1 Introduction

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1.1 WHAT IS SPECIAL ABOUT TRANSPORT?

Why a handbook on methodology for transport economics and policy? It is a reasonable question. Transport economics is an application of economics so surely the methodology is simply that of economics?

To a degree that is true, but transport as a product has various characteristics which require careful attention if misleading conclusions are to be avoided. Transport is a derived demand, which is in general only valued for the activities it makes possible. It is a service, which is non storable (if it is not sold when produced then it is simply wasted in the form of empty capacity). Much transport is produced on own account (private motoring and own account road haulage) and even when it is not, it involves a substantial input of the user's own time and effort. It is subject to economies of scale and scope, particularly in the infrastructure but also in the services themselves: increases in frequency, other things being equal, provide more capacity but also a better service as passengers or freight can be moved at a time nearer their ideal. But the infrastructure and services do provide numerous distinct products in the form of transport between a particular origin and destination at a particular time. It is also subject to indivisibilities, particularly in the infrastructure (unless there is at least a single track road or rail no transport can be provided on a particular route; adding an additional track or lane provides more than a doubling of capacity by removing conflict between vehicles travelling in opposite directions). In turn these characteristics give rise to institutional issues, such as whether the transport system – or some parts of it – is a natural monopoly, and if so whether it should be regulated and in what way. Transport is also a major producer of externalities.

Of course, none of these characteristics are totally peculiar to transport. As one of the authors of the following chapters has pointed out, many of them apply to services in general (Jansson, 2006) and given the rise of services in importance in the economy, it is surprising that they have not been studied more widely. But the transport sector has been the source of major advances in research in many areas, such as cost functions, discrete choice theory and cost–benefit analysis.

The book is divided into six sections. First we consider transport costs, externalities and transport demand. We then turn to pricing and investment, regulation and privatisation and transport policy impacts.

1.2 TRANSPORT COSTS

The above-mentioned transport characteristics are particularly relevant to the analysis of transport costs, and that is where the Handbook begins. Chapter 2 describes methodologies for analysing infrastructure costs. A key issue here for pricing policy and for

economic appraisal is the degree to which infrastructure costs vary with usage. Estimation of a translog cost function has become the standard approach here, and the approach is described, with examples from the literature. But another concern is to analyse the efficiency with which a particular infrastructure manager is providing the infrastructure in question. For this data envelopment analysis or frontier methods are needed, and these methods, together with the rather more limited literature applying them to transport infrastructure, are also described.

Chapter 3 deals with analysis of the costs of transport operations. The same issues of measuring marginal cost and of comparing efficiency are important here as well, but so are a host of other issues, including the role of economies of scale versus economies of scope, the impact on costs of product heterogeneity and the way in which services are provided (e.g. by franchising versus outright ownership). It should be noted that in the transport literature, economies of scale and economies of density are normally defined as follows. Economies of scale refer to the situation where an operator expands in terms of both route kilometres and vehicle kilometres, so that density remains unchanged. Economies of density refer to the expansion of vehicle kilometres over the same set of route kilometres. It would be more reasonable to refer to these as economies of scope and economies of scale as expanding the route kilometres almost invariably means expanding the range of products (increasing the number of origins and destinations served); running more services over the same route length corresponds more to what the economics literature regards as economies of scale – namely producing more of the same product.

The approach taken in Chapter 4 on freight costs is rather different from these two chapters. Whilst data on freight companies as a whole may be available from company accounts, it is considered more useful in most cases to build up data on individual routes or flows of traffic, using a cost accounting approach. Freight costs comprise numerous individual cost elements, such as wagon provision, maintenance, fuel, terminals, collection and delivery, and in itself freight cost comprises simply part of the wider costs of freight distribution. This approach is illustrated with specific reference to a model developed of the British freight market. It may of course also be taken in the case of public passenger transport to examine costs of particular routes.

1.3 EXTERNALITIES

As well as costs to operators, transport imposes costs on users and on society at large, and the next few chapters consider these costs. Chapter 5 introduces the notion of an externality and shows why the presence of these leads to distortions in decisions, for instance, regarding the amount of road traffic. If these externalities are to be taken into account in pricing and appraisal decisions, they need to be valued in money terms, using either the willingness to pay of the recipient or the willingness to accept compensation. Chapter 5 explains the different techniques (discrete choice modelling or hedonic pricing) and the different types of data (revealed preference or stated preference) that may be used to obtain these valuations. Applications are illustrated with particular reference to the value of time and environmental externalities.

Chapter 6 considers congestion. Congestion as an external cost arises when an additional vehicle on the road leads to longer travel times for those already using it. The

traditional economic analysis of this dates back to Walters (1961), which derives the external cost of congestion from first principles using speed–flow curves. This chapter shows, however, that dealing with networks and with changes in the levels of congestion over time pose problems which require the traditional economic analysis of congestion to be replaced by a much more complex analysis, using techniques such as micro simulation.

Chapter 7 considers congestion and scarcity in scheduled transport modes, and particularly rail and air. In a scheduled mode, a timetable is produced which should avoid routine congestion in the form of queuing, although there is evidence that the higher the level of capacity utilisation, the higher the unreliability. To the extent that an operator adds to unreliability through additional knock-on effects, even if the service in question is never directly responsible for any delays, simply by occupying a slot and thus removing the ability to recover from earlier delays there is still a congestion externality present even in scheduled modes. But there is also an important additional effect in that if capacity is scarce some operators simply cannot get the slots they want. This chapter considers the problem of developing efficient timetables in these circumstances, and suggests ways in which scarcity pricing could be used to improve the efficiency of the allocation of scarce capacity, and in turn improve the efficiency of investment planning.

Chapter 8 deals specifically with accidents. Costs of accidents include damage to vehicles, medical costs and administration, but the major item is the impact on the health and well-being of those involved in accidents. This chapter examines the current approach taken to estimating these costs, which is based on estimating the willingness to pay of passengers to reduce the risk of death or injury in a transport accident.

1.4 TRANSPORT DEMAND

In Chapter 9, we turn to the issue of forecasting the demand for transport. Chapter 9 deals specifically with car traffic; freight and public transport are dealt with in subsequent chapters. Chapter 9 considers the problem of forecasting the demand for car transport in two parts, first forecasting car ownership and then car use. The forecasts of car use go through the traditional stages of forecasting trip generation for all modes, then distribution (i.e. choice of destination), choice of mode and assignment to specific roads. The methods are illustrated from work on Britain, but are applicable to anywhere subject to limitations of data.

Chapter 10 considers public transport. There are good reasons why different approaches are commonly taken to forecasting demand for public transport compared with roads: the ready availability of ticket sales data, and the fact that as (in most Western countries at least) a minority mode it may not be forecast well by the standard four stage model. Consequently most public transport demand models are simple aggregate elasticity models. However, such models cannot be used for a totally new service where no service existed before, and this chapter also considers approaches to this problem as well as to the consideration of networks as a whole.

Chapter 11 deals with the demand for freight transport. In many ways freight transport demand is more complex to forecast than passenger. It is driven by production and consumption activities, which are hard enough to forecast in themselves. But freight

demand also results from the choices of many other agents responsible for deciding on distribution systems (e.g. use of distribution depots; consignment size and frequency) which determine the actual origin/destination flows of freight. The valuation of attributes of freight supply varies greatly with the commodity carried and with decisions such as size and frequency of consignments. This chapter presents models of all the stages in the process and gives examples of their use in practice.

1.5 TRANSPORT PRICING AND INVESTMENT

This section opens by considering pricing and investment in roads (Chapter 12). It uses the bottleneck model of congestion, in which delays take the form of queuing at the bottleneck, and shows that, whilst a flat charge to use the road will achieve some benefits by reducing total demand, a fine charge which varies with time of day will produce much greater benefits by influencing not just the volume of traffic but also when it travels. Optimal pricing will also influence the case for investment. The chapter closes by considering three case studies where urban road pricing has been introduced to good effect – London, Stockholm and Milan.

Chapter 13 deals with public transport pricing, both urban and inter urban. It stresses that optimal public transport pricing needs to go hand in hand with system optimisation and that user costs play an important role in both. Public transport is characterised by major economies of scale in terms of vehicle size. However, a system designed around maximising vehicle size would have a small number of routes operating infrequent services. When the sum of production and user costs is minimised, an optimal pattern of routes, frequencies and vehicle size is obtained. At the optimum, marginal cost might be obtained by increasing any of these variables. If the chosen variable is frequency, then the production cost of the increased service is considerably offset by reduced user costs (the Mohring effect). However, the overall marginal cost will vary greatly from the optimum if service frequency is non optimal. By contrast, the marginal cost of increasing vehicle size is much more consistent.

The authors consider in turn central city public transport, commuter services and inter urban services. For central city services it is argued that peaks in demand are not a great problem, so fares, routes, frequencies and bus size can be optimised for a steady level of demand. For commuter services, peaks in demand are key, and fares should be levied mainly on the critical section in the peak direction; they will be much higher than for central city routes. For inter urban services, there are still more complicated patterns of peaks in demand by time of day, day of week, time of year and route section. Fares should differ by all these factors. But in all three cases, economies of scale mean that the optimum is likely to involve subsidies.

Chapter 14 considers pricing and investment in airports. Airports nowadays are normally run as commercial enterprises, whether privately or publicly owned. Thus a simple marginal cost pricing regime poses a number of difficulties. In particular, it fails to cover total costs, and it fails to give appropriate incentives for cost efficiency and appropriate investment. This chapter considers these issues, in the light of the fact that airports are most often regulated, and outlines alternative approaches to price regulation. It also considers some other second best problems, namely the possible market power of airlines,

and the possibility that competing modes are inappropriately priced. The last part of Chapter 14 illustrates current airport pricing practices.

Port pricing is the subject of Chapter 15, and is shown to be even more complex than airport pricing, because of the number of different agents involved and the number of different services charged for. How best to incentivise investment is again a key issue, and it is suggested that long-run marginal cost pricing may be more appropriate than short for that reason. However, it is concluded from the description of current port pricing practices that there is a lack of application of modern pricing methodologies to port pricing at the present time.

1.6 DEREGULATION AND PRIVATISATION

As noted above, alternative approaches to price regulation have already been examined in the chapter on airports (Chapter 14). This section considers ways of analysing the impacts of the widespread deregulation (of entry as well as price) and privatisation of transport systems that has occurred in recent decades.

Chapter 16 looks at local and regional transport. It points out the wide range of reforms that may be implemented, from complete deregulation and privatisation through the introduction of competitive tendering to provide services, regulation based on 'yardstick competition' (i.e. benchmarking of different operators) and reform of public sector governance. The chapter emphasises the difficulty of getting reliable and comparable data for quantitative analysis, and the need for qualitative analysis to help understand how different institutions work.

Similar issues arise in Chapter 17, which looks specifically at railways. Reform of railways has varied from the substantial deregulation and private ownership of North America, to the introduction of competition through a combination of open access to the infrastructure or competitive tendering in Europe. Analysis of the impact of reform on railways is rendered more difficult by the heterogeneous nature of railway output (railways do not simply serve a lot of origin/destination pairs, but they also carry a mixture of freight, local and long distance passenger services, and the reforms implemented in each sector may be different). There are also important structural differences, for instance, in the degree of vertical integration (broadly infrastructure and operations may be completely separate, separate parts of a holding company or completely integrated). Given the variety of circumstances in the rail sector, and of techniques used to analyse the impact of reform, it is not surprising that different studies yield different results.

Chapter 18 turns to the airline industry. The worldwide trend to airline deregulation started in the US and this chapter takes the example of the US to consider the rich sources of data available there and the ways in which it may be used to study the impacts of deregulation. Not all countries will have such good data as the US, but this chapter will give researchers an idea of what organisations to look at for data and of the many different ways in which data may be used.

1.7 TRANSPORT POLICY IMPACTS

Chapter 19 presents a wide-ranging review of the sorts of models used in assessing the economic impact of transport policy. These range from macroeconomic models, models of land use/transport interactions and general equilibrium models of the economy as a whole to models of competition, demand and valuation of costs and benefits considered in detail already in earlier chapters. Attention is paid to the phenomenon of agglomeration economies, now seen as a major reason why transport investments may raise labour productivity. Some of the biggest difficulties of such models, such as the need to forecast technological and behavioural change, are noted. A key trade-off is also pinpointed. There is a steady tendency for models to become more and more sophisticated and complex, such that only a few specialists understand them. Yet the democratic selection of transport policy and projects requires that the general public can understand what is being forecast and why, so that it can genuinely participate in decision taking.

Chapters 5–8 have already considered the problem of externalities and how to value them. Chapter 20 considers what externalities mean for transport policy. Whilst the early economics literature considered the issue of internalisation of externalities as a problem solely in terms of economic efficiency to be resolved by the use of a single policy instrument, namely Pigouvian taxes, this chapter considers the full complexity of the real world, in which transport policy has multiple goals and in which transactions costs mean that the perfect Pigouvian tax is not a realistic option. The consequence is that policymakers have to assess the value of packages of measures, including pricing and regulation. The author illustrates this point using examples from European transport policy.

Finally, Chapter 21 considers the issue of equity in transport policy. Alternative approaches to equity are considered, including equity in needs evaluation, equity in needs definition and process equity. It is widely accepted that when considering costs and benefits of alternative courses of action, consideration needs to be given as to who receives those costs and benefits, and weights may be attached reflecting differing levels of income or other factors such as disability. But this chapter looks at other aspects of equity which have come to be seen as important in transport policy, including avoiding social exclusion and facilitating participation in decision-taking. A case study is presented of the treatment of equity in bus planning in Melbourne.

REFERENCES

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