THE POLITICAL ECONOMY OF URBAN TRANSIT

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SUMMARY

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1. INTRODUCTION

In most countries, the public sector interferes in the operation of urban transit in many distinct ways. In the past, public transit systems have usually been operated by the public sector itself, with pricing and investment decisions directly under political control. Many countries have begun to privatise transit companies, but even then, regulations of pricing and investment decisions usually remain. One specific aspect is that public transit is usually heavily subsidised. According to the American Public Transit Association (2006), total fares in several thousand public transit authorities in the US accounted for only 33% of operating costs and 23% of total operating and capital costs, while for Europe corresponding figures show fares cover about half of operating costs (APTA, 2005). Urban transit is obviously heavily subsidised through general tax revenue. Interestingly, automobile travel too, often does not cover the full costs of road construction and usage (let alone environmental and accident costs). Indeed, in the US, user fees (including gasoline taxes, licence fees and other charges) accounted for only 60% of total highway expenditures (Brueckner, 2005). In Europe, higher petrol taxes suggest that subsidies to automobile travel should be significantly lower. These subsidies obviously have repercussions on individual commuting choices. For instance, subsidising automobile travel may provide incentives for individuals to move further out from the city centres into the suburbs.

Subsidies also impact the optimal investment policies in urban transit or alternative transport systems such as roads. The choice of transport system obviously depends on the part of the cost that is borne by individuals. Subsidising transport may therefore lead to overinvestment (Brueckner, 2005)[1]. Both subsidies and the choice of transport system have efficiency and redistributive consequences. Indeed, it will usually be the case that different groups of individuals have a preference for or against public transit and, likewise, for or against subsidies for alternative transport modes. Winston (2000) argues that public involvement in urban transportation will remain large because transportation policy is shaped by political interests.

This paper presents a selective survey of the political economy of urban transit. It will ask who benefits and who pays for different regulations, in particular, pricing and investment policies. In so doing, the author reviews in a non-technical manner recent contributions to the political economics of subsidising transport and of determining the configuration of urban transport systems. The general idea is to determine the effects of the analysed policies on urban structure and on the distribution of residents' welfare.

Before proceeding, it is worth emphasizing the scope of the paper. It will deal with issues from a positive political point of view. That is, different political measures such as subsidies will be evaluated according to the political support they generate, which in turn depends on their distributional impact. Brief mention will be made of efficiency effects of transport policies but these will be only cursory. Also, the main focus of the analysis is on urban economic models (although non-urban models will briefly be discussed). These models explicitly incorporate the interaction of transport costs and land use. When the political sphere interferes with housing and transport markets, this will affect land use and urban spatial structure. Thus, an important question is how different measures affect consumers' location decisions, commuting times, housing prices and mode choice. Moreover, the paper looks at subsidies and system choice in a relatively abstract manner. Thus, questions such as institutional arrangements, ownership and regulation will be mostly disregarded, and no strong effort will be made to gauge the empirical evidence in support of the presented models[2]. This is not because these issues are unimportant. In fact, ownership questions probably do play an important role in the working of urban transit. For instance, Winston (2000) claims that government failure is responsible for poor performance of urban transit and should be remedied by privatising government monopolies. However, in order to distil the distributional implications of transit policies, it is useful to abstract from these questions.

The paper is organised as follows. The next chapter very briefly reviews some normative criteria for public transit policies. Chapter 3 then presents some elements of the political economy of public transport in general models, i.e. models that disregard the explicitly spatial aspects of urban transport. Chapter 4 provides the theoretical background for the urban economic models analysed in the sequel. Chapter 5 then describes the political economy of transport subsidies and Chapter 6 turns to the political choice of transport system. Chapter 7 discusses how the two approaches – choice of subsidies and of transport system – can be combined. The last chapter concludes the paper with some general remarks on the political economy of transit reform.

2. NORMATIVE THEORY OF REGULATION

Before the advent of political economic theories of regulation, analysis of pricing and investment choices was based on welfare economic analysis (Braeutigam, 1989). The basic tenet of welfare economics is that prices should reflect marginal social costs[3]. From this prescription, a natural case for subsidies in transit emerges through the existence of economies of scale or economies of traffic density. Economies of scale imply that average costs are higher than marginal costs and, hence, marginal cost pricing will not cover costs. Subsidies to transit providers are necessary to cover losses. Economies of scale arise from large fixed costs in the case of rail service. For bus service, technological economies of scale are likely to be small, but average costs for users decline with service frequency, since waiting times decrease (the so-called Mohring effect).

In the case of multiple services, cross-subsidies emerge from an application of pricing rules such as the simple Ramsey rule, where the deviation between price and marginal cost is inversely proportional to the price elasticity of demand of the relevant service.

Other cases for subsidising transit have been made. For instance, a first-best policy includes congestion prices for automobile travel, but if congestion costs are not internalised, subsidies to public transit may be a second-best response to reduce automobile travel. The empirical case for this instrument is, however, weakened somewhat since the cross-price elasticity between automobile travel and transit prices seems to be low.

For the case of optimal investment in a transportation mode, we find similar rules going from simple to complex. In the most basic framework, the capacity of a system should be expanded until the marginal social benefit equals the long-run marginal cost. Social benefits include the time savings for users of a transport facility and reduced congestion. In the case where congestion is efficiently priced, congestion tolls exactly cover the costs of optimal capacity if there are constant returns to scale (Mohring and Harwitz, 1962).

All of these propositions have some merit, mainly for our understanding of what efficient policies may look like. However, as a positive description of regulatory policies, the normative theory clearly fails (Noll, 1989). Indeed, it was soon recognised that actual policies in regulated industries deviate wildly from those prescribed by welfare economics; and these deviations were too large and too systematic to be explained by occasional mistakes or the ignorance of decisionmakers. In fact, it soon transpired that regulatory policies do not generally seem to serve the consumer interest. In a seminal piece, Stigler and Friedland (1962) found that regulation of electricity markets in the US had not lowered electricity rates. Similarly, Winston (2000) shows that in the US, transit fares have risen by 54% from 1980 to the late 1990s, despite increasing subsidies. Thus, it seems as though regulation may serve other goals than protecting consumers. Hence, the need arose for positive theories that are able to explain the policies we actually observe. This endeavour is at the heart of political economy.

3. POLITICAL ECONOMY OF PUBLIC TRANSPORT; GENERAL MODELS

3.1. Capture theory of regulation

The capture theory, or Chicago theory of regulation, in its simplest form states that, instead of maximising welfare, regulatory policies such as pricing of public transport tend to serve the producers' interests. This argument was first advanced in a coherent framework by Stigler (1971). He argued that politicians value money and votes; they want to get elected, but they may also be interested in bribes, campaign contributions and the like. Accordingly, politicians set policy to maximise some function of these two arguments. Thus, whether consumers or producers "win" in the regulatory game depends on what they can "offer" politicians. Stigler's general insight was that producers tend to win for two reasons; they are better organised than the usually diverse consumer groups and they have higher stakes and therefore push harder for favourable regulation. Consumers are generally affected only marginally by regulation and therefore each consumer has a small stake in the regulatory game. According to the capture theory, subsidies to regulated industries do not serve to set prices at marginal costs but rather increase producer profits at the expense of consumers.

While this line of research has yielded important insights, it is also difficult to reconcile with many empirical regularities, especially in public transport pricing, such as pricing below cost. Later research in this vein has addressed these shortcomings. Peltzman (1976) argued that as long as consumers provide some votes, producers will not receive maximum profits. He also showed that pricing to different consumer groups is dictated by their political weight and not the cost of serving them. This generates an inherent tendency toward cross-subsidisation; if two groups have the same political clout, both should pay the same price regardless of their marginal costs. This may explain, for instance, the widespread support for public transit in regions with low population densities.

Different extensions of the capture theory have been offered. Becker (1983) shows that regulation will be efficient compared to alternative methods of redistributing between the relevant political groups. Laffont and Tirole (1991) include imperfect information and study how different incentive schemes affect the incentives for a regulatory agency to collude with the regulated firm.

Transit subsidies may redistribute not only between different groups of voters or transport users and firms: Winston (2000) and others have argued that an important part of subsidies goes to workers in transit authorities in the form of higher wages and higher returns to suppliers of capital. For instance, a large part of the cost reduction achieved by British bus deregulation came in the form of reduced wages (Nash, 1993).

3.2. Voting models

In the Chicago theory, the focus is on the conflict between consumer and producer interests, but conflicts among different consumer groups are usually considered only in a very broad sense. In voting models, on the other hand, this is the central focus of the analysis. Consider the following setup. A group of individuals who differ by income must decide the pricing policy of public transport. If the transport industry is subject to increasing returns to scale, marginal cost pricing leads to losses for the producer and would require subsidies. Society would then need to pay for this subsidy, for instance, through an income tax. The political support for such subsidies then depends on the progressivity of the income tax and on the incidence of benefits from public transport for heterogeneous consumers.

This is essentially the case considered by Corneo (1997). He shows that individual preferences for public pricing depend on income; given a proportional income tax and quasilinear utility, the higher an individual's income, the lower is his preferred subsidy and tax rate. This is because the demand for public transit is assumed to be income inelastic while the tax share increases with income. A well-known implication of this assumption is that in pair-wise votes over all possible alternatives, the winner will be the pricing policy preferred by the voter with a median income.

Corneo (1997) then shows the following. If median income corresponds to mean income, pricing of the transit authority will correspond to marginal cost pricing, with fixed costs covered by a subsidy. Intuitively, in this case the median voter is also the average voter, which means that maximising his welfare corresponds to maximising society's average welfare. If, however, income is skewed to the right, such that median income is below mean income, prices will be below marginal cost and the implied subsidy correspondingly higher. Here, the median voter benefits more than average from subsidising prices. This kind of model then generates the testable hypothesis that public transit prices should be lower, all else being equal, the lower the ratio of median to mean income.

Corneo (1997) also shows that pricing rules for a setting with many goods (for instance, a transit authority with several modes such as rail and bus) will correspond to a modified Ramsey rule, with the difference between price and marginal cost being inversely proportional to the demand elasticity of the corresponding good weighted by the difference between median and mean income. The intuition is that if the price elasticity of demand is large, departing from marginal cost pricing entails larger welfare costs and hence, in equilibrium, the price to marginal cost ratio is lower the larger the price elasticity. The median to mean income ratio shapes the distributional gain of the median voter from pricing as described above.

3.3. Empirical evidence

It is worthwhile pausing here to see how theory squares with some of the facts of transit pricing. Since the focus is on theory, however, the discussion will be brief.

A first issue is how subsidies redistribute between consumers and producers. According to the capture theory, the share of subsidies going to producers should be relatively high. Indeed, according to studies cited by Winston (2000), as much as 75% of subsidies go to workers in the form of higher wages or suppliers of capital in the form of higher profit (see also Rottemberg, 1985). The remaining 25% go to reducing fares and improving transit quality. This seems consistent with a version of the capture theory that stresses the political strength of producer interests.

Voting models look at how this quarter or so of a subsidy that goes to consumer interests is distributed among heterogeneous consumer groups. According to the simple median voter model above, if the subsidy is financed by linear income taxes and transit demand is income inelastic, the incidence of a subsidy is progressive, i.e. poorer transit users will tend to benefit at the expense of wealthy taxpayers. It is generally believed that transit users are relatively poor, so this would be compatible with the theory. However, the model presented did not account for consumers' mode choice. While bus users – at least in the US – tend to be relatively poor, rail commuters are often relatively wealthy. For instance, Garrett and Taylor (1999) show that more than half of bus riders in Los Angeles earn under $15 000 a year. Typical Southern California commuter rail riders, however, earned about $65 000 a year (see also Pucher and Renne, 2003). While in many European countries transit use is more widespread, data show here, too, that low-income individuals tend to disproportionately use mass transit (Infas and DIW Berlin, 2004).

Hence, subsidies to rail transit may well benefit relatively wealthy households; an important part of the arguments in the following chapters will explain why. Rail transit often serves suburban locations which are predominantly populated by upper middle-income residents. Therefore, it is not unrealistic to assume that the fiscal incidence of at least part of transit subsidies may be regressive, which would seem to contradict the simple median voter story. However, the ensuing analysis will also show that the fiscal incidence of a subsidy (i.e. the effect on an individual's net income position) is not enough to gauge its redistributive effect. General equilibrium effects on urban housing markets may be important and may, in particular, explain why poor residents may support subsidies which seem regressive at first sight.

There is also an explicit regional dimension to subsidies for urban transit. In most countries, transit authorities are operated locally but subsidies often come from national governments. Hence, local transit users are subsidised by non-users. Urban transit users are subsidised by residents of rural regions where mass transit is not available (Rottemberg, 1985).

4. URBAN MODELS: BACKGROUND

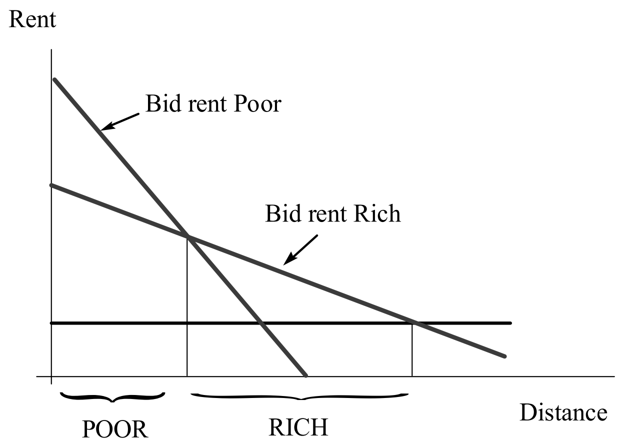
The political economic analysis, as described in the previous chapter, has one drawback from the point of view of urban transport. Namely, by postulating aspatial models, it ignores potentially important effects of urban transport policies on urban structure and housing markets. Indeed, since most individuals use public transport to commute to work, ignoring the effects of policies on commuting distances may be misleading. Moreover, in choosing their location and hence commuting distance, individuals trade off commuting costs and housing benefits. Therefore, transport policies which affect commuting costs may have important repercussions on housing markets, and ignoring these may lead to false conclusions.

Therefore, we now turn to models which explicitly incorporate urban structure into the analysis of urban transport policies. Before describing these models, however, a brief background is provided which is common to urban economic models.

The models described below are based on the so-called Alonso-von-Thünen model of a monocentric city[4]. These models analyse individuals' housing and location choices in a city. All individuals in the city commute to work in the Central Business District (CBD). Commuting costs are assumed to be linear in the commuting distance. Individuals derive utility from housing and non-housing consumption. Residents are assumed to be mobile within the city. Therefore, an individual must reach the same utility level regardless of his location in the city. Locations further from the CBD imply higher commuting costs; in order for individuals to be willing to move there, housing rents must then fall enough to compensate the individual for this higher commuting cost. This is captured by the fundamental concept of a bid rent function; it shows how much an individual is willing to pay for housing (per square metre) at a particular location. The bid rent function declines with distance from the CBD to compensate for the higher commuting cost (see Figure 1). For instance, in the simple case where all individuals consume one unit of land, bid rent falls with a marginal increase in commuting distance exactly by the marginal commuting costs. When housing consumption is endogenous, bid rent falls by the ratio of marginal commuting costs to individual housing consumption. Intuitively, the higher the marginal commuting costs, the more individuals will want to live close to the centre to economise on commuting costs, and the willingness to pay falls rapidly with distance. Conversely, high housing consumption means that an individual has much to gain from the lower housing rents obtainable far from the CBD.

An important question which will also play a role in the subsequent analysis is how different groups – e.g. different income classes – choose their location in a city. Since land is assumed to go to the highest bidder, the group which has the steeper bid rent function will outbid the other group in the centre while being outbid in the suburbs (see Figure 1). Thus, which group lives in the centre depends on how the slope of a bid rent function changes with income. It turns out that how this plays out depends on the income elasticities of commuting costs and housing consumption. On the one hand, individuals who earn higher wages face higher time costs of commuting and therefore have a preference for living close to the CBD. On the other hand, they also have a larger demand for housing space, which means that they are especially interested in lower housing rents at locations far from the CBD. Depending on whether housing consumption or transport costs increase faster with income, we get different location patterns. If housing consumption is more elastic with respect to income than marginal transport cost, the poor will live in the central city and the rich in the suburbs. This case is shown in Figure 1. In the converse case, the rich will live in the centre and the poor in the suburbs. In the following subsections, we use this setup to model the effects of urban transport policies on the welfare of rich and poor city residents.

Figure 1. **Equilibrium in a city with two income classes**



Before going on to the next chapters, two remarks are in order. First, the model is able to explain why in some cities, notably in the US, the rich live in the suburbs while, on the other hand, in many European cities (for instance Paris, see Brueckner *et al*., 1999) the rich live in the city centre and the poor in the suburbs.

Second, however, this prediction is valid only if one believes that location choice is driven by the trade-off between commuting costs and housing consumption, as just described. But whether housing or transport costs have a higher income elasticity is basically an empirical question. The result that the rich live in the suburbs only if housing demand is more responsive to income than marginal transport costs has been challenged on empirical grounds (see, e.g., Glaeser *et al*., 2000). In fact, it seems that the income elasticity of housing consumption is less than one, which is (approximately) the income elasticity of transport costs; if transport cost consists largely of time costs (which are proportional to wages), then its income elasticity should be close to one. Why then do the poor tend to live in central cities, at least in the US? Since later analysis will use similar insights, it is worthwhile to look at part of Glaeser *et al*.'s (2000) answer to this question, namely the availability of public transport. Suppose that, in contrast to the basic model, individuals can choose between two transport modes: public transit and automobile. Automobiles entail relatively high fixed costs and low time costs, while the converse holds for public transport; low fixed costs (from an individual rider's perspective) and high time costs. Since the poor have low wage income, they care less about the time costs than the fixed money costs and, therefore, tend to prefer public transit over automobiles; and since transit tends to be available in central cities but not in suburbs where population density is low, the poor will be drawn to the central cities. Glaeser *et al*. (2000) find that this model can explain location patterns in the US.

Let us look at the mode choice problem in a bit more detail. LeRoy and Sonstelie (1983) and Sasaki (1990) have provided detailed analyses of the combined choice of location and transport mode. Since mode choice and location patterns are determined simultaneously, we get quite a few possible patterns. Consider first the individual mode choice problem. An individual with wage w_j, living at distance r from the CBD, who uses mode i, is assumed to incur a transport cost of $F_i+(k_i + t_i w_j)r$. Here, F is a fixed cost which is unrelated to the distance travelled, k is the monetary variable cost and t the inverse of travel speed (i.e. the marginal time cost per kilometre of commuting distance). Since time cost is valued at the individual wage, an individual w_j incurs a time cost of $t_i w_j$ when using mode i. Suppose there are two modes, called bus (B) and automobile (A). The bus is cheaper but slower, that is, we assume that $F_A>F_B$, $k_A>k_B$, $t_A<t_B$. Then an individual living r km from the CBD will use the bus if $F_A+(k_A + t_A w_j)r > F_B+(k_B + t_B w_j)r$. Since the incentive of using the car comes from saving time costs, an individual is more likely to use the car the higher his wage. Also, for each wage level, there is some critical distance r^*, such that all individuals living at distances $r > r^*$ will use the car and all others the bus.

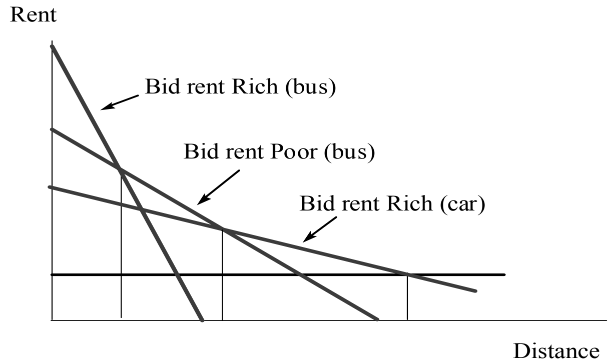
To see how location pattern and mode choice interact, let us consider again the trade-off faced by an individual who considers moving one kilometre away from the CBD. Again, the benefit will be a lower housing rent, while the cost consists of increased commuting costs, which are now a function of the individual's income and the transport mode used. The group that has the higher ratio of marginal commuting costs to housing consumption will live closer to the CBD.

Several possibilities exist. Sasaki (1990) concentrates on the case where the rich live in the suburbs and the poor in the city centre. The following possible equilibria exist:

- Both groups commute by bus;
- The rich commute by car and the poor by bus;
- The rich commute by car, some of the poor by bus and some (those living further from the CBD) by car;
- All the poor commute by bus, the rich who live relatively close to the CBD also commute by bus and those living farthest in the suburbs commute by car.

LeRoy and Sonstelie (1983), on the other hand, argue that if both groups use the same mode, then the rich would live closer to the CBD than the poor; this is because they assume that the income elasticity of housing consumption is less than one. If the costs of commuting by car are low enough for the rich, but not for the poor, to use it, then some rich will commute by car and the poor by bus. In this case, the poor bus commuters will live closer to the CBD than the rich car commuters. An example is shown in Figure 2. Here, some of the rich commute by bus and live close to the CBD. The poor all commute by bus and live between the rich bus commuters and the rich car commuters.

Figure 2. **Equilibrium in a city with two transport modes and two income groups**



According to LeRoy and Sonstelie, this can explain the history of American urban structure; when everyone walked to work, the rich would live close to the centre. The advent of the streetcar (which was not affordable for the poor) in the 1850s and 60s first caused richer individuals to move out of the city centre. The same occurred when cars were first used by the richest portion of society. In this view, when car use became widespread even in the poor segments, re-gentrification occurred as the rich moved back to the city centres.

Glaeser *et al*. (2000) present a small model that reaches similar conclusions. They focus on a city with rich and poor residents and three transport modes: walking, public transit and automobile. They assume zero money costs for walking (the slowest mode). Hence, in a ring close to the CBD, people will walk, and the rich walkers live closer to the CBD than the poor. In the next ring, people use public transit, and farthest from the CBD, people commute by car. By assumption, the rich who commute by car live further from the CBD than the poor who use public transit.

5. TRANSPORT SUBSIDIES

Eventually, the focus of the paper will be on the link between subsidies and the political support for different transport systems, e.g. public transit versus individual transport. To set the stage, however, it is useful to ask how transport subsidies are politically determined, by outlining results from an urban model where subsidies redistribute between rich and poor voters. The discussion here is based on Borck and Wrede (2005). They study a monocentric city model like that presented in the previous chapter. Individuals belong to one of two classes: rich or poor.

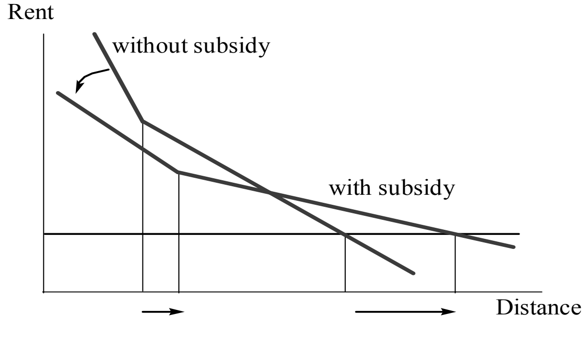
In the benchmark model, it is assumed that the poor live close to the city centre and the rich live in the periphery. The reason behind this result is that both groups face the same commuting cost function (by assumption), but the rich demand more housing space per person because housing demand increases with income.

Commuting is subsidised at a constant rate, and the subsidy is financed by a head tax, i.e. each individual pays the same tax[5]. Note that since the rich have longer commutes than the poor, a subsidy of this type appears to be regressive, i.e. the rich get more than they pay in taxes and are effectively subsidised by the poor. Interestingly, empirical studies tend to confirm this pattern. For instance, Kloas and Kuhfeld (2003) use survey data from Germany. They show that commuting distances are very skewed, and those with the longest commutes have the highest income. Their conclusion is that the commuting subsidy in the German income tax code is regressive.

The question we then ask is: why would the poor majority vote for commuting subsidies, which are so widely observed? The argument turns out to be simple but it hinges on interesting general equilibrium effects in housing markets and residence choices. The key observation is that commuting subsidies lead to sprawl: moving out to the suburbs is made more attractive if commuting is cheap. This conclusion is not as trivial as it seems, since the sprawl-inducing effect of lower transport costs is countered by the sprawl-lessening effect of higher taxes used to finance the subsidy. However, in a model with homogeneous consumers, Brueckner (2005) proves analytically that tax-financed commuting subsidies do indeed lead to urban sprawl.

Since commuting subsidies lower individual net commuting costs, they create incentives for individuals to move out to the suburbs. The individual bid rent functions rotate inward, as shown in Figure 3. Effectively, individuals are willing to pay more for land far from the CBD since commuting long distances has become cheaper. But this implies that competition for land in the city centre is reduced, while competition for land in the suburbs increases. As a result, housing rents will increase in the suburbs and decrease in the city centre. This is shown graphically in Figure 3, where r_1 is the border between rich and poor and r_2 the city border. The figure shows that the city expands spatially. After introduction of the subsidy, the poor occupy a larger part of the city's land. Hence, even if the poor have short commutes, they may willingly subsidise commuting if their housing rents fall sufficiently.

Figure 3. **Effect of commuting subsidy on urban equilibrium**



If both rich and poor voters gain, it would seem that transport subsidies are efficient in the present model. This is, however, not the case (Brueckner, 2005). In fact, without congestion or other market failures, the market equilibrium is efficient and the welfare of city residents, including land rents, is maximised at a subsidy rate of zero. Resolving this puzzle requires the introduction of a group that we have not considered so far: landowners. In effect, part of the cost of the subsidy is borne by absentee landlords in the form of lower land rent. The owners of central city land should definitely oppose commuting subsidies since their income falls as residents move to the suburbs. Landowners at the city edge benefit from the subsidy, since the flight to the suburbs increases land rent there. It can be shown, however, that aggregate land rents fall; hence, landowners as a group are worse off than without the subsidy. Thus, distinguishing between renters and owners as a group, we can say that a commuting subsidy, in addition to redistributing between short and long commuters, redistributes between renters and landowners, with the latter group bearing part of the burden of the subsidy.

The political support for commuting subsidies then depends on the influence of landowners. In the US, where homeowners have a large say in local politics, one might expect less support for these subsidies than in other parts of the world. However, if landowners live in the city, the results change somewhat and are described below.

Borck and Wrede (2005) go on to extend the model along several lines. The first one is to allow for different commuting costs between groups. As shown above, if the rich have sufficiently higher commuting costs per km (because their time costs of commuting are higher for a given transport mode), then they will live closer to the CBD than the poor[6]. If the poor have longer commutes, will they then automatically benefit from a commuting subsidy? The answer turns out to depend on the exact form of the subsidy. If the subsidy is a flat subsidy per km of commuting, then the poor will indeed benefit from the subsidy (at least in the case of absentee landownership). However, if the subsidy is a fixed percentage of commuting costs, then the rich may benefit more than the poor, since their higher commuting costs are now subsidised more in absolute terms. We will return to this topic in subsection 7.2.

Another extension asks how the distribution of land ownership affects the results. If the city residents themselves own the land on which they live, then a commuting subsidy purely redistributes between rich and poor residents. Costs cannot be passed on to absentee landowners. If landownership were evenly distributed among rich and poor residents, then in the case where the poor live in the centre, they will definitely be hurt by commuting subsidies, while the rich benefit. However, the poor will be more likely to support commuting subsidies the more skewed is the distribution of land, in the sense that the rich own disproportionately more land than the poor. In this more realistic case, the part of the subsidy borne by landowners falls disproportionately on the rich.

Finally, the paper also considers financing commuting subsidies by an income tax. This implies that the rich bear a larger fraction of the tax burden necessary to finance commuting subsidies and, hence, support for subsidies by the poor increases.

6. SYSTEM CHOICE

We now turn to the political choice of a transport system (see Brueckner, 2005; Brueckner and Selod, 2006). Critics in the US have argued that cities invest in inefficiently fast transport systems, in particular, that investment is biased towards highways against mass transit, and that this overinvestment leads to undesirable urban sprawl. City residents can determine the nature of a transport system along two dimensions: speed and money cost. They may opt for a fast but expensive system, or for a slow and cheap system. In general, increasing monetary costs will lower time costs. For instance, a city may heavily invest in roads or rapid rail systems which are fast but expensive, or it may focus more on bus transit which is cheaper but slow. Again, the choice of transport system has redistributive consequences and will therefore be the subject of political conflict.

The basic setup of Brueckner and Selod's (2006) model is as follows. Residents of a city differ by income but have fixed housing consumption. It is assumed that richer individuals have a taste for living in the outskirts. Therefore, if all individuals face the same marginal transport costs, richer individuals will again live further from the CBD than poorer ones.

Transport costs per mile of commuting have two components: time and money costs. The time cost is the inverse of travel speed and is assumed to be proportional to the individual wage: the higher the wage, the higher the opportunity cost of time. Money cost, on the other hand, is independent of income. The trade-off between the two is then assumed to be shaped by the transport system. A faster system such as the automobile, has low time costs but high money costs, and the converse holds for slow systems which are cheap (per person), such as the bus. Individuals can therefore influence their time and money costs through the choice of the transport system. The transport system here is assumed to be chosen from a continuum menu of different time and money costs[7].

From an individual voter's point of view, the optimal transport system minimises the sum of time and money costs. It is readily seen that the higher one's income, the faster and more expensive is the preferred transport system. Since richer individuals have higher time costs but money costs are independent of income, a rich resident has a higher demand for speed than a poor one. Moreover, since the distance of residential location to the CBD increases with income, demand for transport quality increases more than proportionately with income. Intuitively, a higher income resident has a higher time cost, which leads to demand for a faster system for any given location. In addition, richer individuals also face longer commutes than lower income residents, which increases their demand for high-speed systems even more.

In Brueckner and Selod's analysis, city residents vote over the speed and money cost of the transport system. Since the optimal speed varies monotonically with income, the outcome corresponds to the preferred system of the median voter, i.e. the voter with median income. Higher-income individuals prefer a faster system and poorer individuals a slower but less expensive system. Half of the population thus wants a faster and half a slower system than the median voter, but no coalition could gain majority support for their proposal.

Brueckner and Selod (2006) then compare the median voter's optimum with the social optimum, which is defined as the transport system which maximises average utility in the city. Suppose that median income is less than mean income. This is the case with typical right-skewed income distributions. Then the median voter votes for a transport system which is inefficiently slow. The reason is again that demand for speed increases more than proportionately with income. As a result, it can be shown that residents with income below average vote for a system which is slower than that demanded by the average voter. Intuitively, reducing income reduces optimal speed, and this effect is compounded by the effect of residential location – which decreases with income – on the optimal speed of the system.

Is this consistent with the available evidence? Some commentators, at least in the US, have argued that many cities have opted for inefficiently fast systems, and in particular highway systems instead of public transit. Indeed, Brueckner and Selod (2006) in part motivate their paper with this alleged overinvestment. In the case of transit, Small (1992) shows that several US cities have built rapid rail systems, but these are more efficient than slower bus systems only at very high travel densities, which are only realistic in the very largest cities. Since, in the US, the rich typically live further from the CBD than the poor, this seems to be at odds with the conclusion of Brueckner and Selod (2006). Instead of overinvestment in fast and expensive systems, their analysis predicts underinvestment (under the assumption of a right-skewed income distribution). However, one might argue that the political choice in cities is biased towards the rich. For instance, rich individuals participate more in local politics through voting. They also donate more to politicians in the form of campaign contributions. Hence, they might have a larger say in politics than the poor. Then, the equilibrium choice of transport system might not represent that preferred by the median voter but rather that preferred by someone with higher income. This case is briefly analysed by Brueckner (2005) who shows that choice of the transport system by the rich leads to an inefficiently fast system[8].

Interestingly, the location pattern described above may be reversed if the rich live closer to the CBD than the poor. This is the case in many European cities such as Paris (Brueckner *et al*., 1999). In this case, the demand for transport quality (i.e. speed) increases less than proportionately with income: while a higher-income resident at a given location still prefers a faster system, commuting distances for high-income voters are now less than for poorer ones. In this case, demand for travel speed rises less than proportionately with income. This implies that the mean voter's demand lies above the social demand. Therefore, if the income distribution is not too skewed, in the sense that median income is close to mean income, the median voter will vote for an inefficiently fast system, that is, there will be overinvestment. When the distribution is very skewed, however, the total effect is ambiguous and there may be over- as well as underinvestment. It is interesting to note that Brueckner and Selod's analysis predicts underinvestment in the US case where the rich live in the suburbs and overinvestment in the "European" case where the rich live in the city.

7. COMBINING SUBSIDIES AND SYSTEM CHOICE

So far, subsidies and the choice of transport system have been looked at as if the two margins of choice existed in isolation. Yet, it is obvious that subsidising transport will impact the efficiency of different transport modes and, likewise, choosing a certain transport system will have an effect on the desirability of transport subsidies. The literature on the combination of these issues is, however, even smaller than that which looks at the isolated issues. Some of the following conclusions may therefore be speculative.

7.1. Effects of subsidies on system choice

The first observation comes from the analysis in Brueckner (2005). He studies a model largely like the one in Brueckner and Selod (2006) except that there is only one income class. The optimal transport system in a city again trades off higher money costs against lower time costs. Now, if the money costs of travel are subsidised, the implication is that every individual in the city will prefer a faster transport system. This is a natural conclusion, since individuals are not faced with the full monetary costs of transport. Applying this insight to the Brueckner/Selod (2006) model, the following prediction emerges: if the distance of residential location from the CBD increases with income, subsidies would counteract the tendency of underinvestment in the transport system; as we have seen in the previous chapter, in this case the median voter votes for an inefficiently slow and cheap transport system. Hence, subsidising the monetary costs of transport would be helpful, since the median voter would then face lower monetary cost and vote for a faster transport system.

In reaching this conclusion, Brueckner (2005) assumes that voters are myopic, in the sense that they do not consider how system choice affects the taxes paid to finance the subsidy. A richer model would yield somewhat more complicated conclusions. First, a faster system would increase the taxes necessary to finance a given subsidy rate, since the subsidy is applied to a higher monetary cost. Second, the subsidy would lead to sprawl, that is, longer average commutes. Again, this effect would tend to increase the consumers' tax burden. My conjecture is, therefore, that overinvestment would be somewhat attenuated if consumers are foresighted.

Again, in the case where richer individuals live closer to the CBD, the analysis has shown that there may be overinvestment in transport speed already without subsidies. Here, then, transport subsidies would make the political choice of transport system even more inefficient. In fact, transport subsidies are seen by researchers as one of the reasons why some cities apparently build inefficiently fast transport systems, such as rapid rail (Small, 1992).

7.2. Effect of mode choice on transport subsidies

Let us now switch perspective and ask how the introduction of mode choice changes the incentives of subsidising commuting expenses. To tackle this question, we go back to the analysis in Section 3.1. above, where individuals in a city have the choice between two modes, car and bus.

The money costs of using mode i, in the presence of a subsidy with rate s, are now $(1-s)t_i r$. Assume for now that this subsidy rate applies to both modes.

A first thing to note is that an increase in the subsidy rate will decrease the distance r^* where an individual switches from bus to car usage. Intuitively, the lower time costs of the faster mode now weigh more heavily than its higher money costs, since these are now paid by the individual only in part. Thus, subsidising automobile and bus at the same rate should bias the modal split towards automobile usage, at least as long as we assume residential locations to be fixed. An implication is that this will result in a further increase of necessary subsidies, since the faster and more expensive mode is now used more heavily.

What then are the effects of commuting subsidies? Since there is a multitude of possible equilibria, we cannot deal here with all the possible cases. Instead, a couple of potentially interesting patterns are described.

One facet of this setup is that commuting subsidies now redistribute in more ways than before; in particular, between short- and long-distance commuters, and between users of transport modes with low money costs and those with high money costs. On the assumption that both modes are subsidised at the same rate, automobile users are now subsidised by bus riders. Potentially, since the rich are more likely to commute by car, this aspect makes commuting subsidies more regressive. However, the incidence of a subsidy again depends on the combined choice of transport mode and residential location, so that the net effect is complicated by the many possible equilibria.

Suppose that the poor live in the city and the rich in the suburbs and everyone commutes by bus. We can then apply the analysis of Borck and Wrede (2005) directly. Disregarding the effect on housing rents, a commuting subsidy then redistributes from poor to rich. Continuing to assume that the poor live in the centre, this regressivity is exacerbated if the rich commute by car. Since the car is assumed to have higher monetary but lower time costs, the subsidy now redistributes from the poor to the rich on account of two aspects: because the rich have longer commutes and because they choose the more expensive mode. As shown before though, housing rents in the city centre will fall, so that in the end the poor, too, may benefit from such a subsidy[9].

In part, the analysis of mode choice in urban models was motivated by the observation that the single-mode framework has difficulties in explaining why the rich live in the suburbs, since the income elasticity of land consumption seems to be much lower than one. Therefore, an interesting pattern is that where the rich live closer to the centre than the poor, when both commute by the same mode. How would this change the analysis? Things now get much more complicated since, as shown before, many equilibrium patterns are possible. Let us examine one particular equilibrium; Suppose that without a subsidy, the group closest to the city centre is rich and commutes by bus. Then follows a zone of poor bus commuters, and finally, the suburbs are populated by the rich who commute by car. Then a commuting subsidy redistributes from the bus users with short commutes to the car drivers with long commutes. However, by assumption, the rich must be as well off when commuting by bus as when commuting by car. This implies that the burden on the rich bus commuters must be compensated by lower housing rents in the centre[10]. In the case of absentee landownership, one can show, at least for simple examples, that the rich as a group definitely benefit from the introduction of a commuting subsidy. In purely fiscal terms, the poor are net contributors to the subsidy scheme. However, they may also benefit in the form of lower housing rents. When land is entirely owned by the city residents in equal proportions, the poor will be made worse off by the subsidy, although there are rich residents with shorter commutes.

A natural question to ask is how the analysis is affected by assuming that the two modes are subsidised at different rates. Consider again the first case above, where the poor live in the centre and commute by bus while the rich live in the suburbs and commute by car. An interesting result is that – assuming again absentee landowners – the poor benefit from subsidies on both modes while the rich benefit only from subsidies to automobile users. The reason for this asymmetry again lies in the housing market effects. Subsidies for automobiles increase incentives for the rich car users to suburbanise even further. This eases housing market competition in the centre and therefore benefits the poor. On the other hand, subsidising buses makes the poor want to move out of the centre. This in turn leads to further suburbanisation and longer commutes for the rich. It also increases competition for land in the suburbs and raises land rents for the rich. This argument supports the view that transport subsidies on fast modes may also benefit those who do not even use these modes[11].

8. CONCLUSIONS: POLITICAL ECONOMY OF URBAN TRANSIT REFORM

The paper has surveyed political economy models of urban transit, focusing on subsidies and transport system choice. There are two general lessons from this work. First, since the redistributive consequences of transport policies form the basis for their political support, it is important to analyse these in detail before proposing policy reforms on the grounds of efficiency aspects. Second, however, in order to understand these redistributive effects, it is not enough to analyse their effects on individuals' net income positions. General equilibrium effects may be important and, in the particular case of urban transit, the effects on commuting patterns and housing markets will be relevant.

In general, whether rich or poor city residents gain most from particular policies turns out to depend on their residential location, which affects commuting distances, and on the distribution of land ownership. Cross-country differences in residential location patterns and land distribution may therefore partially explain the observed differences in regulatory policies for urban transit.

The redistributive consequences of urban transport policies are sometimes surprising. For example, it appears that transport subsidies in many instances may benefit the rich who have long commutes and use fast, expensive transport modes. Taken at face value, this finding may indicate that transport policies are biased towards the rich, with "perverse" distributional consequences. However, as the paper has shown, sometimes these distributional effects may turn around once general equilibrium effects are taken into account. In particular, policies such as commuting subsidies or inefficient transport investment choices often reduce land rents, which hurts landowners who are presumably richer (as a group) than average. In summary, this line of research has yielded some interesting insights. Yet because of the complexity of the models, the analysis of political institutions has been particularly simplistic. Almost no mention has been made of interest groups such as the transport industry or politicians' own incentives. Therefore, further research will inevitably delve deeper into the political economy of urban transit.

With these caveats in mind, what are the implications for the political economy of transit reform? The elimination of subsidies following privatisation or deregulation of public transit will generally lead to higher fares. For instance, despite potential competition, British bus deregulation led to fare increases of about 9% in the first years after deregulation and up to 39% in metropolitan areas (Nash, 1993). The first thought is that this fare increase benefits the general taxpaying public at the expense of transit users. If transit users tend to be relatively poor, this implies adverse redistributive effects. In order to win support for this kind of measure, politicians (at least those who do not cater only to upper-middle-income classes) would need to compensate those who are affected.

A further implication of the analysis presented here is that housing markets would be affected. In the simple case where the poor live in the centre and use buses, cutting subsidies for buses should lead the poor to seek to move closer to the centre in order to economise on transport costs[12]. As a result, housing rents in the city centre should increase. This should hurt the poor city residents, benefit the rich suburbanites, for whom competition for land decreases, and benefit landowners as a group, since total land rents should rise. Finally, among landowners, those owning land in the centre should benefit at the expense of those earning land in the suburbs, and landowners as a group should benefit since total land rents would be predicted to rise.

NOTES

1. In a similar vein, Winston (2000) argues that local officials overspend on urban transport projects financed by state or federal grants.

2. As a partial excuse, since some of the theory is fairly new, empirical analysis has not yet caught on.

3. If there are empty seats in a train compartment or bus coach, the marginal cost of admitting an additional user is zero.

4. Good references to this type of model include Brueckner (1987) and Fujita (1989). The Alonso-Muth-Mills extends this model by incorporating housing production.

5. The paper also studies the case of income tax financing. The results then change quantitatively, but the thrust of the argument is the same.

6. Note that we have to assume here that the sum of money and time costs divided by housing consumption is larger for the rich than for the poor.

7. Technically, let the money cost be k. Then time cost (the inverse of travel speed) is assumed to be $t=f(k)$, with $f' < 0, f'' > 0$.

8. This conclusion is reached by assuming that consumers have Leontief preferences over consumption and housing, i.e. that housing and non-housing consumption are perfect complements.

9. Borck and Wrede (2005) use numerical simulations to show that this may actually happen.

10. In fact, since the city border is fixed for given population and land rent at the border tied down by the fixed agricultural rent, in this case housing rent must fall over the entire range of the city.

11. The analysis here parallels Sasaki's (1990) analysis of the effects of transport cost changes in a two-mode model.

12. If the modal split is endogenous, some of the poor people living close to the CBD should switch from transit to walking, which would become a more attractive alternative in the wake of increased transit fares. Some other poor residents who live further from the CBD should switch from bus to car. In sum, for given residences, the modal share of the bus would decrease and that of walking and car use increase.

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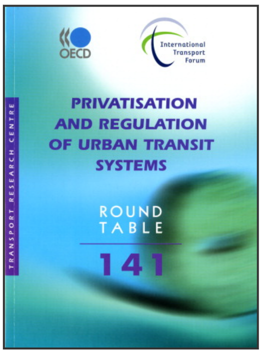

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