Transport Investment and Economic Assessment

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Sustainability Of Land Use and Transport In Outer NeighbourhoodS

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Summary

This paper discusses the economic assessment of transport policies under market imperfection. It argues that conventional forms of assessment focussing only on transport changes can underestimate the economic benefits of a policy. The paper argues that the benefits need to be measured by the changes of prices of goods and services acquired at the end of a trip and not just by the changes in travel costs. This form of assessment highlights the distributional consequences between users and producers. Models that do not estimate the changes of prices at the end of a trip cannot properly assess the impact of a policy.

Key words: Prices, Policies, Cost-Benefit,

Introduction

Conventional assessment uses Cost-Benefit analysis which involves the comparison between the capital cost of a project or a policy with the net economic benefits obtained by its implementation (see, for example, Button, 1993). Assessment is the process for estimating *ex-ante* the impact of a policy and therefore needs models for forecasting the outcomes. It is necessary to forecast the future situation with and without the policy to estimate the benefits. Assessment is, therefore, a relative measurement of the benefit obtained by the policy with respect to a base case (e.g. without the policy).

Economic benefits

Economic benefits include, normally, the following:

(i) User's benefits: this is estimated by the user's (or consumer's) surplus, which measures the difference between what the user is willing to pay (derived from a demand function) and what he or she actually pays (Dupuit, 1844). The differences between the surpluses obtained with and without the policy represent the net user's benefit after its implementation.

(ii) Producer's benefits: this is estimated by the differences in profits between the base and alternative case. Some, but not all payments by the users to the producers cancel out when all the benefits are added up as they are transfers and do not add to the overall welfare of the area under study. But, there are additional benefits to producers out of the additional demand generated by a change in prices after a policy is implemented. It is useful, in any case, to account for the transfers separately. It shows the income to the producer, which provides the information to estimate the viability of the project (see, for example, Foster and Beesley, 1963). It also shows the distributional impact of a policy between users and producers.

(iii) Government's benefits: this is usually estimated by the difference in revenues from taxes, less subsidies, between the base and alternative cases. Again, some of these are transfers and when added up they disappear. But there could be additional revenues (or reduction of) with a change in demand.

(iv) Environmental benefits: this is the net difference in environmental costs between the base and the policy. This difference does not influence the demand or the supply since these costs are not perceived by users or by producers.

The addition of all these benefits, suitably scaled to an annual figure, can be compared with the cost of implementing the policy. This comparison gives the social rate of return of the capital invested. This rate can be compared with the accepted social rate of discount for public investment.

User's benefits

Figure 1 illustrates the principle of calculating the user's benefit by estimating the difference in surplus between situation 1 and situation 2. Given a demand function D, a base situation, without the policy, gives the quantity q_1 (e.g. passenger-km travelled) at the price p_1 (e.g. cost of travel per km). After the introduction of the policy, the price drops to p_2 generating additional quantities q_2. The shaded area represents the net benefits after the introduction of the policy. It can be divided into two areas: the rectangle p_1ABp_2 that represents the savings incurred by travellers after the introduction of the policy (e.g. $p_1 - p_2$). The triangle A, B, C represents the benefits obtained by the new (induced) travel.

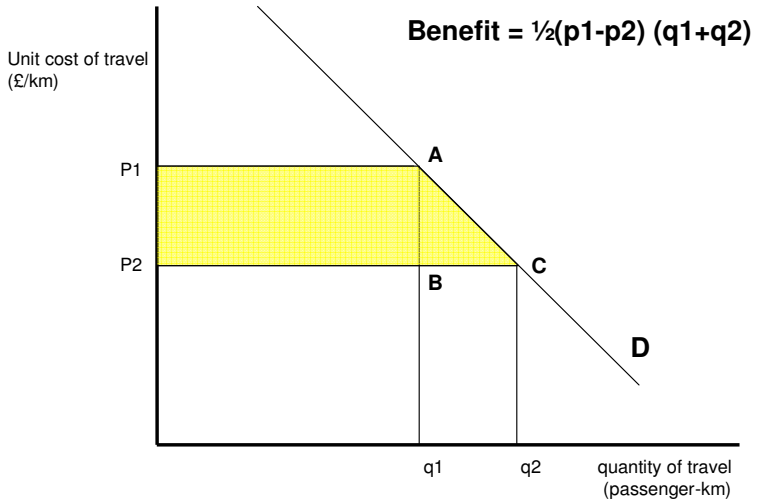

Figure 1 Users' surplus

The total benefits can be estimated, assuming a straight line between A and C, as follows:

Benefit of policy (2) over base (1) = ½ $(p_1 - p_2)$ $(q_1 + q_2)$ (1)

Where p_1 and p_2 = price in base and alternative respectively

q_1 and q_2 = quantity in base and alternative respectively

The prices p include the money cost and time costs and, sometimes, the inconvenience cost. The quantities are normally measured by the volume of travel (e.g. passenger-km). The estimation of benefits can be calculated for each link of the transport network or, alternatively, for each pair of zones, measuring the volume of travel and the corresponding cost of travel from a zone of origin to a zone of destination. The aggregation of the benefits, duly expanded to an annual value, gives the total user benefits.

This paper argues that this conventional form of assessment can underestimate the wider economic benefits of a policy. More often than not, the changes in prices per unit distance can be negligible, because the additional (induced) traffic generates congestion, which in turn, reduces the savings in travel cost (see figure 2). If, for example, congestion increases to the same level as before the introduction of a policy of, say, increased capacity of a link, and therefore p_1 =

p_2 in equation (1), the benefits are reduced to zero, even if the quantities have been increased by the induced traffic (e.g. $q_2 > q_1$). Clearly, this is a wrong result because if there is a larger volume, the additional traffic must have an additional benefit, if not; there will not be more traffic.

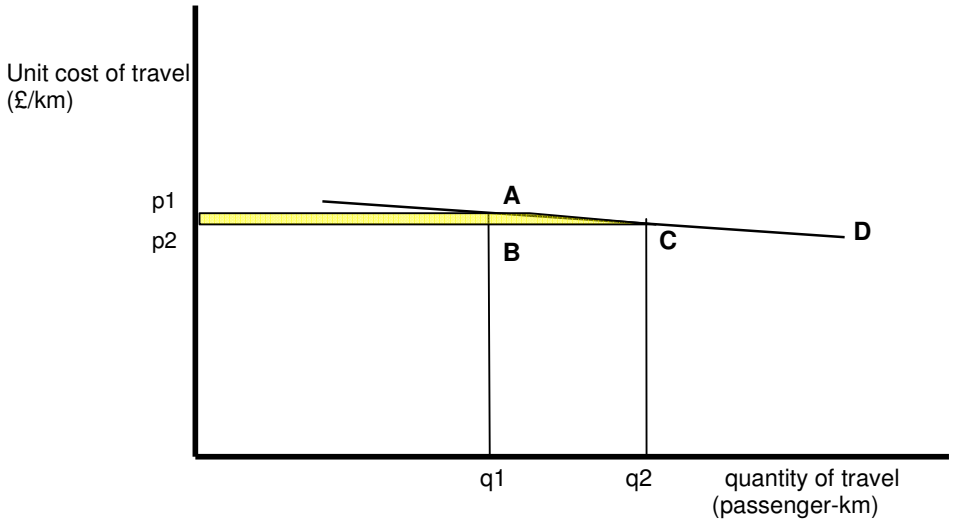

Figure 2 Users' surplus with small variation of travel costs

So, where are those benefits? The answer must be that there are benefits at the end of the trip that are not taken into account in the standard measurement. The mistake lies in measuring only the changes in transport cost. Transport is a derived demand: the benefits are not obtained by the travel itself but in what can be obtained at the end of the travel. The correct calculation of the benefits should include not only the price paid for the transport but also the price of the good or service obtained by travelling (see Venables and Gaslorck, 1998). This extra benefit only arises when there are market imperfections. The market imperfection means that producers set prices above their marginal production cost or, in the case of public subsidies, below it. The extra travel reduces the monopoly power of producers gaining additional benefits for the users.

Figure 3 illustrates the measurement of benefits incorporating the travelling cost in addition to the cost of the good or service purchased by travelling. In this case the travel cost can be the same before and after the introduction of the policy, but by travelling further an additional benefit is obtained because of finding a cheaper good for purchasing. The initial improvement in transport conditions (e.g. faster speed); can disappear because of increased congestion due to the induced additional traffic. But provided that the combination of travelling and the purchase of the good or service cost is less than the base situation, there will be a benefit.

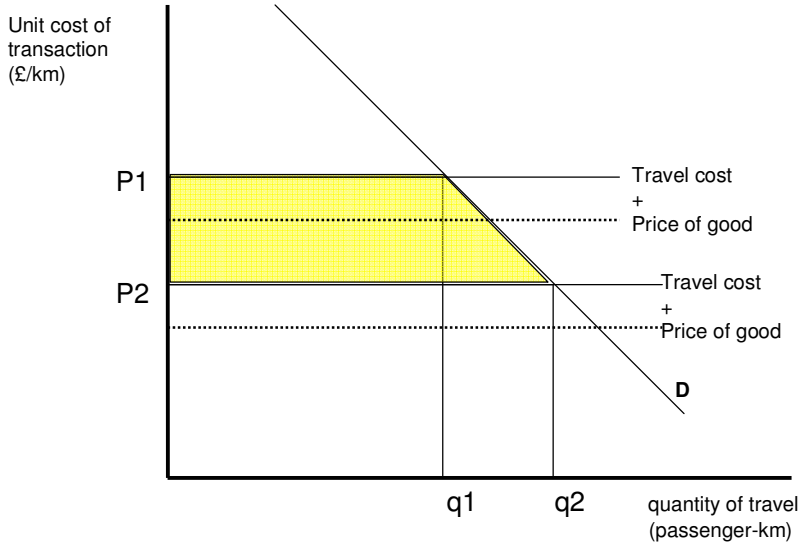

Figure 3 Users' surplus that includes travel and the price of the good (total transaction cost)

A typical example of such benefits is transport improvements that allow shoppers to reach large out-of-town shopping centres. The reduction in price of purchased goods everywhere can be the product of competition that reduces the monopoly power of central city shops. It forces central providers to reduce profits. In addition the out-of-town shopping centre usually takes advantage of large scale operations, reducing costs that are translated into lower prices of products.

The conclusion is that the correct measurement of users' benefit in the presence of market imperfections must include the variation on prices of goods and services, including land and labour, obtained by travelling. The total net benefits (i.e. users, producers and government benefits) of the policies, however, may be lower than users' benefit alone as some of the latter ones are mere transfers. That is to say, users' gains can be producers' losses. Careful accounting must be exercised to avoid double counting. The implication is that forecasting the effect of a policy must, by necessity, include its impact on prices.

An example: Transport improvement and commuting costs

Assume that a city is surrounded by a green belt where housing is not allowed within it. Commuters who are employed in the city have the option to either live in the city paying high rents for their dwellings and incurring relatively low transport cost or, alternatively, live in villages beyond the green belt where housing rental are much lower but incurring greater transport costs, mainly because the access to the city is highly congested. If a policy of increasing access capacity to the city is implemented, it will result in an increased number of commuters who decide to leave the city because of reduction of travel cost (mainly through travel time reductions) in search for lower housing rentals beyond the green belt. As a consequence, housing rentals in the city reduce as the demand shifts to the surrounding villages where housing rentals increases. After a while the increase in commuting trips creates congestion in the access links to the city. The resulting travel cost per unit distance may increase to nearly the same level as before the policy was introduced, reducing the changes in the transport user's surplus to a small quantity, but the overall user's surplus, including the housing rental, could be positive as illustrated in figure 4.

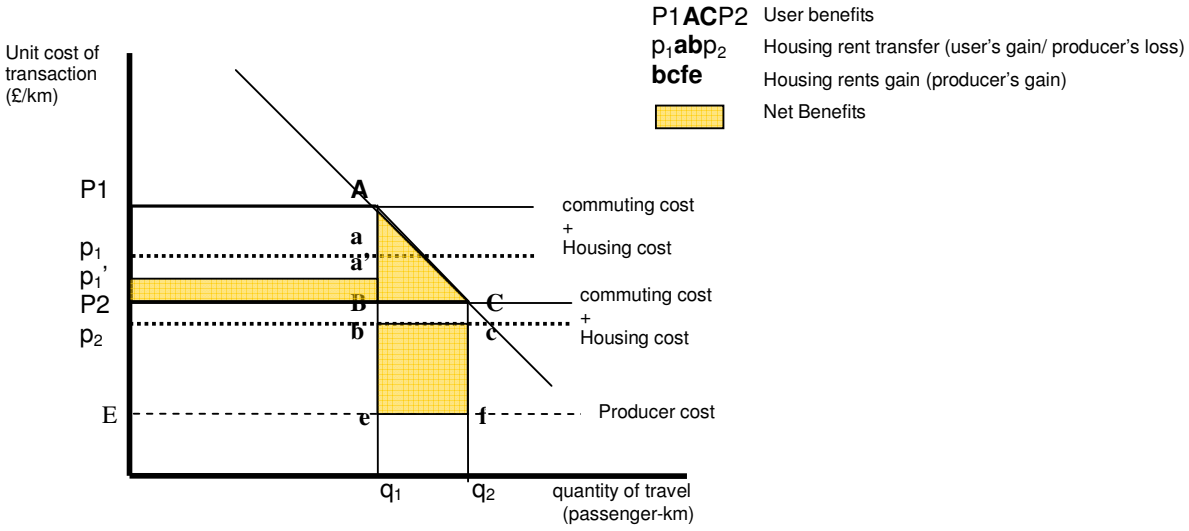

Figure 4 Wider net benefits

In figure 4 the users' benefit is illustrated by the area P1ACP2, representing the reduction in rents (p_1 minus p_2), the reduction in travel cost (P1- p_1 minus P2- p_2), and the induced travel (ACB). Producers' benefit (loss) is illustrated by the area p_1abp_2 representing a loss of rent but compensated by the area bcfe, which is the new rents paid by the induced travel. The line E represents the producer's cost (depreciation and interest on capital for housing). The total net benefits are illustrated by the shaded areas, including the small saving in travel cost (p_1'a'BP2), induced travel (ACB) that represents an increase in consumption of housing and increase in rents received by producers (bcfe).

Traditionally the increase in rent is not included as benefit because "land values only rise as a result of a transport improvement because of some realized or prospective reduction in transport costs" (Foster and Beesley, 1963). That statement is correct for the existing travel q_1 as the reduction of travel cost leads to less loss of rents for the producers. But the newly generated travel does create an additional benefit to the producers of housing (bcfe) as they will be receiving additional rents.

Dupuit (1844) argued that "when there is a merely a change in the market price the consumer gains what the producer loses, or vice versa" and thus there is no change in welfare. This is the case for the existing travel q_1. Dupuit admits that "the fall in the market price indeed brings about an increase in consumption" but, curiously, he does not accept that the benefit derived can be attributed to the transport improvement, because according to him, "the result … might equally well have been obtained by a simple legislative measure" (Dupuit ,1844).

Instead, Venables and Gasiorek (1998) argue that "one of the consequences of transport improvements is that the intensity of competition between firms in different locations may increase…, so dominant positions on local markets are eroded." This is exactly what occurs in the local housing market. Monopolistic power of central city property owners can be eroded by the competition exerted by housing providers in surrounding areas. The results are a lowering of housing costs that reduces the cost of living of households in the area that then, in turn, is reflected in lower pressures for increasing labour costs. Property rents are a product of scarcity: transport improvements reduce this scarcity.

In another paper the overall benefits that include the variation in prices are calculated for a case study of the Cambridge sub-region (Echenique, 2005).

Distributional aspects

Rents have a heavy impact in terms of its distribution across income groups. In general it is accepted that property and land owners have higher than average returns under oligopolistic conditions. Transport investment can enhance or reduce the power of property owners: certain types of transport such as public transport, can concentrate accessibility in a discrete number of location (e.g. stations) building a hierarchy in space, which is reflected in sharp increases in rents on these locations. In contrast, road transport tends to equalise accessibility, flattening rents across space. Lower prices for goods and services have definitive different impacts across income groups, if it is accepted the concept of decreasing marginal utility of income. Even when there is a general efficiency gains by increase competition, there could be negative impacts for certain groups when, as a result of transport improvements, labour that hitherto was inaccessible enters the market exerting downwards pressure on wages.

Conclusion

"The ultimate aim of a means of communication must be to reduce not the costs of transport but the costs of production (by cost of production we mean what it costs to make an article available for consumption)" (Dupuit, 1844). That is precisely what a transport policy or project can achieve – by promoting competition amongst suppliers such as shopkeepers, property developers, etc. monopoly power reduces bringing prices more in line with marginal production costs.

Space creates monopolistic situations: transport facilities reduce the monopoly of location. Total transport cost can increase as a result of a policy and therefore only measuring the changes in transport cost can lead to underestimate the benefit of a policy. In situations where market imperfections exist, as it is clearly the case of cities, the impact of transport policies in the changes of prices of goods, services, land and labour is of particular importance for assessing the wider economic and distributional impacts.

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