On land sites located along the structural axes, local legislation permits buildings to have a total floor space up to six times the total plot size. Developments close to other roads with good public transport are allowed floor space up to four times plot size. The coefficient decreases the further a site is from public transport. This encouraged new commercial developments outside the city, along each structural axis, and also high-density residential developments. The result is a match between residential and commercial areas and public transport provision.

Second, planning for public transport was incorporated centrally in land use planning. The city center was pedestrianized with access to public transport but not to private transport. Each of the five main arteries contains one two-way lane devoted exclusively to buses. This inner lane is flanked on either side by (1) a local access lane for cars and (2) a high-capacity one-way route for use by both cars and express buses. Separating traffic types and establishing exclusive bus lanes on the city's predominant arteries helped to ensure a safe, reliable, and efficient bus service operating without the hazards and delays inherent to mixed-traffic bus service.

The popularity of Curitiba's bus rapid transport (BRT) system has effected a modal shift from automobile travel to bus travel. Already by 1991 it was estimated that the introduction of the BRT had caused a reduction of about 27 million auto trips per year. In particular, 28 percent of BRT riders previously traveled by car. Compared to eight other Brazilian cities of similar size, Curitiba uses about 30 percent less fuel per capita, resulting in one of the lowest rates of ambient air pollution in the country. Today about 1,100 buses make 12,500 trips every day, serving more than 1.3 million passengers, 50 times the number from 20 years ago. Eighty percent of travelers use the express or direct bus services. Citizens spend only about 10 percent of their income on travel, much below the national average.

Source. Gwilliam 2012b

issue may preclude anything better than informed political judgment.

Transport service and pricing policy may be complementary to both densification and mixed land use policies, and may be structured to favor lower-income groups. For any given disposition of land uses, maintenance of low transport fares will improve perceived accessibility more for lower-income groups (for whom fare cost is a higher proportion of total generalized cost) than for higher-income groups. In the short term, steeply tapered public transport fares (where cost per kilometer diminishes as trip length increases) and particularly flat fares will particularly enhance the potential accessibility of peripherally located low-income groups.

1.3 Dynamics—Short-run and long-run responses

In practice, there may be significant longer-term land use structural effects arising from a transport price strategy. For example, steeply tapered fares (where cost per kilometer falls sharply as trip distance increases) or flat fares (where the fare per kilometer is strictly inversely proportional to trip length) will reduce the perceived costs of access from more remote locations and may enable people to take the benefit of lower long-distance fares in the form of the extra living space or more rural surroundings that they can obtain in cheaper, more peripheral residential locations. It is clear from the evidence of suburbanization in many cities that a significant proportion of many populations value increased personal living space highly, and what may initially appear to be an increase of accessibility is converted through increased trip length into more highly valued living conditions.

Other apparently "pro-poor" transport and land use strategies may have complicated or even perverse effects in the longer term through the process of gentrification. Transport improvements or fare policies specifically designed to favor low-income residential areas may have the effect of increasing property values in those areas. The benefits ultimately go to the land owner. If the poor are only renting their properties, the increase in rents will drive poorer tenants away to locations that they can better afford, leaving the benefits of increased accessibility to the new, higher-income occupants. Even if the poor own their properties, they may choose to capitalize their gains by selling out to a higher-income household. This has been observed in large cities of Europe (e.g., London's Docklands) and Latin America (e.g., Buenos Aires' Puerta Madera) (Janoschka and Sequera 2016).

1.4 The benefits of a comprehensive strategy

Mixed land use may at first sight appear to be less favorable to public transport as it may not generate the corridor public transport traffic volume necessary to support cheap, low-cost, public transport services. However, that need not be the case if land use planning is explicitly directed at what is now known as "transit-oriented development." By combining land use zoning with floor space density controls differentiated to encourage higher residential and other activity densities in the closest proximity to public transport routes and nodes, the choice sets both of developers and land users may be subtly changed. The best-known example of this is Curitiba, Brazil (Box 2).

Curitiba is an unusual case. Its renowned planner, Mayor Jaime Lerner, was originally a political appointee of the military central government and only later became a popular democratically elected mayor. His planning agency, IPPUC, obtained, and has retained, great power. The urban development policy, though built around the public transport structural axes, was much broader than public transport. The flood plain of the river was converted into a protected park area. The favela (slums) were partly sanitized by a "garbage for cash" scheme and as far as possible connected to the public transport network. Curitiba's reputation as a model city was thus broadly based. Not all of the IPPUC policies were pro-poor, however. Strict land use control raised land prices and forced many poorer residents into favelas at the periphery—outside the city proper. Peripheral "urban villages" were developed to accommodate growing rural-urban migration outside the city, with accessibility to city work assisted by the flat-fare policy of the integrated transport system. Despite these flaws, the strategy retained a high level of public support.

To some extent the city has now become a victim of its own success. The population growth rate is very high. Although living conditions are better than in other Brazilian cities, crime rates are high, and 15 percent of Curitiba's population live in substandard housing. Favelas are growing in number and size. Road congestion is increasing, and patronage of the public transport system has been on the decline since 2008. Recent critics argue that Curitiba has retained the image of a model sustainable city but lost the reality (Martinez, Boas, Lenhart, and Mol 2016).

The relevance of this case study to the central concern of this paper is that fare policy was the glue that held the integrated strategy together. Flat fares gave cheap access to poorer peripheral dwellers, facilitating the strict land use controls and high land prices in the city itself. However, as the metropolitan area grew, the disadvantages of the flat fare system also grew. What was cheap for long trips was expensive for short ones. Moreover, the poor total revenue yield discouraged the extension of services, and critics argue that the city has failed to integrate its growing suburbs into a coherent regional plan (Halais 2012).

Clearly, although the metropolitan population is only about 4 million, it has outgrown the flat fare. Fortunately, this is not necessarily fatal to Curitiba-style development planning. Modern smart card technology makes it possible to reconcile a generally graduated fare scale with differentiated fares for specific locations, income groups, or trip categories. Hence, the problems that Curitiba is presently facing do not detract from its value as a model for integrated land use and transport development to improve accessibility.

While the case of Curitiba shows that it is possible to combine high density in public transport corridors with reduced auto use and environmental impact, it is not an easy trick to pull off. It needs careful integration of mutually consistent land use control, public transport supply and pricing, and private vehicle investment and restraint policies applied consistently over a long period (often too long for the local political cycle).

2. Transport pricing Interventions and cash transfers

We now turn to the affordability issue. An important strand in the argument for refocusing transport policy on accessibility, from which this paper started, is that so long as the mobility focus effectively redistributes welfare in favor of the rich auto user, it is appropriate to use subsidies to public transport as a countervailing measure of welfare redistribution. This section therefore addresses the fundamental question of the role of public transport fare subsidies as an agent of redistribution.

2.1 The competitive market paradigm

Economists have traditionally approached questions about prices and subsidies from the starting point of a competitive market paradigm (Gwilliam 1987). Within that simplistic model, economic efficiency is achieved as a consequence of all actors pursuing their own self-interest. Consumers will buy a product only if it has a value to them greater than the price they have to pay. Producers will make a profit only if customers value the product sufficiently highly to recompense producers for the costs of production, including the costs of capital. Investment funds will flow to uses that yield the highest return to the investor. Finance, both of the capital and recurrent costs of production, will thus be efficiently and appropriately ensured through the operation of the market.

Equity issues are largely disregarded in the simple competitive market paradigm. While this does not necessarily entail the judgment that the initial income and wealth distribution is socially ideal, economists have usually presumed that if the government wishes to redistribute welfare, this is done in the least distortionary way through lump sum cash transfers within the fiscal system rather than by intervention in the product markets.

Until recently a reliance on subsidizing targeted services rather than on direct cash transfers has been based on the assumption that many countries, particularly the poorest, lack both the administrative database and the implementation capacity to focus cash transfers effectively on the poorest groups without very large leakages to wealthier non-target groups. Hence, it was believed that if such attempts to target transfers through the fiscal system have substantial leakages, it cannot be presumed that transfers through selected product or service markets are necessarily inferior.

2.2 Cash transfers as an alternative to supply-side interventions

During the last decade and a half that situation has changed dramatically. According to a review by the British Department for International Development (DFID 2011) there were between 0.75 and 1.0 billion people worldwide in receipt of direct cash transfers in 2011, not only in middle-income countries but also in some very low income countries. Methods of delivery include general social pension systems as well as sector-specific grants and public works programs. The transfers were particularly aimed at helping households maintain expenditures on food, schooling, and health care in periods of economic or political disruption to which the poor are particularly vulnerable. They had both the immediate, short-term objective of protecting living standards and the longer-term objective of supporting transition to more sustainable livelihoods, creating the possibility to invest in human capital and thereby escape from chronic intergenerational poverty. In this context transport received only brief mention as a necessary supporting service requirement, rather than as a primary target for support.

The schemes took two main forms. Conditional cash transfers (CCT) linked the transfer to evidence of some beneficial activity (school or clinic attendance). Unconditional cash transfers (UCT), though aimed at sustaining those beneficial activities, did not link the cash transfers to specific household actions. A major problem requiring further research is the extent to which the cash transfers pass through to the (usually female) household manager rather than being appropriated for personal consumption by the (usually male) head of household. UCTs are inherently cheaper to implement than

CCTs, but the fear is that UCTs would be less effective in securing the fundamental objectives of the schemes.

The outcomes have now been rigorously researched. The DFID report presented convincing evidence from several countries that cash transfers—whether conditional or unconditional—can reduce inequality and the depth or severity of poverty in the face of adverse shocks. DFID also reports robust evidence that cash transfers have leveraged sizeable gains in access to health and education facilities in low-income countries. Though it is reported that well-designed and well-implemented cash transfers have helped to strengthen household productivity and capacity for income generation, the effect on final outcomes in health or education was viewed as less certain. The reason offered for this is that while cash transfers can help the poor overcome demand-side (cost) barriers to schooling or health care, they cannot resolve supply-side problems with service delivery. It was therefore concluded that cash transfers need to be complemented by ongoing sectoral strategies to improve service quality.

There is also some evidence that cash transfers into poor remote areas can stimulate demand and local market development. Other beneficial outcomes appear to be improvements in human empowerment, particularly of women in cases where they are the chosen instrument for transfers. At the same time, there is little evidence of any adverse effects of cash transfers on labor market participation or fertility.

According to DFID, the design of the cash transfer systems is critical. While CCTs have achieved considerable success, it is not clear that this is a consequence of the conditionality requirements. Public works programs, while apparently offering a double dividend through the wage income creation and the benefits of the infrastructure created, have not performed well. The best option for targeting will thus depend on program objectives, characteristics of the affected set of poor and vulnerable, availability of data and funds, institutional capacity, and political acceptability. Electronic payment systems can significantly reduce both costs and leakage.

The general conclusion would thus appear to be that direct cash transfers are generally preferable to pricing interventions in product and service markets as a means of assisting the poor (Estupian et al. 2007). The importance of transport in general, and urban transport in particular, is seen not itself as an objective for protection through cash transfers but as a potentially important supply-side complement to enable cash transfers to be effective in promoting household wealth creation.

3. The complex objectives of transport pricing

In practice, transport pricing policy is not just or even primarily concerned with welfare distribution. That is because the sector exhibits an unusually large and varied range of characteristics that limit the applicability of normal competitive market mechanisms. Sector pricing policy is primarily concerned with securing an economically efficient use of resources in the context of these complexities.

This section describes those complicating characteristics, which include natural monopoly and public good characteristics, externalities of production and consumption, and problems of "second-best" efficiency when subsectors with differing cost structure characteristics interact. It identifies the various objectives of transport pricing in dealing with these specific sector characteristics.

3.1 Commercial pricing—revenue generation

Even if public transport were a completely commercial activity, with no external effects to consider, the fare structures would not necessarily be simple. That is because, with relatively high fixed costs and a very diverse demand, various forms of price differentiation would appear as normal commercial practice in efficiently securing the total revenue necessary to cover total costs. Thus, some apparent subsidies within fare systems can have a perfectly standard commercial rationale within a competitive market regime. These may include various forms of price discrimination including off-peak fare discounts, spatially differentiated fares, and even flat fares in some circumstances.

3.2 Controlling natural monopoly

Probably the most extensively discussed problem is that of a natural monopoly. Originally discussed by Mill (1848), it has been more precisely defined by Baumol (1977) as "an industry in which multiform production is costlier than production by a monopoly." This applies where economies of scale or scope yield a large cost advantage. It is often associated with high levels of indivisibility in infrastructure (for example, in gas or electricity distribution) or strong scope effects in network services (for example, in telecommunications). Both circumstances apply to urban rail transport.

In the absence of regulatory control, natural monopoly power may be exploited to the advantage of the supplier rather than the consumer. While profit taxation can extract part of that surplus, it does not eliminate the cost to the consumer. This has typically been addressed by the imposition of government controls on the price and output decisions of the supplier, often through the instrument of nationalization or municipalization of the supply agency. Associated with this has been the acceptance of state or municipal responsibility for both operating deficits and finance of the capital programs of the supply agencies.

Unfortunately, the absence of competitive pressure has been associated with inefficiency in production and exploitation of the monopoly power by owners, managers, or organized labor. Attempts have therefore been made to re-establish commercial discipline either through competitive tendering of a public-private partnership concession or assignment of supply rights to a regulated asset-based company.

A particular problem arises where a rail mode exhibiting decreasing costs is integrated in a system with modes—such as buses—with constant or increasing costs. In these circumstances an efficient outcome may involve an integrated fare structure with the rail mode cross-subsidized by the road-based modes (Train 1977). For example, cost recovery for the bus sector in Transantiago, in Santiago, Chile, is higher than that for the metro. In these circumstances, it is necessary to view charging and financing policies at a strategic sector level, rather than separately for the individual components of the system. It could be the case, however, that poorer people living in outer areas, who make less use of the metro, are in fact cross-subsidizing richer people in inner areas who make more extensive use of the metro in multi-leg, multi-modal journeys. This appears to be another case where the right balance can only be determined based on detailed empirical analysis.

3.3 Combating adverse environmental externalities of production

Externalities of production exist when the production of a good or service imposes private costs on third parties not directly involved in a transaction. In the urban transport sector, vehicle users of road systems usually impose external costs both through congestion effects and through air pollution and other environmental spillovers. Such effects are usually interpreted to require that prices should reflect marginal social cost rather than just marginal private cost. In congested road systems this would generate financial surpluses that could be used to compensate the financial costs incurred by others. However, identifying and implementing the implied compensations may prove to be conceptually difficult as well as administratively intractable. This difficulty often leads to the introduction of charging systems for "users" or "polluters" without any link to a mechanism of compensation for those who suffer the external effects. When, as with road congestion, the same group of people both cause the external effect and bear its consequences, the lack of a compensation mechanism may not matter. But with air and noise pollution the sufferers are often a very different group of low-income people, living in the environmentally most vulnerable locations. To avoid the outcome of system efficiency being achieved at the expense of the poor, there is then a need for some proxy to direct compensation—for example, the earmarking of the externality charge for investment in protective policies such as the provision of sound barriers.

3.4 Exploiting scale economies—the Mohring effect

Mohring (1972) observed that where the frequency of a bus service increases with demand, the interval between services, and hence the waiting times of randomly arriving passengers, will decrease. As waiting time forms part of the generalized cost of the trip, this implies increasing returns to scale for bus services. This has subsequently been advocated as a justification for subsidy so that the fare properly reflects marginal social cost (Jansson 1995).

The relevance of this argument has been challenged on two grounds. First, average waiting times are only inversely proportional to frequency if passenger arrivals are random. Where service operates to a published schedule, and services are relatively infrequent, the benefit of higher frequency reflects the inconvenience of the greater constraint on activity scheduling, normally assumed to be less than that of the waiting time cost. Second, it has been argued that increasing returns to scale is common to large sectors of the economy. Subsidizing all such sectors would require tax adjustments with complex distortionary effects. Moreover, if, as is frequently suggested, transit agencies tend to supply a suboptimally high frequency at high fares, a subsidy to increase frequency is not necessarily justified (Van Reeven 2008, Savage and Small 2010).

Despite these theoretical reservations, empirical studies have generally concluded that subsidies to increase frequency are socially desirable (e.g., Savage and Schlupp 1997). Most recently, Parry and Small (2009) analyzed bus and rail subsidy justifications separately for peak and off-peak services in Los Angeles, Washington D.C., and London. While they found positive scale economy benefits from subsidies in all cases, the benefits were in all three cities greater for bus than for rail and for services off-peak than peak.

The distributional effects of such subsidies can be surmised. Because bus users typically have lower incomes than rail users in the cities studied, subsidies to increase frequency of bus services would probably be pro-poor, unless financed from some source that impinged exclusively on the poor.

3.5 Recognizing beneficial externalities of consumption—merit goods

Externalities may also occur in consumption in the form of "merit goods." These goods have two basic characteristics. First, unlike a private good, the net private benefit to the consumer is not fully recognized at the time of consumption. For example, the benefits that good urban transport gives to its consumers in terms of access to job markets may increase their earning capability. Second, consumption of a merit good also generates external benefits to others, which are also unlikely to be recognized at the point of consumption. For example, beneficiaries of urban transport journeys to work include employers and all those who consume the products supplied by the employer. Merit goods are usually subsidized and subject to detailed government control of standards and often primarily tax-financed (Musgrave 1959).

Interpreted strictly in the Musgrave sense, the merit-good argument offers an economic justification for subsidies with welfare redistributing properties. It suggests that, with perfect information about the true benefit of individuals' consumption of the good, both to themselves and to society at large, total social welfare would be improved by increased consumption of the good. That would certainly seem to apply to health care and education expenditures, and is the basis of an argument for subsidizing journeys to work.

The difficulty is that the degree to which consumption should be increased on these grounds is virtually impossible to quantify. In the absence of such quantification, the application of the merit-good concept to health care and education has been given an ethical dimension, as justifying some defined minimal standard of consumption of merit goods as an inalienable individual right.

In urban transport this approach has been embodied in the concept of affordability, introduced in the World Bank by Armstrong Wright and Thiriez (1987). They argued that "in developing countries a reasonable level of household expenditure on bus travel should not exceed 10 percent of household income." Later, based on previous studies by the Urban Markets Initiative of the Brookings Institution, which linked housing and transport costs, Litman (2007) defined transport as unaffordable if it accounts for more than 20 percent of the household's income. However, there does not appear to be any analytical basis for the adoption of either threshold. While they may reflect a judgment with which many political authorities might agree, they are no more than that.

Moreover, Mitric and Carruthers (2005) report and emphasize two important lessons from their examination of efforts to make transport more affordable by subsidy. First, they report that subsidies tend to have a high propensity to leak to suppliers and their employees rather than go exclusively to those whom they are supposedly benefiting. Second, they report that unless a subsidy has a reliable and secure funding mechanism, the negative impacts on the level of service provided can more than outweigh any fare benefits to the poor user.

3.6 Making adequate provision of 'public goods'

In economic terms, the concept of the public good is defined as a good that is non-rival, in the sense that its consumption by one person does not reduce the level or quality of its availability to others, and non-excludable in the sense that it is difficult or impossible to prevent additional users taking advantage of the service it provides (Samuelson 1954). Non-excludability implies both that the public good has a zero marginal cost of supply and that even those who do not pay for the good can benefit from it. Institutionally, these goods have usually been provided free at the point of use and have been managed by public agencies. In urban transport, local roads are the prime example of a public good.

Without a direct charging system, user finance of public goods such as radio and television broadcasts could only be achieved through legally enforced license fees, and these services were often provided by the public sector. This effectively made a pricing regime that closely resembled the cost structure, with a high fixed charge and no variable use charge. More recently, however, technological methods have been developed for excluding users, making possible a much more structured and variable pricing policy.

There are some interesting hybrids. For example, common pool resources such as fishing grounds may be effectively non-excludable, but because of the possibility of over-fishing, they may be rival in consumption. In contrast are club goods, such as radio or television services that are non-rival in consumption but potentially excludable. Sherman (1967) considered that the difference in cost structure of the car, which has a substantial fixed cost and a low marginal cost of use, and public transport fares, for which there is no fixed cost and a high marginal charge, was the source of a major distortion in mode choice. He therefore proposed that transport users should form clubs that would enter into medium- to long-term contracts with suppliers. They would pay a fixed sum up front and then use the services at short-run marginal cost, as a way of combating the distortion.

While that idea did not raise much immediate interest, it has subsequently been implemented in some of the commuter van services in cities like Bangkok, as well as in the arrangements for senior citizen and other group concession arrangements in which you buy a season card that then entitles you to low marginal trip charges. While distributional impacts would appear likely to be somewhat regressive if the full costs of service were paid, payment of the entry cost as a subsidy does offer an instrument for combining support for specific income or person-type groups with an effective marginal social cost price mechanism comparable to the mechanism for paying for car trips.

3.7 Compensating distortions—the theory of the second best

In a seminal article, Lipsey and Lancaster (1956) demonstrated that, in the presence of irremovable pricing distortions in one market, overall economic welfare may be improved by the introduction of appropriate compensating distortions in complementary or competing markets.

Such system interactions are common in urban transport. Where road congestion occurs, the marginal social cost of vehicle movement exceeds its marginal private cost, even if all the input factors are correctly priced. In the absence of congestion pricing for road use, private use of road space is undercharged. Undercharging for road use is often made worse by the provision of free parking for employees (Shoup 2005). In large urban areas, the value of this subsidy has been estimated to greatly exceed the out-of-pocket expenses of the private car commute.

Following the Lipsey and Lancaster argument, it has been argued that these distortions might be efficiently compensated by subsidies to public transport. Given that in most circumstances the average income of public transport commuters is below that of private car commuters, this would appear to be a circumstance in which economically efficient second-best pricing would also improve the welfare of the poor. However, two caveats should be entered here.

First, would not the best solution simply be to introduce congestion pricing? And, if it were introduced, what would be the distributional effect? Introduction of congestion pricing in London has certainly been the basis on which improvements in public transport have been justified and partly financed. That might be viewed as generally consistent with the objective of improving accessibility to public transport for those of low incomes. But it is also arguable that the greatest beneficiaries of road pricing in London are richer people whose high values of time savings have most exceeded the monetary costs of the congestion charge. Thus, it looks as though that question cannot be answered from a priori reasoning and would need to be subject to quantitative analysis on a case-by-case basis.

Second, this argument for public transport subsidies depends critically on the gap between price and marginal social cost of movement being greater for private than for public transport. With congestion, but without congestion pricing, there clearly is such a gap for private transport. But it has also been shown that, because of the need for extra vehicles and crew to be employed specifically to meet peak demand, the same is also true for public transport. That would appear to make the case for urban transport peak subsidies depend not only on the level of congestion and but also on the size of peak/off-peak public transport demand disparities. Empirically, a study of Belgian cities concluded that while optimal prices for private transport would rise by 150 percent in the peak period, those for public transport would also rise by 22 percent. By implication, however, if private transport prices were not raised, a compensating subsidy of public transport would be appropriate (De Borger, Mayeres, Proost, and Wouters 1996). While it may seem likely that the poor would benefit, it is a matter needing to be determined on a location-by-location basis.

For large cities the outcome is clear. In a recent analysis of subsidies in Los Angeles, Washington D.C., and London, Parry and Small (2009) found subsidies to be optimal at the peak at around 90 percent of operating costs, mostly accounted for by traffic-related externality benefits. As a complementary point, de Borger and Wuyts (2009) argue that subsidizing public transport is an efficient way of cashing out any increases in auto commuter taxation (such as congestion charge revenues) to achieve budget neutrality. For smaller cities the outcome is less certain.

3.8 A social second best?

Corresponding to the economic theory of the second best—which reflects failures in the market mechanism—is a social second best that reflects failures in the fiscal system. A fiscal system that does not achieve a distribution of income allowing for all citizens to afford the basic necessities of life may be considered a fiscal failure. Then, as in the case of the economic second best, perceived social welfare may be improved by second-best welfare redistributing measures in goods or service markets. Of course, different societies will have different views as to what is the minimum acceptable availability of the basic necessities. That does not detract, however, from the applicability of this fundamental concept.

3.9 A summary of objectives and price interventions

The pricing and subsidy instruments associated with this classification of objectives, discussed later, are listed in Table 2.

Before going on to discuss these specific types of interventions, however, we discuss in Section 5 the criteria on which their desirability is to be judged and the ways in which those theoretical criteria can be applied.

Table 2: Objectives and instruments of urban transport pricing

	Type of pricing instrument		
	Subsidizing "goods"		**Taxing "bads"**
Objective of intervention	**Supply-side actions**	**Demand-side actions**	
Commercial efficiency		Class-related fares (4.3) Peak surcharges (4.3) Off-peak discounts (4.3) Flat fares (3.1, 4.3, 5.2) Location-specific fares (4.3)	
Control of natural monopoly	Maximum fare control (5.2) Franchise rights (5.4)		Profit taxation (3.2)
Supply of public goods		Club subscriptions (3.6)	
Scale economies	Network support (5.3) Bus tender subsidies (3.4)		
Merit goods	School bus subsidies (5.5) Non-work journeys (6.2)	Commuting tokens (6.2) Student cards (6.3)	
Environmental protection	Vehicle capital grants (5.1) Clean fuel subsidies (5.1)		Fuel tax (7.2) Tax on vehicle miles (7.2) License duties (7.1)
Economic second best	Earmarked taxes (4.3) Deficit system support (5.3) Route subsidies (5.4) Tendered management contracts (5.3) Off-peak discounts (4.3) Fuel subsidies (5.1) Infrastructure grants (5.1)		Congestion pricing (3.7) Parking prices (7.1)
Social second best	Labor subsidies (5.1) Special transport cash subsidies (5.5)	Child fares (6.3) Seniors fares (6.3) Disabled fares (5.5) Flat fares (3.1, 4.3, 5.2) Location-specific fares (4.3)	

4. Appraising subsidies

As discussed in Section 4, prices and subsidies perform important functions in ensuring the economic efficiency and environmental acceptability of transport systems and also have important distributional effects. The variety and complexity of these effects makes formal appraisal of price and subsidy policies difficult. Efficiency effects and distributional effects are non-commensurate and must be treated separately.

4.1 Efficiency appraisal

Efficiency and environmental effects can be incorporated, with the fiscal cost of a subsidy, in a general cost-benefit analysis (CBA) that attempts to bring together a diverse range of effects in a common metric. These effects will include operating cost savings, time savings, accident costs, and environmental impacts. CBA normally considers the effect of an intervention (usually a capital investment) over a period of years, using whatever time discount rate is considered appropriate in the national context. Incorporating safety and environmental elements in the analysis obviously raises problems of valuation (see Box 3). Formal CBA does not usually incorporate longer-term structural consequences of policy changes (Gwilliam 2008).

Box 3. Evaluating environmental impacts

In principle, following the general prescription that "the proper corrective device is a Pigovian tax to the marginal social damage levied on the generator of the externality" (Baumol and Oates 1988) one should attempt to identify the marginal social cost of each pollutant in money terms. That requires identifying the relevant pollutants in physical terms (local and global air pollution and noise are the usual main categories), then identifying the damage that they do to physical structures or human health, and finally converting that damage into monetary terms. That is an enormous task, not least because it ultimately involves giving a monetary value to morbidity and mortality (reviewed by Gwilliam 2011). Often the best that can be done is to try to transfer values internationally. The general problems of international transfer of environmental values is treated in detail by Nellthorp et al. (2007), and a guidebook on this has been produced for the European Union by Maibach et al. (2008), updated by Ricardo-AEA (2014).

A more general consideration is that the costs accrue to the public budget while the benefits accrue primarily to transport users. Given the general scarcity of public funds, it would therefore be appropriate to require a benefit-cost ratio exceeding whatever shadow price of public funds is considered appropriate in the national context. This approach was used by Glaister (2001) in assessing the economic impact of local transport subsidies under a liberalized market regime.

4.2 Distributional objectives: targeted beneficiaries

Conceptually, the use of some form of equity weighting of all costs and benefits within a traditional CBA would appear to be the appropriate way to balance efficiency and distributional effects. But this begs the question of how those weights might be determined (which has never been satisfactorily resolved). Hence, it is common practice to recognize that these dimensions are incommensurate and to present efficiency and distributional indicators separately to decision makers for their political judgment.

Several types of indicators of distributional effects have been developed in recent years, focusing on slightly different aspects of the distributional issue. These can usually be applied either to describing in an understandable indexed form the distributional characteristics of a current price or subsidy regime, or by taking differences to describe the distributional effects of a change of regime. It should also be noted that the distributional effects of a subsidy, or change in a subsidy, will depend not only on who benefits from the system or change of system, but who pays for any subsidies that must be financed. In this section, we discuss some of the indicators used to describe the distribution of benefits, and in the next section turn to consider the significance of the source of subsidy on the more general distribution of welfare.

The affordability index

The affordability index was described earlier in Section 1.2.3

and its relevance to the merit-good argument discussed in Section 4.5. However, there are some serious problems in using this type of index in a normative context to define a case for subsidy. While in general, as mentioned in the case of Mumbai, the higher the average income the lower the affordability index, both for the average and bottom quintiles, for some of the larger sprawling cities, such as Mexico City, the average commute may be longer than 10 kilometers, and so the nominal affordability indices understate the real burden of commuting costs.

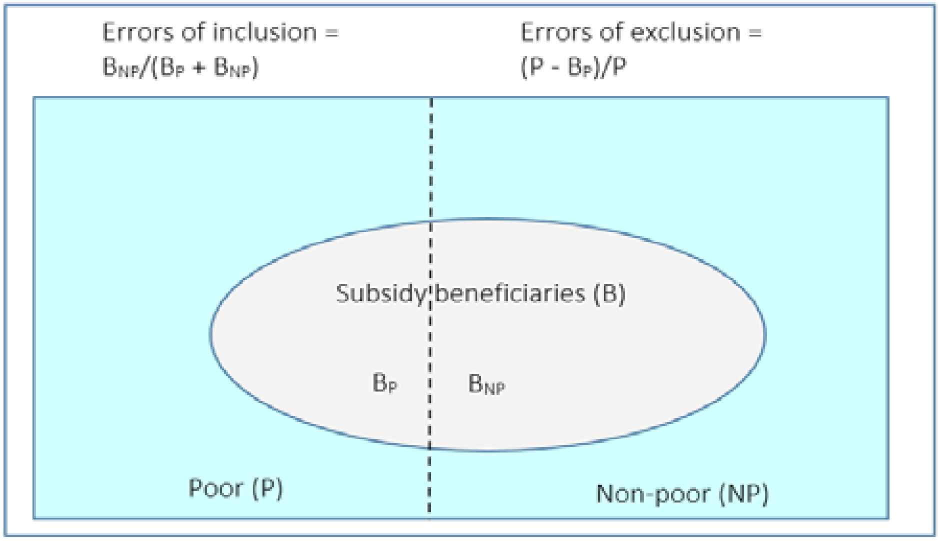
More generally, the proportion of transport costs in the household expenditure pattern will depend on the prevailing political context. For example, if housing or heating is provided freely, as was the case in most of the former Soviet countries, a higher level of transport expenditure can be sustained for a given standard of living. To correct for these differences would be difficult and data demanding. This suggests that there is no theoretically sustainable definition of a "reasonable rate of expenditure," and that what might be considered politically reasonable is very context specific. Despite the difficulties in interpreting the affordability index as a justification for subsidy, it might still be used as an instrument in assessing impacts of specific schemes and on specific groups or locations, particularly if the index were calculated on real expenditures rather than on the nominal expenditures associated with a 10-kilometer commute.

Inclusion and exclusion indicators

Where the purpose of a subsidy is to assist specific sections of the population, one way of testing its effectiveness is to measure the proportion of the target population that fails to benefit from the subsidy (the exclusion index), or the proportion of people outside the target group benefiting from the subsidy (the inclusion index). This is shown diagrammatically in Figure 1. If the objective is to redistribute welfare from the defined non-poor to the defined poor group, the ideal is that both exclusion and inclusion indicators should be close to zero.

The advantage of these measures is that they can easily be estimated from household survey data that show whether a

Figure 1. Errors of inclusion and exclusion


Errors of inclusion = $B_{NP}/(B_P + B_{NP})$
Errors of exclusion = $(P - B_P)/P$
Subsidy beneficiaries (B)
B_P
B_{NP}
Poor (P)
Non-poor (NP)

Source: Foster (2004).

subsidized product or service is consumed or not. This finding may be very important in the design of subsidies. It can be readily applied to the assessment of the likely focus of any specific new subsidy instrument, as well as to the assessment of the change in accuracy of focus over time. It has been applied to the focus of public transport services in Buenos Aires. It can also be applied to the comparative assessment of different types of subsidy, including locality-focused supply-side subsidies if the income composition of different areas is well recorded and understood.

The disadvantage of exclusion/inclusion measures is that they do not distinguish between cases where a household gets some minor advantage from a subsidy (for example, because they made an occasional emergency trip on a mode that they could not normally afford to use) and those where a household is a regular and large consumer of the subsidized service. This shortcoming could be addressed by redefining use as requiring some minimum number of trips per month by a subsidized mode, but doing so would make the index less easy to interpret.

The Lorenz curve, and Gini and Omega coefficients

A more sophisticated approach that overcomes the limitation of the inclusion and exclusion indices is that based on the construction of a Lorenz curve The relative benefit distribution curve, or Lorenz curve, graphs the percentage of a subsidy accruing to any given percentage of households, ranked in ascending order of some measurement of income, expenditure, or wealth. A Lorenz curve falling below the diagonal in the graph indicates a regressive income distribution effect, while one lying above the diagonal indicates a progressive distribution effect.

Associated with the relative distribution curve is the quasi-Gini coefficient, sometimes referred to as the concentration 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 diagonal and the actual distribution curve (with a negative value when the actual distribution curve is above the diagonal). The closer the quasi-Gini coefficient is to –1, the more progressive is the distribution of impacts. This approach was first applied to public transport in Buenos Aires by Foster (2004), and subsequently to changes between 2002 and 2006 by Bondarevsky (2007).

Besides the quasi-Gini coefficient, another summary measurement of the distributive incidence of a subsidy is the Ω statistic, which, with a poverty line defined in terms of a proportion of the population of households, is the percentage of the subsidy accruing to poor households over the percentage of the population represented by poor households. It will be above 1 for a progressive subsidy and below 1 for a regressive one.

4.3 Distributional objectives: the significance of knowing who pays

It would be pointless from a distributional point of view to subsidize services consumed by the poor if the subsidies were paid for by taxes on exactly the same people. It is therefore important in designing any socially oriented support program to pay attention to the distributional characteristics of its source of finance.

Subsidies to public transport may be financed in three main ways: (1) from general taxation, direct or indirect; (2) from taxes on specific persons, goods, or activities earmarked for the purpose; or (3) by cross-subsidy within the public transport sector, which effectively means some public transport users subsidizing others.

General taxation

The most common arrangement is for external subsidies (as opposed to internal cross-subsidies within a sector) to be financed from general taxation (as opposed to earmarking of specific taxes). The net distributional effect of a change in subsidy therefore depends on the characteristics of the change in taxation with which it is associated. A tax is said to be progressive if the proportion of income taken by tax increases with income, and regressive if the proportion of income taken by taxation decreases with income.

Some general observations can be made arising from this.

First, it is generally the case that direct taxes on income are, by design, more progressive than indirect taxation on commodities. Second, there can be significant differences in progressiveness within the category of indirect taxes. Taxes on luxury goods may be expected to be most progressive and those on basic necessities (food, energy, and housing) almost certainly regressive. Flat-rate value-added taxes fall in between, but are also usually on balance regressive due to the decreasing marginal propensity to consume taxed goods as income increases. The progressiveness of taxation may also vary significantly between local and national taxation regimes. Typically, national tax revenues depend more heavily on the more progressive income tax than do local taxes, which tend to be indirect taxes on commodities, services, or property, all of which tend to be regressive.

The difficulty in understanding the net distributional effect of a tax-financed subsidy is that the decisions on tax structure and levels are usually taken at different times and in different contexts from the decisions on subsidy. It may or may not be the case that changes in the tax regime take account of associated changes in the distributional effects of tax-financed expenditures. The marginal sensitivity of particular general tax levels to subsidy changes is thus more a matter of speculation than calculation. So while it may be conceptually desirable to include the tax implications of a subsidy change in an assessment of the distributional impact of the subsidy, it may be practically infeasible if the subsidy is financed by general taxation.

Earmarked taxes

The limitation may not apply to the same extent where the subsidy is financed by earmarked taxes. For example, the distributional effects of an earmarked tax on consumption goods such as alcohol or tobacco may be traced through expenditure surveys (and may actually turn out to be very regressive). Taxes on producer goods such as fuel are more difficult to estimate, as the distribution of their ultimate impact will depend on the effect of a tax increase on the prices of different final consumer goods. This is conceptually traceable, but may again be practically difficult to estimate with any precision. Taxes on road use—such as the London congestion charge—may be similarly difficult to assess as they impact on final consumption both directly, believed to be progressive where use of the private car is viewed as a consumption good, and indirectly, through increases in the embodied freight transport cost of final consumption goods. Their distributional impacts also depend on the cross-elasticities of demand between modes by income group.

Probably the best known and most extensive use of taxation earmarked for the support of public transport is that of the French versement transport (VT). All French local authorities or associations of local authorities that meet the condition of having formed a transport authority (autorite organisatrice de transport urbain, or AOT) and prepared an approved transport plan are by law permitted to impose a local payroll tax on all employers with 10 or more employees. Originally intended to finance capital investment, it is now used extensively to support operations. The tax rates permitted by law increase with the population of the area, the maximum rate currently being 2.6 percent of the payroll for employers in Paris, where the VT covers nearly 40 percent of the operational costs of the public transport of the region.

Estimating the ultimate distributional effect of the VT or the rather similar employer-funded val transporte in Brazil is complex both because of the difficulty of determining how the tax impacts on product prices and because it may have the effect of reducing employment, which is almost certain to be regressive in impact. Moreover, there may be a contrary progressive effect if the result of the tax is a better financed and integrated public transport system that increases the effective size of the transport market (as argued by Prud'homme and Lee 1999). The net effect of using this form of finance thus remains a matter of dispute.

Internal cross-subsidy

Internal cross-subsidy within a public transport mode may be used to generate income from potentially remunerative services to support commercially unremunerative services. In practical terms this means cross-subsidy by location, time of day, class of travel, or mode.

By location

In many cities the instrument of locational cross-subsidy is the system-wide flat fare. This is easy to implement and yields some savings in ticketing costs. Instituting an effective cross-subsidy from short trips to long trips may help the poor living in peripheral areas—as occurs in many South American cities. But at the same time it requires that some services are charged above cost, which means that fares are higher for shorter trips than they might be with a graduated fare scale, and so poorer groups living in inner areas suffer a corresponding disadvantage. The net distributional effect thus depends on the details of the location of population by income-category efficiency loss. At the same time flat fares involve an efficiency loss that increases with city size and may encourage undesirable urban sprawl.

More precisely targeted cross-subsidies by location may be attempted if residential locations are strongly segregated by income group. This has been done successfully in some cities in structuring electricity prices. A similar approach was adopted in the early days of the metro development in Santiago, Chile (Jara-Diaz 1995). It is possible to set different fares for different trip origins or destinations, particularly related to the residential location in respect of journeys to the major employment locations. The danger to look out for here is the possibility of "rail heading," with car trips of long-distance commuters routed to take advantage of low commuter rail fares from the periphery of the city. This is something that would have to be assessed on a location-by-location basis—estimating the extent to which the subsidies targeted at the poorer locations were actually leaking to other income groups.

Time of day differentiation

Cross-subsidy by time of day has also been used in some cities, for example in London in the 1950s, to encourage travel before the morning peak. The economic efficiency of this depends on the assumption of a relatively high cross-elasticity between times of travel, and the distributional progressiveness depends on the assumption that the poor are more likely to be traveling before the peak than higher-income groups. Neither assumption may be well founded, so it is critical in the assessment of this type of instrument that the relevant elasticities and characteristics are well researched. More generally, it is often argued that peak public transport travel should be subsidized by off-peak travel because of the congestion and environmental advantage of shifting passengers from car to public transport. In practice the economic argument might militate in the opposite direction if high-peak usage involves high capacity costs (as is certainly the case for buses and also true for rail systems as they approach capacity), because the excess of marginal over average cost for public transport in those circumstances might approach or exceed the excess of marginal over average cost for the private car. In this case the estimation of the efficiency effects requires careful analysis not only of demand elasticities and cross-elasticities between times of travel and modes, but also supply elasticities by time of day.

Travel class differentiation

Cross-subsidy by class of travel is a third possibility. Insofar as higher-income passengers are willing to pay more for more comfortable (or in the case of express services, quicker) travel, it may be possible to use product differentiation as a basis for yielding surpluses to support lower-income passengers on the basic service. In order for this to be possible, however, a single supply agency must be providing both. Again, this form of cross-subsidy appears to be much more feasible in the case of a system with a single supply manager.

Modal cross-subsidy

Cross-subsidy by mode has been given an economic theoretical basis in the work of Train (1977) on multi-modal systems, the argument being for the subsidy of modes with higher fixed and lower marginal costs by those with lower fixed and higher marginal costs. Typically, this is interpreted as an economic case for the subsidy of metros from bus systems, and gains extra credence from the possibility of reduced congestion and environmental cost by transfer of traffic from road to rail modes. But this argument has no distributional content, and in the case of Buenos Aires would have perverse effects insofar as subsidy to the metro is concerned. Only in the case of the suburban railways would the efficiency and distributional arguments be in synergy. The practicability of the argument does depend, in any case, on the possibility of transferring revenues from one mode to another—which would be greatly strengthened with the existence of a metropolitan transport authority managing services of all modes supplied on gross cost contracts with it.

5. Subsidizing 'goods': supply-side interventions

We now turn to examine the efficiency and distribution effects of different types of fare, tax, or subsidy instruments, beginning with supply-side subsidies. The underlying logic of supply-side subsidies is to ensure the continuation of services that would decline without intervention because they are subject to one or other of the dimensions of market failure. Historically, supply-side interventions have also been used as a proxy for more directly targeted demand-side intervention.

5.1. Subsidy to individual inputs

Several different public transport inputs can be subsidized, for a range of different reasons mostly unrelated to the welfare of poorer users of the system

Public transport vehicle purchase

Vehicle purchase was for a period subsidized in the United Kingdom as a means of encouraging introduction of new rear-engine one-operator buses, but it was eventually abandoned as too distorting (Kerridge 1974). More recently, the state development bank BNDES in Brazil has provided financing on particularly favorable terms for approved vehicles for public transport provision by the private sector. More commonly, many of the countries of the former Soviet Union grant-financed the provision of vehicles for state enterprises.

Subsidized vehicle provision can have perverse effects on efficiency. Several governments in central Asia (Kazakhstan, Uzbekistan, Kyrgyz S.R., and Turkmenistan) have attempted to confront the decline of the large vehicle fleets by international borrowing at favorable rates from the multilateral financial institutions. Where these vehicles have been provided directly to public sector suppliers, as in Turkmenistan, they have quickly fallen into disrepair and have not solved the problem. The same outcome has occurred in Sri Lanka, where a series of purchases of vehicles for the quasi-public "peopleized" companies in the 1990s failed to prevent a continuing decline of these companies as they failed to cope with a combination of public service obligations and inefficient union control of the public sector industry. Even where they have been provided to public sector companies that have been privatized, as in Kazakhstan, the companies do not appear to be earning enough to make them sustainable, and so a decline to a system dominated by smaller vehicles looks likely. Even less attractive is the experience in the Dominican Republic, where vehicles periodically purchased for companies in the private consortium CONATRA disappeared from service even more quickly. Subsidy of vehicle purchase is thus usually inefficient and probably regressive, as the benefit is syphoned away from the poorer passengers it is intended to help.

Fuel purchase

Fuel has been subsidized either intentionally, as in Indonesia, or unintentionally, as in the Dominican Republic, where the subsidy on liquefied petroleum gas (LPG) for domestic purposes has resulted in a proliferation of LPG-fueled shared taxis ("conchos"). The most egregious example of supply-side subsidies distorting choice of technology in the public transport sector is in Santo Domingo. In this case there is a subsidy on LPG, but not on gasoline or diesel. The result is that very old private cars, converted for use of LPG, are able to compete so successfully with bus services that they dominate the market, with adverse effects on efficiency.

Labor

Labor may also be subsidized. For example, in the case of the public sector cluster companies of Sri Lanka, the government paid the extra costs of applying general public sector wage increases. As these are mostly in response to general inflation that inevitably affects the labor costs of private sector operators, this arrangement produced an increasing distortion in the relationships between public and private sector operators. In that case, the purpose of such subsidies was to protect a small minority of specially privileged staff, and the subsidies certainly did not pass on any benefit in terms of accessibility to public transport for the poor. Again, this form of subsidy may be generally regarded as both inefficient and inequitable.

Public transport infrastructure

Infrastructure capital grants are commonly made by the central government for local infrastructure—particularly metro infrastructure—as a general means of supporting public transport supply. That applies in most Western economies as well as in the Eastern European command economies. Metros, though formally established as commercial corporations, are often directly owned by the central government, as for example in London and Bucharest. Insofar as metros form the core of a public transport network that attracts travelers from cars, and unlike buses have no direct congestion-causing effect of their own, subsidization of metro infrastructure may have an efficiency justification. In principle, this could be assessed through a cost-benefit analysis. The larger the city, and the higher the level of traffic congestion, the greater the likelihood that subsidized metro investment might be justified.

The welfare-distributing impacts of subsidized metro investments depend on where the metros are, who uses them, and how they are financed. In many developing country cities, such as Buenos Aires and Santiago, metros are used by relatively higher-income inner-city dwellers, and subsidies to them therefore tend to be regressive in their impact. Funding from local sources is also likely to be more regressive in impact than funding from national funds. But more information is needed on this.

5.2 Maximum fare controls

Maximum fare controls would appear to be the obvious response to any threat of exploitation of a monopoly position. Given that one of the typical—and intended—results of route licensing is the avoidance of direct competition on the road, route licensing would appear to be of relevance to the urban public transport context. However, where the rights to operate are competitively tendered, fares are typically set by the tendering authority and any excess profit arising from the fare set is eliminated, or appropriated by the public authority, through the bidding process. There is no need to specify a maximum fare in these circumstances.

In reality, explicit setting of maximum fares is more common in developing countries, where supply is fragmented and informal. Without some public diligence it would be possible for well-organized associations of private operators, as for example in Ghana, to control both fares and entry to the market to their own advantage. Maximum fare controls therefore look like protections of the passenger interest.

In practice it does not usually work out that way. For ease of administration many developing country cities specify a maximum flat fare for their informal sector services, ostensibly to limit passengers' expenditures. But a flat fare that yields an economic revenue on one route may not do so on longer routes. The effect is that the longer routes disappear, and longer trips require two or three flat fares, as well as the inconvenience of a vehicle change. That has been the case in Accra, Ghana; Santo Domingo, Dominican Republic; and elsewhere. Hence, maximum flat fares set for the informal sector in large cities actually result in increasing the costs for the longer-distance travelers rather than constraining them.

5.3 Network support

Historically, the most common form of supply-side

intervention has been entrusting the support of a whole network to a single "chosen instrument" supplier. In many cases the chosen instrument was a municipally owned company, on the principle that the policies of the local authority would be ensured through the ownership control. There are two quite different justifications for this approach.

The first is concerned with the social objective. Particularly in France and francophone countries, urban public transport networks are considered an essential element of basic social infrastructure, with the provision of a comprehensive network on a common fare basis viewed as the route through which universal accessibility can be guaranteed. In this approach cross-subsidy within the network is an entirely normal situation, and the comprehensiveness of availability an appropriate test of the effectiveness of the chosen instrument. The size of the network subsidy is essentially dependent on a political judgment on what the authority is willing to pay for the comprehensive approach.

A second justification of the network approach might be the economic second-best argument. In this case the justification of the support for public transport is to compensate for the undercharging for the private use of roads, and the purpose of the subsidy is to shift travel from private to public transport in order to reduce congestion and hence minimize the total generalized cost for the system as a whole. A logical corollary of this would be the design of a system that secured the greatest degree of modal shift, and the test of its effectiveness might in principle be the cost-benefit rate of return on the system subsidy. Glaister first enunciated this approach to the evaluation of public transport subsidy in an analysis of the British metropolitan counties in 2001. More recently the same basic approach has been applied by Basso and Silva (2014) to assess the justifiable level of subsidy to Transantiago in Chile.

It should be noted in this context that a subsidy aimed at maximizing the impact on modal choice might be used quite differently from one aimed at reducing transport costs for the poor, as it may focus on public transport quality rather than price. There is some evidence in support of this presumption from various studies of elasticities of demand in the United Kingdom. The direct elasticity of demand for car use with respect to public transport fares in the United Kingdom has been shown to be as low as 0.10 (Acutt and Dodgson 1996). In contrast, elasticity of demand for public transport with respect to quality of service (indicated by bus kilometers offered) is very similar to that measured with respect to public transport fares, at 0.4 in the short term and 0.55 in the longer term (Balcombe et al. 2004). Moreover, White (2009), in an analysis of London data, explained much of the unexplained variation in the Balcombe analysis in terms of qualitative variables such as stability of service, bus priority measures improving speed and reliability, passenger information systems, simplified fares, and ease of interchange. Furthermore, it has been suggested that the difference between long-term and short-term elasticities reflects longer-term adjustments in residential location to facilitate use of public transport. Similar detailed data on elasticities exist for other countries, including Australia (Hensher 1996) and the United States (Transportation Research Board 2005).

Taking that evidence together suggests, or is at least consistent with, the hypothesis that using subsidies to increase service quality is more likely to bring about desired changes in mode choice than are reductions in public transport fares.

At a more anecdotal level, the growth of commuter van services in cities like Bangkok and Manila, at very substantial premiums over normal transport fares, supports the same hypothesis. What appears to be clear in all those cases is that the main beneficiaries of the network support are those who remain as motorists but face lower levels of congestion. Any contribution to accessibility comes incidentally through the benefits that public transport users also get from reduced congestion.

The great weakness of the traditional network support approach is that the absence of any competitive pressure leads to the leakage of the subsidy payment to the advantage of the producers—management and staff. This has been well documented both in the case of Britain (Bly and Oldfield 1985) and the United States (Pucher et al. 1983). In the United Kingdom, the attempt to reduce the adverse effects of deficit finance by putting operational agencies at arm's length from the planning and procuring agencies with which they would have a contractual arrangement turned out to have little effect, and was replaced in the 1980s by competitive tendering systems.

In many French cities, the chosen instrument role is delegated to a private company, which may be free to define networks and even, within limits, to set fares. This delegation has often been undertaken through a competitively tendered management contract in which the general objectives of the city are set out as the terms of engagement for the company. However, there has been substantial doubt about the effectiveness of the competitive pressure in these cases (Yvrande-Billon 2006).

5.4 Contracted service payments

An increasingly common method of combating the disadvantages of deficit finance of a protected operator is through the contracting out of service supply to independent—usually privately owned—operators on the basis of competitive tendering of medium-term service contracts. This may be done on a gross cost basis, under which the franchising authority takes the fare revenues and the supplier is selected on the basis of the least-offered cost of supply, or on a net cost basis, under which the operator keeps the fare revenues and the contractor is selected on the basis of the least subsidy required for the specified service. Contracts may be as small as an individual bus or as large as a whole urban system. Contracts may also vary in length. There is a large literature on design and operation of such systems, not discussed here. Rather, the concern here is for the way in which the interests of accessibility to transport services for the poor are handled within these regimes.

As a prologue to that discussion it should be noted that many of the elements of a system—package size, contract length, termination conditions, etc.—are designed primarily to secure the most effective competition for contracts and hence the best value for money. That is, of course, in the interests of all users, including the poor. Whether the contract form is gross cost or net cost, the franchising authority will typically specify the services to be provided and fares to be charged. These can, if the authority chooses, embody a "basic social service" approach to network and fare definitions. These specifications mainly determine the impacts on the poor.

Service specification usually involves both the routes to be followed and the frequency of service supplied. There is a danger of perverse redistribution arising in this process. For example, as residential densities and income levels normally vary spatially, the imposition of common standards for route network density and frequency will result in services to poorer areas subsidizing those to richer areas.

Fare specification can include both the general level of fares and any concessions to be observed. By including fare levels and structures in the invitations to tender and then in the franchise contracts, it is possible to incorporate in a privately supplied transport market either general fare subsidies or differential subsidies for particular service types or passenger groups. That does not come for nothing, of course. The lower the fares specified or the wider the required availability of concessionary fares, the more it will cost the franchising authority. In the case of net cost contracts, that cost arises in the form of the price that will have to be paid to the contractor to procure the service. For gross cost contracts it arises as the difference between the fare revenues retained by the authority and the cost of the supply contracts. There is some evidence from the United Kingdom that the immediate financial cost to the authority of net cost contracts is larger than that of gross cost contracts with similar fare and service specifications, because the net cost contract transfers both revenue risk and cost risk to the contractor.

5.5 Targeted service support

The support of services specifically provided for particular categories of passengers—for example, school services—can be a very direct targeting mechanism.

School services

The American style of school bus—a basic truck-chassis-based vehicle for limited use—is well known. It can be wasteful if it leads to the provision of capacity that is underutilized for most of the day. But it can also be an effective way of dealing with some form of operator indiscipline. For example, the support of a limited number of special vehicles for school services in Jamaica in the mid-1990s was an effective way of overcoming the resistance of the operators to carry half-fare passengers when full-fare passengers were available. The alternative is to require all services to carry schoolchildren at the prescribed reduced fare. In practice, enforcing an obligation to carry reduced-fare passengers on commercial services has been a perennial problem worldwide (see Box 4).

Services for the physically handicapped

In common usage, concern for accessibility of transport systems has been primarily regarded as concerning the physically handicapped. As with school services, it is possible

Box 4. Transport of schoolchildren in Sri Lanka

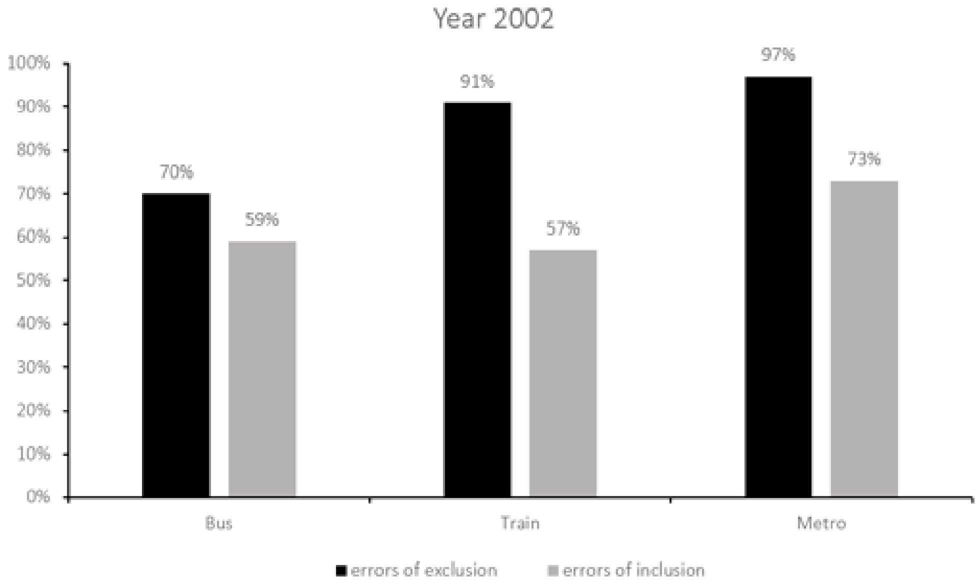
In Sri Lanka, where both private and public sector buses operate, the provision of bus services to schoolchildren on season tickets at fare levels only about 10 percent of the full fare was an obligation on the public sector "cluster companies," which sold monthly student passes at a price that would be approximately 10 percent of the full fare if used for 42 trips per month. The companies were paid on the assumption that each ticket sold would be used for the full 42 trips. As all season tickets were sold at a discount of 35 percent, this meant that in principle there was a subsidy of 55 percent of the full fare payable on student trips. However, cluster company crews, who were allowed to keep a proportion of their takings, were alleged to often refuse to pick up schoolchildren if they could fill their bus with full-fare passengers. As only about one-quarter of the services were provided by the public sector, and their scheduling was uncertain, children were often forced to pay the full fare. It was estimated that only 15 to 20 percent of trips by pass holders in urban areas actually used the public sector services. Hence this kind of remuneration mechanism had the perverse effect that the government was paying for much more service than was actually being provided, while the potential passengers were getting very much less than the nominal level of subsidy.

to try to improve access for the physically handicapped in two ways—by upgrading common services to make them disabled-friendly, or by providing special services. Both are likely to involve provisions that cannot be directly financed from revenues at prevailing prices and are hence forms of subsidy. While to some extent they are alternatives, they are also commonly regarded as complements, with special services being provided for those whose disabilities exclude them from even a disabled-friendly general system.

Many national governments have enacted laws requiring public transport to be accessible to the disabled, and there is even a European Union directive on the issue that is the context for national legislation throughout Europe. For example, the Americans With Disabilities Act of 1990 makes accessibility requirements for all public sector transport operators. Under this kind of legislation some features of "universal design" are now becoming commonplace in new vehicles. These include low-floor vehicles with ramps, larger destination signing, floor markings, additional grab bars, and audible stop announcements. Infrastructure can also be made more accessible by level entrance platforms, cuts in curbs for improved access, and so on. Many of these improvements are of trivial cost when incorporated in new facilities, though they may be somewhat more expensive to retrofit. Even so, they are not provided everywhere even in the United States, partly through lack of direct funding at the local level where formal responsibility for transportation lies. Elsewhere the provisions appear to be more thoroughly and systematically provided in the largest cities, especially those with strong metropolitan planning organizations. The larger cities such as London and Paris give free travel on their systems for wheelchair passengers. The most obvious lesson emerging from this experience is that attention needs to be given to ensuring that there are adequate financing mechanisms provided for within the national accessibility legislation.

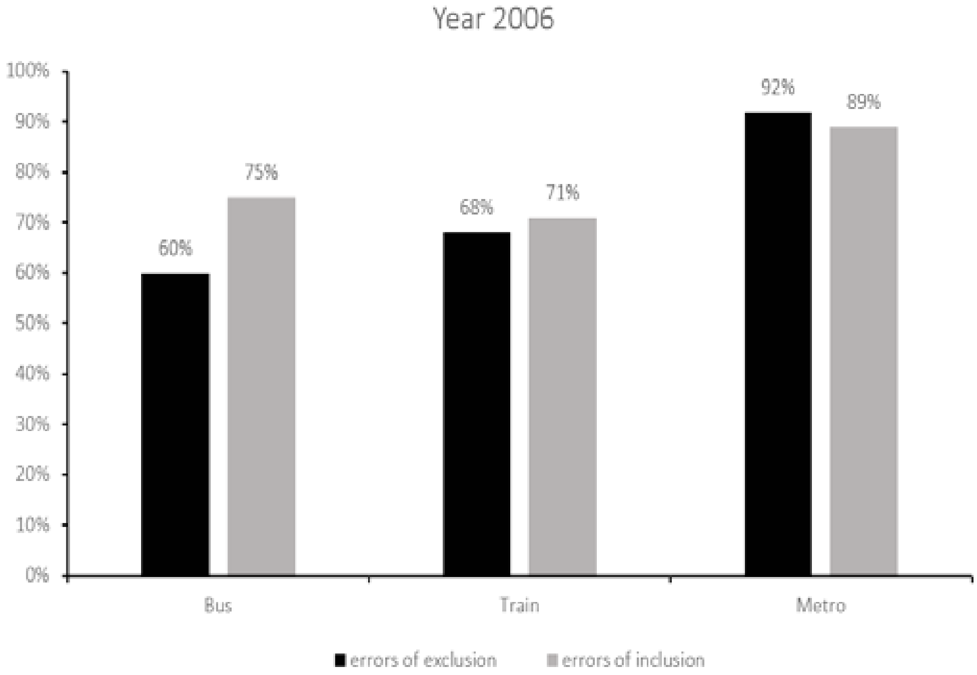
The complement to universal design of traditional public transport systems is demand-responsive para transit designed especially for accessibility, particularly for wheelchairs. In the United States, para transit service must be offered by any public transport agency that offers a general fixed-route service. All new vehicles must be wheelchair accessible. However, financing remains precarious, with the cost of para transit rising. That has led to an increasing use of contracts with wheelchair-accessible taxi companies in a number of U.S. cities, as well as in Paris, where two large private companies provide service for the regional organization STIF. Such private provisions are sometimes supported by public subsidy. For example, in London, the Taxicard guarantees a low flat fare for certain classes of registered disabled persons on standard taxis, while a system called Capital Call gives up to 200 pounds sterling free service per annum on minicabs. A broadened voucher system might make this kind of provision even more

Figure 2. Errors of inclusion and exclusion of Bueno Aires public transport subsidies



Source: Bondarevsky (2007).

Figure 3. The distributional impact of different modal subsidies in Buenos Aires



Source: Bondarevsky (2007).

6. Subsidizing 'goods': Demand-side interventions

In the light of the difficulty in designing supply-side subsidies to focus specifically on the most needy, those concerned with the social aspects of public transport supply have recently tended to shift their emphasis to the design of more specifically focused demand-side subsidies. This change of focus is supported by an early international study on the issue of targeting social programs, which concluded that programs that make use of targeting devices are able to transfer, on average, 25 percent more resources to low-income households than those that do not. Moreover, in the case of better-designed programs the difference increases to 200 percent or even 400 percent (Coady et al. 2003).

6.1 Income-based subsidies

If the justification of subsidy is the social second-best argument, the obvious instrument would be a subsidy directed exclusively at travel by low-income households, accompanied by measures to avoid leakages of the benefits to untargeted groups and to avoid wasteful excess consumption of the subsidized good or service. In practice there have been no notably successful cases of this kind of subsidy in the transport sector, though various proxies for income have been used (see below). However, there have been some explicitly income-directed subsidies in other sectors from which the transport sector might learn. For example, in the domestic water sector in Chile and Argentina, income-based tariff schemes have been generally successful in targeting the poor without any significant leakages to richer household and without any adverse effects on supply efficiency (see Box 5).

Chile also has a program of subsidizing privately provided housing, focused on low-income families. After 2002 the Ministeria de Vivienda y Urbanismo abandoned its previous program of direct provision of social housing in favor of a highly progressive system of subsidies to construction and first house purchase, with a special program, Fondo Solidario de Vivenda, focusing on low-income households. At the heart of the Chilean housing and water subsidy systems is detailed means testing, based on household interviews as well as submitted income documentation. There is no reason why the same database should not be used for transport-specific subsidies.

A similar cash transfer mechanism has recently been adopted in passenger transport in Bogota, Colombia, where fares for the Transmilenio-based system are set much closer to cost-recovery levels than in other cities in the country, where operators receive higher subsidies. To balance this, in 2013 the city authority in Bogota, with the assistance of the World Bank, introduced an explicitly "pro-poor" cash transfer system. Members of households that have a low national poverty index score can opt for a public transport subsidy through a personalized smart card, which gives them up to 40 trips per month at a fare of 30 U.S. cents compared with an average fare of 55 cents. The subsidy has been taken

Box 5. Domestic water subsidies in Chile and Argentina

In Chile, the Subsidy Law of 1989 established a direct subsidy for low-income household drinking water and sewer services. All water is metered, so household consumption was known. By the law the subsidy could cover 25 percent to 85 percent of the household water and sewer bill for up to 15 cubic meters of water per month, with all consumption above the limit charged at the full commercial rate. This was to discourage wasteful consumption of a free good. The system is managed by the municipalities, which are responsible for the registration process and the selection of beneficiaries (Gomez Lobo 2001). Money is transferred from the Ministry of Finance through regional governors to the municipalities. The private water companies invoice the municipality for the subsidy payment, and can charge interest for late payment. There is thus an incentive for rapid transfer of funds, with the recipient of the subsidy suffering no delays. Although some of the subsidy went to middle-income customers, it was in fact highly progressive and considered a success.

Social tariff schemes in the water sector in Argentina also proved generally effective in targeting the poor, with concentration coefficients as high as -0.80 in one province and a clearly progressive effect everywhere except in Buenos Aires (Foster 2004). Unfortunately, the explanation of this exception—that around the metropolitan axis there is a greater prevalence of impoverished middle-class households that do not exhibit many of the traditional characteristics of poverty, making it more difficult to design successful eligibility criteria—applies equally to the urban public transport sector.

up particularly by low-income workers and women. It has contributed significantly to an increase in incomes for informal sector workers (Rodriguez et al. 2016). However, the question should be asked why, if the targeting is so effective, it should not be used for a general cash subsidy rather than separate service-specific subsidies.

6.2 Journey-purpose-based subsidies

Several countries have introduced measures to subsidize journeys to work of the lowest-income groups. In discussing earlier the theoretical justifications for subsidies, it was suggested that some elements of urban transport possessed the attributes of a merit good, insofar as the benefits are either under-perceived at the individual traveler level or accrue to the society at large in terms of increased productivity. That argument applied particularly to work journeys in low-income countries where the transport costs of commuting might actually discourage work journeys and reduce the level of employment. There are two striking examples where this view has led to direct subsidy of work journeys for the poor.

Commuting tokens (South Africa)

During the period of the apartheid regime in South Africa, the constraints placed on where black and colored people could live resulted in a great distance separation between the residences of the African workforce and the locations of industry. This segregation was recognized by the regime as an impediment to employment. Hence, a scheme of subsidized commuting tokens was introduced to enable workers to afford to travel from the townships to the industrial centers in South Africa.

For rail commuters, it was possible to set low fares on the state-owned suburban rail systems with the ensuing losses financed partly by cross-subsidy from other traffic and partly by government deficit financing of the rail operator. For passengers in conventional large buses, which were operated by private (white) companies, this was not possible. Instead, black workers could obtain travel tokens—just enough for the daily commute and not more—at an affordable price. The bus operators were then remunerated by the government for the difference between the token fare and what was called the "economic price." While this did not eliminate the very long travel times, it did make the journeys financially affordable, and was in fact an extremely effective and well-targeted subsidy for its purpose. For some time at least, it also protected the market for the chosen operators as a reward for their effective support of the political regime.

In practice, in later years this system discriminated heavily by location. By the mid-1980s, there began to emerge an indigenous alternative in the form of a minibus market—the "black taxi." While unsubsidized and charging fares higher than the rail or bus token fares, they had the advantage of greater speed, reducing commuting travel times by one-third. By 1990, almost half of black commuters were using these unsubsidized services, particularly for the shorter (and hence cheaper) commutes.

Val transporte (Brazil)

Probably the most sophisticated and extensive system of subsidized commuting is the val transporte (VT) system, introduced in Brazil in 1985. Brazilian law requires formal sector employers to provide return work journey tickets on the formal bus company services, for which the employers are entitled to deduct 6 percent of the employees' wages. The effect of the 6 percent salary deduction is that the system was only of value to those with low incomes, and hence was well targeted among employees. About two-thirds of the cost is directly borne by employers and one-third by the government, as val transporte expenditures are allowed as a business cost before the calculation of taxable profit.

The VT system is organized and managed under the responsibility of state or municipal governments. In either case, there is a "selling agency," which may be a private bank or a clearing house operated by the government itself or by a syndicate of bus companies. At the beginning of the month, business enterprises purchase the number of VT tickets they need from the selling agency. The enterprises then give these tickets to their employees, who use them to pay for the trips they make via public transport companies. At the end of the month, the public transport companies exchange the VT tickets for their full cash value.

In practice, however, the system has been characterized by important leakages. A significant number of the people (estimated in 2000 to be about 25 percent of recipients) did not use their tickets to purchase formal public transport services but preferred to sell them, at a discount, on a well-organized black market. Some VT recipients would sell their tickets to traders, at a price lower than the transport ticket value. The traders might sell the tickets to other bus users for a (still discounted) trip on a public transport company. Or they might sell them (again at a price lower than the formal ticket) directly to the formal sector operators. VTs were even accepted for travel on informal sector minibuses, whose operators could then sell them through the exchanges even though they could not redeem them directly themselves. At the end of the chain the formal sector operators could cash in the VT ticket for the full value even though they had not taken them in return for a transport service provided. In this way the traders and formal bus operators were the effective recipients of part of the subsidy. Eventually, however, many formal operators came to the view that they would be better off if they retained their passenger market and hence in some cities moved to a personalized rechargeable smart card, which could not be traded.

The VT is basically progressive, though the very poorest, who have no job at all, are self-employed, or employed in the informal sector, do not receive the VT. The result is that not many people in the lowest income quintile benefit from the system. But many people in the second quintile do benefit from it, for something like 30 percent of their income. Some people in the next quintile are also aided, for much smaller amounts. And nobody in the remaining higher quintiles gets anything out of it. There is not much public expenditure for which this can be said. The VT also significantly increases the effective size of the labor market. For low-wage earners located far away from their work, the cost of commuting to work would represent 30 percent or more of their wages and two or three hours of time per day.

Though it has some positive distributional effects, it also has some perverse or negative effects. As a tax paid (for 65 percent) by enterprises, VT increases production costs, and may negatively affect national competitiveness. It increases disproportionately the cost of unskilled labor, and may reduce the demand for unskilled labor and induce firms to discriminate against workers located too far away from work and having to take more than one public transport trip. It even has some unintended redistribution effects: from non-wage earners to wage earners; from rural areas (with little public transport) to urban areas; and from the informal sector to the formal sector. It is also costly to administer.

While a general cash supplement to low-income households, whether in the formal or informal sector, would be preferable, it has been argued that the administration of the Brazilian tax system makes this an unlikely outcome. In those circumstances the best should not be allowed to be the enemy of the good, and the val transporte is likely to continue to play an important role in implementation of subsidies in Brazilian urban public transport.

Non-work journey subsidies

The merit-good logic clearly applies to other types of journey, for example, those involved in job search or in access to health care. An experiment in Ethiopia showed that subsidized transport for job-seeking journeys increased the probability of finding permanent employment, though whether the magnitude of that effect was great enough to justify the subsidy is not clear (Franklin 2015). The Hong Kong Special Administrative Region of China operates a system in which low-income individuals or households can apply, ex post facto, for commuting transport subsidies to help them secure or retain employment. However, as the payments relate to the previous 6 or 12 months during which the applicant was in employment, it is not clear how the program can stimulate employment, but it can work as a targeted low-income supplement

6.3 Person-type subsidies

Seniors

Many countries offer some kind of fare concession to pensioners. For example, in the United Kingdom anyone over the state pensionable age is entitled to free travel on local buses after 9.30 a.m. on weekdays and all day at weekends and bank holidays. There are also discounts on full fares for intercity rail and bus travel. This is sometimes justified on the grounds that pensioners are likely to be on more limited incomes than those in employment. While this is likely to be true on average, there are also likely to be substantial leakages of the subsidy finance to relatively higher-income groups.

The budget burden is reduced to some extent, and the efficient use of the available subsidy funding increased, by limiting subsidies to off-peak travel, a time when the marginal costs of service supply are lower (because they do not bear the burden of peak capacity costs). This restriction both reduces peak-period crowding (and possibly required peak capacity) and helps to maintain patronage through the inter-peak hours.

Juniors

There are two different bases for price concession to young people. The first is age per se. This tends to be based on tradition rather than any specific targeting aim, with the age limit varying from country to country. For example, while in London juniors can get free travel up to the age of 17 (albeit with a personalized identification system for 16-17 year olds to limit cheating) the age limit for Paris is 12. These concessions are often self-imposed by operators and are not usually the subject of specific external compensation.

The second source of concessions to young people is based on their being in education—which might be viewed as a merit-good justification. Again, the arrangements differ substantially from country to country. In London students above 18 years of age can get a 30 percent discount on full fares with an identity card. In Paris, students under 26 can obtain a 50 percent discount, administered through personalized monthly or annual passes. In the Netherlands, Dutch students get travel that is free at the margin, financed by deducting moneys from the government's student loans. The problem with all of these systems is the danger that they actually generate extra travel of low value, unrelated to their purpose of ensuring access to education. For this reason, a limitation is sometimes applied to the use of student passes outside school terms.

Efficient administration of targeted schemes to avoid excess demand generation is a perennial problem. This can be addressed increasingly effectively with modern smart card systems that limit the amount or nature (timing, location, etc.) of travel that is done at the reduced rates. Efficient administration is also easier to achieve in larger sophisticated metropolitan administrations, especially when the number of supplying organizations to be dealt with is limited

Disabled persons

It appears to be generally agreed that the best way of improving accessibility for the disabled is either to design general public transport facilities that are disadvantaged-friendly or to provide specific demand-responsive services that can approach the degree of availability of the public transport network. But in areas in which such services are not available, or for disabilities that cannot be accommodated in this way, direst subsidy can still have a role to play. For example, the British Columbia government offers a "special transportation subsidy" to recipients of disability assistance who are unable to use any other public transportation available. The subsidy can be used to pay for their own special private transportation or for others to provide service for them.

6.4 The contribution of IT to improved accessibility

Modern information technology (IT), and particularly smart card technology, is increasingly common in transit. While simple unintelligent identification cards have long been used to prevent fraudulent use of concessions, the most sophisticated smart cards like London's Oystercard or the HongKong Octopus can do much more. They use an embedded radio-frequency identification (RFID) chip within the card that enables it to hold information about the traveler and connect it to real-time information about the pricing of the specific trip. This feature can assist the improvement of accessibility in public transport systems in a number of ways

First, smart cards can improve operational efficiency, which is to the benefit of all. The information collected by smart cards can be used to improve service design. The cards can collect information on personal characteristics of the traveler, some special journey categories, and origin and destination—both of a leg and of a total trip—that can be used to design routing and service improvements.

Second, smart cards can improve pricing flexibility. The technology can facilitate multi-modal or multi-operator fare integration, automatically distributing revenue between modes or operators. It can also automatically administer pricing structures that differentiate between times of day or between different sections of the network.

Third, smart cards can assist the targeting of subsidies. In addition to carrying whatever money the holder has put onto it, the card can automatically pick up user-related subsidies and other contributions, as well as limit the aggregate use that the passenger can make of subsidized rates. In this way it is possible to avoid excessive use of subsidized fares. Fourth, personalizing the card with a photo identification of the holder can limit some forms of misuse of concessionary systems.

Smart cards are not the only application. GPS systems can also be used to enforce franchise contacts and to sharpen real-time operational control and can give real-time information on optimal routing. Real-time information systems can tell passengers when the next service is due, and can increasingly be accessed from personal cell phones to reduce passenger waiting times and uncertainty.

7. The effects of taxing 'bads'

7.1 Pricing for traffic restraint

There are several different pricing instruments that can restrain private automobile traffic.

Congestion pricing

Congestion pricing is the most direct and focused charge on trips in urban areas. If the primary aim is to improve efficiency in the use of scarce road space throughout the network, as in London and Singapore, or in specific corridors, as in some cities such as San Diego, Miami, and Tampa in the United States or Dubai in the United Arab Emirates, a charge should be imposed equal to the marginal social cost of road use. With such a charge, only those who value their use of the space more highly than its marginal social cost would use the space. In practice, however, charges cannot be varied so finely, so that a degree of approximation is inevitably involved. Moreover, some cities have other objectives. Of the better known cases, Stockholm was primarily concerned with generating revenue for urban road improvement, while Milan explicitly aimed at reducing pollution. Experience in implementation of congestion charging has been extensively discussed (International Transport Forum 2010).

The technology selected should be appropriate to the local situation. Singapore and Stockholm, as relatively small cities, began with simple manual implementation of cordon charging. London used an area charge, with a more complex (and expensive) charging system. Though Singapore and London were both primarily aimed at trip restraint, their geographical circumstances were very different. Singapore, as a closed city-state, did not have to worry about the passage of out-of-state vehicles, and the use of a highly sophisticated technology made sense in that case. An important issue is the willingness to charge. Costs are largely fixed with respect to the level of charge levied. The net financial benefits to the authority only arise at prices that at least cover the full costs (capital and operating) of the system. In London, while many commentators judge the congestion charging scheme to have been beneficial (D'Artagnan Consulting 2013), Prud'homme and Bocareja (2005) estimated that its operating costs exceed its benefits. But the available technology has become smarter over time. Singapore already has much more complex electronic road pricing, and, early in 2017, the London Assembly Transport Committee reported that the current London system was no longer "fit for purpose" and should be replaced by a system better targeted at areas of congestion at the specific time when it occurs.

Assessing the distributional effects of congestion-charge schemes is complex (Banister 2003). For the simpler single-corridor schemes, such as the SR 91 tolled lanes in Orange County, Calif., Schweitzer and Taylor (2008) concluded that lower-income groups benefited from the imposition of congestion-related tolls compared with raising of revenue from a general sales tax. But given the regressive nature of a general sales tax, this is hardly a strong defense of the distributional effect of congestion pricing. In a much more extensive analysis of nine different pricing schemes in Paris, Bureau and Glachant (2008) show the distributional effects to be very complex, but can in some circumstances favor lower-income individuals (see Box 6).

In an early analysis of cordon-pricing schemes in three English towns, Santos and Rojey (2004) found the impacts to be town-specific depending on where people live, where they work, and what mode of transport they use to go to work. For a broader range of system-wide pricing schemes, later European research also showed that much depends on the distribution of the reactions of users and on what is done with the revenues. Poorer motorists who continue to use the cars suffer in comparison with richer motorists because of the former's lower value of time savings. On the other hand, poorer people are more likely to switch to public transport, which would benefit, particularly if the road pricing revenues were devoted, as in London, to public transport improvements or subsidies.

Parking charges

In most large Western European cities, particularly those with central cores developed before the growth of motorization, there is a serious incipient problem of road congestion. In the absence of any effective congestion-charging system, control of parking is the most commonly used second-best instrument. A typical strategy would be to attempt to balance the available capacity of parking for the area to a level consistent with the traffic capacity of the roads.

Total parking capacity in the central area is the sum of privately owned and controlled operational parking and publicly available on-street and off-street parking. In many cities it is difficult to withdraw existing private non-residential parking, which was often provided originally in response to planning requirements, except at very large cost of compensation, so the focus usually falls on publicly available parking. The withdrawal of on-street parking has the dual advantage of reducing the total available parking stock and increasing total available road space, so it is the usual starting point for a parking restraint policy. It is not always politically easy to achieve, since many shopkeepers, particularly on the periphery of congested areas, highly value the availability of convenient on-street parking. Nevertheless, most large cities have taken control of the total amount of on-street parking by a combination of parking bans and charged, usually metered, parking. The conventional wisdom is that the parking charge should be set at a level

Box 6. Distributional effects of system-wide road pricing schemes

A study of commuters in Paris investigated which groups of commuters—motorists or public transport users—were winners or losers in terms of toll cost and reduction in journey time under nine possible road-pricing scenarios, taking into account the cost of cars versus public transport, the value placed by different income groups on reduced travel times, the availability of free parking, household income, number of children, and number of cars per household. It concluded that, on the whole, motorists tend to lose financially by the introduction of tolls. Taking the value of time savings into account, higher-income motorists lose less than lower-income motorists, among those who continue to use their cars following the introduction of a toll. However, lower-income motorists would increasingly switch to public transport, particularly if toll income is used to subsidize public transport. Lower-income motorists would be hardest hit by the scenario that charged motorists entering a zone from outside, as they tend to live in the suburbs. Political acceptability of the scheme would be improved if city center residents were partially exempted. Low-income motorists could benefit from a rebate for greener vehicles. In relative terms, tolls are always more detrimental to lower-income groups as a percentage of income. Above all, the results depend crucially on how much the traffic is reduced. If higher tolls lead to greater traffic reduction, and motorists who switch to public transport lose less in terms of time and money, more stringent tolls can in fact favor lower-income individuals.

Source: Bureau and Glachant, (2008).

that keeps 15 percent of spaces empty at any time in order to reduce excess traffic movement in hunting for space.

Off-street parking may be publicly or privately provided and charged for. In some cities it has been politically necessary to increase off-street parking to compensate for the loss of on-street parking. Increasingly, however, city authorities control both the total amount and the location and terms of availability of parking to combat congestion. Parking price controls are an essential element of this strategy. The more central the parking, the higher the price. For centrally located parking the price may be much higher for all-day parking, or for parking stays commencing in the morning peak, in order to discourage the use of the private car for peak-period commuting movements.

Clearly the details of a parking policy will depend on the circumstances of the location, but price will normally be an essential part of the strategy. Only in lower-density developments, as in some newer United States developments, is it likely to be possible to provide enough parking for unconstrained motorization without suffering severe congestion. It should be noted that while parking strategy is primarily an economic second-best strategy unrelated to any distributional objective, its effect should be to facilitate the improvement of public transport, which will be of benefit to lower-income groups.

Vehicle registration charges

Many countries charge an annual vehicle license fee, the revenues from which contribute to the cost of maintenance of the road system. These may be differentiated by vehicle size or engine performance to give incentive to ownership of "socially desirable" vehicle types. In most cases these contribute rather less to the exchequer than fuel taxation. In contrast, a number of Far Eastern cities use an initial vehicle registration charge as the primary instrument of a policy to restrain private vehicle ownership and use. For example, in Hong Kong a first registration fee of about US$20,000 is charged for a vehicle with an engine size of up to 1600 cc, with larger fees for heavier vehicles. There are also annual license fees and a number of other fees for inspection and license renewal once the vehicle reaches six years of age.

Many other large Chinese cities have now followed the Hong Kong example of restricting the number of private vehicle licenses available (Zhao and Block-Schachter 2016). Restrictions are differentiated by location and by residence status, with less-stringent restrictions on suburban and permanent residents. In Beijing, and to a partial extent in Guangzhou, the available licenses are distributed by lottery. This not only makes the instrument revenue-negative but also opens up the possibility of a black market, with the revenues associated with restraint accruing to private individuals rather than the public budget. In Shanghai, in contrast, licenses valid for operating within the outer ring road of the city are distributed through a public auction. With a price in 2016 of US$14,000, the auction yielded a sum equal to 90 percent of the city transportation budget, and was spent mostly on bus purchase and operating subsidies for older people's fares and subsidies of unremunerative routes.

Singapore has taken the auction procedure even further. Those wishing to purchase a car have to obtain a "certificate of entitlement," which lasts for 10 years. Each month, in the knowledge of how many certificates are expiring and an estimate of an acceptable total car stock, the government decides how many new certificates are to be put to auction. These will be differentiated by vehicle class, based on previous experience of demand for different classes. Bidders are allowed only one bid per auction round, and the certificates go to the highest bidders, though all pay the lowest winning bid price. The 2016 price for a certificate of entitlement for a vehicle under 1600 cc was about US$35,000. In addition, for new imported cars there is a 41 percent ad valorem customs duty.

The accessibility and distributional effects of the auction devices appear to be generally positive. Richer car owners get the advantage of less congestion as a result of the restriction on car numbers, and they pay heavily for it. Lower-income people get better public transport, including easier access to the system as a result of the subsidy of some unremunerative routes.

7.2 Transport pricing for environmental protection

The main environmental outputs of transport are jointly produced with transport service provision, and vary according to the vehicle technology, the fuel used, and the amount and location of transport provided. The major local air pollutants—suspended particulate matter, carbon monoxide, NOx gases, oxides of sulfur, ozone, and unburnt hydrocarbons—can all be reduced significantly by a combination of vehicle and fuel technology and are subject to increasingly stringent regulation. Once embodied in accepted standards, the costs of suppression are small relative to the total costs of transport. In distributional terms they may impinge slightly more heavily on the capital costs of newer vehicles, because of the typical structure of vehicle depreciation costs, and since richer people tend to drive newer vehicles the costs may be slightly progressive in effect. But if that effect exists at all, it is likely to be weak.

Fuel prices

The main global warming gas, carbon dioxide, is emitted in direct proportion to the amount of hydrocarbon fuel consumed. While carbon dioxide has been reduced substantially by technological development in recent years, and can be addressed by regulations on engine size or fuel consumption characteristics, it is the main subject for pricing action through fuel taxation, and has been the main object of concern on distributional grounds.

The distribution effects of a change in fuel taxation can be estimated by examining the proportion of expenditures on fuel by income group in household surveys, allowing, if data are available, for differences in price elasticities of demand for fuel between groups. In the United States, where journey to work by low-income residents is still heavily car-oriented, and these cars tend to be older, more-polluting vehicles that are targeted by environmental pricing and regulation, vehicle fuel taxation can be very regressive (Poterba 1991). However, social conditions vary greatly between countries, and much depends on the distribution of car ownership and use. In Europe, Asensio et al. (2003) showed that the greatest burden fell on the middle-income groups, while for the United Kingdom Santos and Catchsides (2005) concluded that fuel taxes are very regressive if only car-owning households are considered, but more or less neutral if all households are included. In a recent study of seven European countries—France, Germany, the United Kingdom, Italy, Sweden, Spain and Serbia—Sterner (2012) also found only very weak evidence of regressiveness, and suggested that fuel taxes might safely be viewed as effectively proportional. West (2004) considered taxes on vehicle miles traveled, which have similar characteristics to fuel taxation.

Fuel taxes also change prices of other goods and services, so that to reach a total tax burden one would have to include this indirect effect in the analysis. Datta (2008), attempting this for India using an input–output model together with detailed information of fuel use for every industry in the economy, finds auto fuel taxes in that county to be progressive. That supports the intuition that the lower the national income per capita, the more progressive fuel taxation is likely to be.

Even that is not necessarily the complete story. If one were to use the fiscal space generated by an increase in a proportional fuel tax for a reduction in a progressive income tax, then the overall effect would be regressive. Unfortunately, it is often difficult to attribute changes in one tax to changes in another, so that a comprehensive conclusion is hard to reach. In any case, the changes in structure are the results of political judgment, and there is the possibility of a "double dividend" when both the fuel tax increase has a progressive impact and the use of the fiscal space to finance public transport is also pro-poor.

Other environmental charges

A fuel tax is not the only environmentally oriented tax on transport, of course. Both sales taxes and annual license duties may be differentiated by engine size, vehicle age, or other characteristics. There are so many possibilities that it is not possible to give a general judgment on their distributional effects here. But the approach to analyzing them would be like that discussed above for fuel taxation. Similarly, environmental taxation on polluting freight vehicles entering urban areas—as imposed in London and other cities—would have distributional consequences of the kind that would need the Datta type of analysis.

Conclusions: efficiency pricing with an accessibility focus

The questions

The overall theme of the program to which this paper is a contribution links two perceptions of traditional transport planning practice, namely:

- That it has incorrectly focused on increasing mobility rather than on improving accessibility.
- That this focus has been associated with transport policies that are distributionally regressive or "pro-rich."

Accepting both of these propositions, this paper takes the view that the second is not a logical consequence of the first. Rather, they are both the consequence of an underlying fixation, particularly in transport infrastructure investment policy, on facilitating private automobile movement. That being the case, the issues of accessibility and welfare distribution have been treated separately. Moreover, there is a wide range of special characteristics affecting efficiency in transport markets that the pricing of transport services may be trying to address. In the context of the emphasis of the overall program with the welfare of lower-income groups, it therefore seemed important to examine the implications of those pricing policies for the welfare of the poor.

That approach yielded three main areas of inquiry, namely:

- The approach to accessibility.
- The approach to targeted income redistribution through transport prices.
- The reconciliation of efficiency pricing with equity considerations.

All three issues are confusingly complex. In this section, we therefore attempt to present the main conclusions of the discussion in a simplified form to highlight the underlying, hopefully consistent, story line.

The approach to accessibility

The first issue concerns the transport policy focus and its implications for practice. The main conclusions are as follows:

Accessibility is preferable to mobility as the policy focus, both because it is what people are really trying to achieve and because, unlike mobility, it does not have any adverse environmental side effects.

It must not be presumed that measures to enhance accessibility are necessarily pro-poor. Road infrastructure investments can increase accessibility, and may in any event prove to be regressive in their impact because the rich make more use of unpriced roads than do the poor. In contrast, some land use management measures are generally more favorable to the poor.

An integrated land use and transport strategy is the preferred instrument for enhancing accessibility, involving transport-oriented development on the main public transport corridors, implemented through a combination of zoning regulations and floor space ratio controls. While there may be some remaining environmental reasons to segregate heavy industrial and residential land use, much modern light industry is both environmentally benign and footloose. The main danger seems to be that a gentrification process will drive poorer residents out of improved areas, further marginalizing them.

Some commercial price discrimination enhances system accessibility. A normal commercial supplier of public transport services would be aiming to make a profit, and in pursuit of that objective might differentiate its prices significantly. In particular, off-peak discounts and peak-price surcharges would be commercially rational, given the extra capacity costs incurred in providing for the peak. Certainly in respect to off-peak discounts, it is likely that they would be consistent with accessibility objectives, as they would probably attract pensioners able to travel off peak. Attempts to increase revenue through differentiation by class of service would also seem to be consistent with the objective of increasing accessibility for lower-income groups.

Integrated transport fares increase transport system accessibility but may have distributional drawbacks. Modally integrated fares make it easier to use urban transport systems by eliminating any financial penalty on transfers. But they generally involve either some cross-subsidy from bus to rail or an increase in the basic fare. Either outcome adversely affects the poorest bus users. Increasing use of rail stations in inner urban areas may also affect property markets and drive out poorer residents in the process of gentrification.

Public transport fare strategies can protect the poor from the worst effects of marginalization. In smaller and medium-sized cities, flat fares militated in favor of equal access for all income groups. In larger cities, however, the distortionary effects of flat fares are magnified. In that case it may be necessary to resort to measures of spatial, income-based, or journey-purpose-based differentiation of fares, implemented through modern smart card fare instruments, to protect against marginalization. Designing those systems is a challenge remaining to be met.

The approach to targeted assistance for the poor

The second topic area concerns ways of maintaining the affordability of transport for the poor. The main conclusions are as follows:

The effectiveness of measures to assist the poor can be formally appraised using inclusion and exclusion indicators, Lorenz curves with their associated quasi-Gini coefficients. This will help to eliminate waste of resources through inefficient targeting, and help to justify resources committed.

Unearmarked cash transfers appear to be generally the best way of shielding poor transport users from economic changes that make transport seem less affordable. Recent developments in electronic payment and cash transfer systems, particularly in Latin America, have allowed cash transfers to be targeted at selected groups of the poor. Economic theory generally suggests that the benefit to the poor is greatest where the cash transfers are not earmarked for specific items of consumption.

Earmarking of cash transfers does make sense in the case of merit goods, where the benefits of increased consumption accrue either to members of households who would not normally control expenditures (women and children) or to society in general. Where cash transfers are related to specific goods or services that are viewed to have the characteristics of merit goods, electronic payment systems can cap the level of consumption that is eligible for subsidy to limit the distortionary effects of intervention in specific product markets, as shown recently in the design of public transport subsidies in Bogota, Colombia.

Supply-side subsidies may be justifiable in some merit-good cases, even though targeted demand-side subsidies are generally preferable. Cash in the passenger's pocket will not be enough to ensure adequate consumption of merit goods if there is no supply of such goods on the market. And, because the essence of merit goods is that they yield benefits to society more generally as well as to the direct consumer of the service, cash in the pocket may not be converted into an effective market demand for the product.

Supply-side subsidies should generally focus on outputs rather than inputs. Subsidies for vehicle purchases, fuels, or labor, while capable of giving short-term financial relief to operators, almost always produce serious distortions in resource use and in operational incentives in the longer term. Only when there is a clear and well-justified purpose—such as accelerating a change in fuel technology—should input subsidies be used.

In general, therefore, targeted subsidies of passenger transport are rarely the optimal way of helping the poor, because they are limited on the demand side to cases where transport is demonstrably a merit good and on the supply side to cases where the market is failing to produce a supply to satisfy the merit good demand. Even recent improvements in the ability to target transport subsidies through smart card technology may be better used to direct non-earmarked cash transfers than to generate benefits in kind.

But that is far from the end of the story as far as the importance of transport prices are concerned for the welfare of the poor. Particularly in urban areas, public transport fares and other transport prices are not only or even primarily concerned with welfare distribution, but also play a central role in managing the efficiency of the system. Public transport fares and subsidies may be managed to enhance system efficiency, to prevent exploitation of natural monopoly powers, and to reduce environmental impacts of transport. However, ostensibly efficient fare systems are not necessarily pro-poor. So it is important to ensure that the best balance is found between the objectives of efficiency and equity.

Reconciling efficiency pricing with equity considerations

Public transport subsidies are often part of a second-best system efficiency control regime. Where roads are congested, but there is no efficient congestion charges scheme in place, a combination of physical restraint of traffic (often through parking control) and public transport subsidies are often used to obtain a more efficient balance between public and private transport. The risk that subsidies will undermine operational efficiency must be mitigated by control in the form of strict efficiency benchmarking or, even better, competitive tendering of franchised services. Cost-benefit analysis can be used to test the efficiency of different allocations of traffic between private and public transport modes, using a shadow price for subsidy expenditures greater than unity to recognize the scarcity of public funds.

Subsidizing fares may be a weak instrument. Over-optimism about the ability to shift passengers between modes must be avoided: although cross elasticity of demand for car use with respect to public transport fares is higher in the long run, in the short run it may be very low. The evidence suggesting that relative travel time and service quality are more important influences on mode choice than are public transport fares is quite strong. For efficiency reasons it may therefore be more effective to use public transport subsidies to improve quality rather than to reduce fares.

However, subsidizing public transport quality may not be the most pro-poor use of subsidies. Because richer travelers tend to have higher values of time and of comfort than poorer travelers, a regime that gives preference to quality improvement over price reduction in order to encourage a larger use of public transport has some distributional hazards. Different scenarios in respect of the use of subsidies should be examined and formally assessed not only in terms of traditional cost-benefit analysis but also in terms of the distribution of benefits. Such an assessment should also take into account the issue of who pays for the subsidies, as this may itself be a very regressive element.

Direct congestion charging may be a preferable approach to the efficiency issue, especially in large cities. Not only does it have the right properties of private car restraint, but it also generates funds that can be used to finance public transport. Being revenue-positive, its distributional characteristics may be simpler to assess, as it does not depend on the nature of the financing source. In cities where income and car ownership are highly correlated, it is likely to be strongly pro-poor, though this is not necessarily the case in all situations. Again, the instrument needs to be subject to both efficiency and distributional assessment.

Parking charges are equally important for efficient use of road space. Parking charges support physical restraint of car use as a means of inducing a shift to public transport. They should be applied to on-street as well as to off-street parking in congested areas. By assisting public transport, they help poor public transport users, but reduce the welfare of poorer car-dependent households.

Setting maximum public transport fares may prevent excess profits, but it often has perverse effects. At first sight price caps on state owned monopoly operators may appear to be strongly pro-poor. In practice, the issue is not so clear. When the practice is extended to the application of fare caps on routes in a private flat-fare system, the result may simply be route splitting by operators. This outcome has the effect of requiring those making longer trips to pay two or three fares, which is definitely not pro-poor. Competitively tendered concessioning may be a better protection against inefficiency, which can still occur under price- or profit-controlled regimes.

Pricing for environmental reasons is likely to be pro-poor in low-income countries. As far as handling environmental impacts of urban transport are concerned, the best package would seem to be a combination of enforcement of vehicle and fuel standards—in terms of unit emissions of local air pollutants —with the use of fuel taxation to discourage the amount of travel and directly reduce global-warming-gas emissions. The general evidence on this is that in lower-income countries the package would be strongly progressive, while in higher-income countries it would have minimal or zero regressive effect. Only in the United States has a fuel tax been found to be strongly regressive.

The bottom line

The policy conclusions of this paper may be briefly summarized as follows:

First, accessibility is preferable to mobility as a policy objective because it focuses better on the achievement of the final purposes for which transport is simply an instrument, and because it avoids some of the adverse environmental side effects of increased mobility. But focusing on accessibility is not necessarily more pro-poor than focusing on mobility, unless accompanied by other measures to make it so.

Second, though there are some good efficiency reasons for subsidies, recent experience worldwide has shown that assistance to the poor is more efficiently delivered through direct cash transfers than through service subsidies. Subsidizing transport services, either on the supply side or demand side, is likely to be the best policy for assisting the poor only in the case of merit goods, where the consumer may not make the socially optimal use of the normally preferable direct cash transfers.

Third, however, the efficacy of direct cash transfers does not mean that transport pricing is unimportant for welfare distribution, as there are many applications of pricing policy aimed at improving the overall efficiency of the transport sector that may have significant impacts on the welfare of the poor. Formally analyzing the distributional effects of these policy applications, and seeking acceptably pro-poor variants, can be very important.

To achieve that objective, several difficult tasks remain unresolved, either for analytical or data availability reasons. These include:

- Calculating the magnitude of external benefits where transport is a merit good.
- Assessing the distributional effects of cross-subsidy in integrated multi-modal systems.
- Assessing the welfare distribution effects of subsidized metro investments
- Identifying the welfare losses attributable to the appropriation of benefits by the head of household in household-based cash transfer systems.

Hence, focusing on the distributional effects of transport pricing policies such as road pricing, integrated fare schemes, and infrastructure capital subsidies aimed at improving the general efficiency of the system is likely to be more helpful to the poor than the design of primarily redistribution-oriented fare systems.

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Endnotes

1. For example, after the currency collapse in 2002 the Argentine government introduced a program, "Jefes y Jefas," intended to protect those who had lost employment and income in the collapse. While the program did clearly help some of those most adversely affected, it also clearly failed to restrict the benefits to the explicit target group (Galasso and Ravallion 2004).

2. The following subsections are developed from (and hopefully consistent with) earlier work undertaken by the author for the Brookings Foundation (Gwilliam 2016).

3. In the case of appraising a fare, or subsidy, as both the costs and benefits are primarily in current rather than capital terms, the outcome is likely to be sensitive only to the choice of a discount rate if the costs of the subsidy and the benefits of the subsidy change at different rates over time. This may occur either because of demand-side changes such as road congestion increasing or because of cost-side changes occurring for exogenous reasons.

4. That presumption has been challenged by cities such as Curitiba and Bogota, which have chosen bus rapid transit (BRT) systems as a more efficient use of scarce resources in their circumstances. The question of what are the limits for applicability of BRT remains a matter of hot debate. For example, the Hanoi BRT, commissioned in January 2017, reverts to unsegregated operation in the most congested city center sections.

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