

THE FINANCING OF A NONPURE PUBLIC GOOD: THE CASE OF ROADS

by

CLIFFORD MARNETZ NAUDÉ

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SUPERVISOR: PROFESSOR TJ STEENEKAMP
JOINT SUPERVISOR: PROFESSOR WA PRINGLE

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SUMMARY

This dissertation is concerned with the financing of roads in terms of public finance economic theory. The theory of public goods is applied to the case of roads and it is concluded that roads possess significant elements of privateness and are therefore nonpure public goods. Given that roads are nonpure public goods, and that the market for roads has natural monopoly characteristics, it is proposed that user charges have a role to play in the financing of roads. Road user charging techniques such as licence fees, fuel levies, tolls, area licensing, parking charges and weight-distance charges are evaluated. The advantages of user charging versus tax earmarking and general fund financing are examined. A road financing system for South Africa is proposed, whereby National roads are financed by user charges, and Provincial and Local roads are financed partly by user charges and partly by general taxes.

KEY TERMS

Road financing; Public finance; Public goods theory; Nonpure public goods; User charges; Licence fees; Fuel levies; Toll charges; Area licensing; Parking charges; Weight-distance charges; Tax earmarking; General fund financing.

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CHAPTER 1

INTRODUCTION

1.1 DEFINITION OF THE PROBLEM

Expenditure on road infrastructure has decreased the world over in recent years and South Africa has certainly been no exception. Funding for roads has come under pressure as governments attempt to channel revenue into other competing avenues of activity, which has resulted in situations where revenue to finance even the maintenance of existing infrastructure is inadequate, let alone the construction of additional facilities which would require significant capital investment.

Given this problem of decreasing funds, the objective of this dissertation is to provide a theoretically defensible basis within economics upon which road infrastructure may be sufficiently funded. Thus, the dissertation seeks to establish not only the status of roads as a pure or nonpure/quasi public good, but also what financing instruments are most appropriate to providing revenues and how best these revenues may contribute to the financing of road infrastructure.

In South Africa, as has been the case in most other countries, the chosen route in the provision of roads has historically been that of taxation by central government. Three factors, however, warrant a review of this choice. Firstly, the increased emphasis on privatisation throughout the world and in South Africa; secondly, the constitutional developments under the Government of National Unity (GNU) which seem to favour some form of decentralisation (some devolution of authority to the provinces); finally, the fiscal pressures to which government has increasingly been subjected in recent years which has been reflected in declining budgetary allocations to road construction and maintenance, not only in South Africa but the world over. The situation in South Africa is now even more acute, given the myriad demands being placed upon government for delivery of basic services and the general fulfilment of basic needs, in which South Africa has a formidable backlog. This implies that a new approach to road financing must be sought within the realms of the other way in which

goods are provided, i.e. pricing, or a combination of the taxation and pricing routes.

Thus, the overall objective of this dissertation is the identification of the options that are available for road financing and to investigate the implications of these options, using public finance theory as a basis for the determination of a road financing arrangement for South Africa.

As such, the dissertation examines six essential issues:

- the theory of public goods in public finance theory;
- the application of the theory of public goods to the case of roads;
- the determination of whether roads are pure public goods as this will determine how they ought to be financed;
- the sources of funds for roads;
- the broad arrangements for the allocation of road funds; and
- the implications for road financing in South Africa.

1.2 THE THEORETICAL CONFINES OF THE STUDY

The financing of roads can be studied in the context of different analytical frameworks. As this dissertation will be concerned with the financing aspects of road infrastructure, public finance theory will be examined so as to provide a theoretical basis for this work. This implies that a distinction must be made between public sector economics and public finance. Furthermore, road financing will be studied within the context of a mixed economic system, which will also be defined in this section.

1.2.1 The theory of public finance

Public finance is but one aspect of public economics policy, the others including regulatory policy, monetary policy and planning. This dissertation will be concerned with public finance primarily as distinct from public economics as such. Public finance then involves the effect of government revenues and expenditures on allocation, distribution and stability within the economy (Davie & Duncombe, 1972: 22). Furthermore, only those aspects relating to the provision of public goods and the related taxation and expenditure will be considered. This would refer to the public economy as opposed to the private economy (Cauley, 1960: 3; Newman, 1968: 2). Thus, this dissertation will examine the expenditure and taxation aspects of public finance.

The theory of public finance could be said to have its roots in *The Wealth of Nations* of Adam Smith (1776). Smith perceived the functions of the state to be: the protection and preservation of the autonomy and sovereignty of the society; the establishment and maintenance of the rights of the individual through a system of justice; and, finally, that of "erecting and maintaining certain public works and certain public institutions, which it can never be for the interest of any individual, or small number of individuals, to erect and maintain because the profit could never repay the expense of any individual, or small number of individuals, though it may frequently do much more than repay it to a great society" (as quoted in Brown & Jackson, 1986: 7).

The principles underlying public finance are the same in nature as those which underpin economics in general (Hunter & Allen, 1940: 5). This is because just as economics as a whole involves the study of the actions of individuals directed towards the satisfaction of their needs, so public finance involves the study of the ways in which "public authorities" at whatever level extract benefits for the greater society from the actions of individuals directed towards the fulfilment of various needs (Dalton, 1946: 3). Thus, it may be said that it is the "duty of a state to provide for the demands made upon it, and in this respect its activities are similar to those of the individual...a government should likewise consider not only the available revenue but its expenditure so that the greatest social benefit will result" (Hunter & Allen, 1940: 4).

Hyman (1987: 2) defines public finance as that part of economics which is devoted to the study of government activities and the various ways of financing of government expenditures. Brown and Jackson (1986: 7) distinguish between public sector economics and public finance. Public sector economics is described as being taught extensively as an element of public finance. However, the authors argue, this is not the case historically. Indeed, in their view, public finance has been regarded as a rather narrow field of study devoted to the taxation aspects of the budget. Public sector economics is deemed to be more general in scope, encompassing both the expenditure and taxation aspects of the budget.

Public finance is regarded as of the utmost importance due to the magnitude of public expenditures in any one country, as well as the critical role played by public finance in facilitating normal economic activity (Cauley, 1960: 3-4). However, aside from the undeniable importance of public finance in the economy, the scope and actual activities of public finance need to be defined in order that the rationale of public finance may become clear.

Public finance can, then, be regarded as covering the revenue, expenditure and debt operations of the authorities concerned, and therefore stems from the basic economic requirement of government expenditure which exists in any mixed economic system due to the imperfections of competitive market prices (Hockley, 1970: 69-70). That public finance covers more than simply government finances is also apparent from Shoup's work, in which it is stated that public finance involves the allocation of resources to service the needs of the community - the means by which these resources are provided are from the proceeds of taxation of individuals of which the community is composed (Shoup, 1969: 3).

1.2.2 Description of a mixed economy

The South African economy, like many others in the world today, is commonly described as "mixed", implying that it has both public and private elements which, between them, allocate the scarce resources of the country amongst the many competing applications.

As far as the role of government in the mixed economy is concerned, the government has a number of obligations, one of which would be the provision of public goods. Inherent in this

activity would be the raising of revenue and the expenditure of the same in order that those public goods may be provided.

In a mixed economy, resource allocation will take place partly within the private sector and partly within the public sector. The former will involve the allocation of resources via the market-price mechanism and a number of buyers and sellers exchanging goods and services at agreed prices. Allocation by the public sector will involve budgetary allocation for the provision of certain goods and services which the market cannot/will not provide (Newman, 1968: 2).

Buchanan and Flowers (1980: 3-20) refer to the case of a "no-government economy" (p.2) which would involve business organisations and consumers exchanging goods and productive services perpetually in a series of private consumption decisions which sees consumers deciding on the amounts purchased at whatever price is acceptable to both parties. This is then usefully contrasted with the "all-government economy" (p. 10) which involves collective decisions, and collective organisation and distribution, with each individual obtaining equal amounts of the good (p.17). A mixed economy would then include elements of each of these systems and can be defined as:

"A market economy in which both private and public enterprise participate in economic activity....some of which may be reserved for public monopoly" (Bannock, Baxter & Davis, 1987: 273).

1.3 OUTLINE OF THE DISSERTATION

The real examination of the theoretical base begins in Chapter 2, in which the theory of public goods is set out in detail. This involves an examination of the economic rationale for government, which begins with the concept of Pareto-efficiency and moves on to market failure and its causes, namely common property resources, public goods, externalities and market imperfections/natural monopoly, the rationale for government being the failure of the market to provide goods in certain circumstances. The principal roles of government are then outlined, these being allocation, distribution, stabilisation, and regulation. The three functional

levels of government (central, provincial and local) are also dealt with, as well as the issues of decentralisation, assignment of expenditure and taxation functions between levels of government and intergovernmental transfers. Public goods are then defined and their principal criteria of nonrivalness in consumption and nonexcludability are explained. Finally, the provision of public goods is dealt with, encompassing the partial equilibrium and general equilibrium approaches to the provision of public goods, the free-rider problem and the role of voting in the revelation of demand for public goods.

The theory of public goods is applied to the case of roads in Chapter 3. Roads are examined in terms of the criteria of nonrivalness in consumption and nonexcludability in order to determine whether they are pure public goods. It is argued that roads can possess significant elements of privateness in terms of these criteria and are nonpure public goods. At the same time, it is shown that the market for roads is characterised by elements of natural monopoly. It is concluded that roads do conform to the criteria of pure public goods in certain circumstances but in others do not, and can be termed nonpure public goods.

Chapter 4 deals with the financing of roads as a nonpure public good. Accordingly the principles of taxation are spelled out, ranging from the justification for taxation in the benefit principle and ability to pay principle, as well as the criteria necessary for good taxes such as administrative efficiency, allocative efficiency, neutrality and equity. The financing of roads as pure public goods through general taxes is then examined. The discussion next turns to the financing of roads as nonpure public goods through user charges and the rationale for this is explored. The concept of user charging is then evaluated and its suitability for the roads sector is examined. The setting of user charges is briefly dealt with according to the marginal cost and average cost approaches. The techniques of road user charging such as first tier charges (licence fees), second tier charges (fuel levies, toll charging, area licensing, parking charges) and third tier charges (weight-distance charges) are set out in detail; these user charging techniques are then evaluated in terms of allocative efficiency, equity, practical implementability, general applicability and potential as a source of revenue.

The allocation of revenue, whether it be obtained from general taxation or road user charging, to the financing of roads is the subject of Chapter 5, and is a critical issue if adequate funding

is to be directed towards the roads sector. In this chapter, the various approaches are compared. This involves consideration of the relative advantages and disadvantages general fund financing approach versus that of tax earmarking on the one hand, and then the earmarking of taxes and direct user charging on the other.

Chapter 6 is the final chapter of the dissertation and deals with the financing of roads in South Africa. The objective of the chapter is to put forward a road financing arrangement for South Africa that is defensible in terms of economic theory. Thus, the financing of roads in South Africa up until the present is described so as to give some idea of the fluctuations in funding which have occurred, particularly since the demise of the dedicated road fund in 1988. This is followed by an examination of road financing instruments and their applicability to South Africa, and includes: the issue of allocative efficiency versus equity and how this relates to road funding in South Africa; the future role of user charges in road financing in South Africa; and the relevance of general fund financing, earmarking and user charging in a road financing system for South Africa. The penultimate section of the chapter contains details of a proposed road financing system for South Africa at a central, provincial and local level. The concluding section of the chapter summarises the arguments for the financing of roads in South Africa as a nonpure public good.

CHAPTER 2

THE THEORY OF PUBLIC GOODS

2.1 INTRODUCTION

In Chapter 1 it was stated that road financing will be studied within the context of a mixed economic system and that the theory of public finance will principally be used as the theoretical framework in this study of road financing. The objective of this chapter is to set out the public finance theory of public goods. The theory of public goods will then be applied to the case of roads in Chapter 3, and will determine the extent to which roads are pure public goods and how roads are to be financed. For this purpose, a number of fundamental issues pertinent to the study of road financing need to be addressed:

- What role does government have in the economic system?
- How does the market finance and provide private goods and what are the characteristics of the latter?
- What are the causes of market failure? How does market failure provide a rationale for the provision of public goods? What are the characteristics of pure public goods?

In order to address these questions, this chapter of the dissertation is structured in the following manner. In the first section, the economic rationale for government is examined in order to determine whether there is a need for government. The concept of Pareto efficiency will be dealt with, as well as market failure in the provision of goods which necessitates government action in the form of the provision of goods by the public sector. The principal roles of government in the theory of public finance, namely allocation, distribution, stabilisation and regulation are discussed.

The three functional levels of government in a democracy, i.e. central, provincial and local, is the subject dealt with thereafter. This includes: an examination of types of government

ranging from those more centralised to those more decentralised in nature, and the advantages and disadvantages associated with these types of government; and a discussion around the assignment of expenditure and taxation functions of the levels of government.

The discussion will then turn to the subject of public goods and their characteristics. This section will revolve around what constitutes a pure public good in terms of the two main characteristics of nonrivalness in consumption and nonexcludability, as well as the characteristics of what may be termed nonpure/quasi/mixed public goods. The differences between pure public goods, nonpure/quasi/mixed public goods, and pure private goods in terms of nonrivalness in consumption and nonexcludability are set out as this is crucial for what follows. The provision of public goods is also discussed from a theoretical perspective, including the partial equilibrium and general equilibrium approaches. The notion of the free-rider in the provision of a public good is then discussed. The role of voting in the revelation of preferences in demand for public goods concludes the chapter.

2.2 THE ECONOMIC RATIONALE FOR GOVERNMENT

Public or social goods come about as a result of the failure of the market to provide certain goods. The economic rationale for government begins with the subject of the efficient allocation of resources by the market, and moves to the notion of the failure of the market to provide certain goods. The analysis begins by examining the concept of Pareto efficiency which is the case of efficient allocation of resources by the market without any form of government.

2.2.1 The concept of Pareto efficiency

The overall objective of economics is the efficient allocation of scarce resources. In order to assess the success of the market and government in reaching this objective, economists utilise the Pareto efficiency yardstick.

Pareto efficiency is defined by Bannock, et al (1987: 308) and Hyman (1987: 70) as the economic state where no individual can be better off without rendering some other individual

worse off. For this state to hold, a number of conditions must prevail (Due & Friedlaender, 1981: 9-12). In an economy characterised by two individuals, two goods and two factors of production, these conditions are:

- Productive efficiency - in which the output of the economy must be produced at the lowest cost. This will occur when the marginal rate of transformation (MRT) of the two products is equal and the marginal rate of substitution (MRS) for both consumers is likewise equal (Due & Friedlaender, 1981: 28);
- Allocative efficiency - where resources are allocated to the production of the goods that the economy requires. This occurs where $MRT = MRS$ (Due & Friedlaender, 1981: 28). It will then be impossible to reallocate resources so that one consumer can be made better off without making another consumer worse off (Tresch, 1981: 6);
- Distributional efficiency - output is distributed in such a way that consumers will not spend their incomes in a different manner, given their disposable income and prevailing market prices.

Given the Pareto conditions for economic efficiency, it can be shown that a perfectly competitive market will, under certain conditions, ensure a Pareto efficient allocation of resources (Rosen, 1992: 50). These conditions include:

- a significant numbers of buyers and sellers in the market;
- no product differentiation in the market;
- all buyers and sellers in the market have access to information needed to make decisions (Tresch, 1981: 7).

However, the conditions of Pareto efficiency do not hold in many cases, and it must be reiterated that the concept is a yardstick after all. The discussion will now turn to the failure of the market to provide certain goods.

2.2.2 Market failure

If the conditions for the efficient operation of the market are met, the market achieves an efficient use of resources by providing private goods. This implies that consumers will place bids for what they wish to purchase and will be obliged to reveal their preferences to producers. In their turn, producers will endeavour to produce what consumers wish to purchase and will do so at least cost so as to maximise their profits. Competition will serve to ensure that the goods produced will be in line with the preferences of consumers. In the real world, the perfectly competitive and efficient market does not exist, although the market does manage to provide private goods reasonably well (Musgrave & Musgrave, 1989: 42-43).

Market failure occurs in the case where economic efficiency is not attained as the market mechanism is unable to operate properly. The failure of the market could occur where, for example, the system is unable to produce goods which are desired, or where the distribution and allocation of resources is not Pareto optimal (Bannock, et al, 1987: 262). Brown and Jackson (1986: 23) make the point that the market system is, in many cases, unlikely to operate efficiently if left to its own devices. The production of goods will include surpluses of some goods and scarcities of others, with complete market failure implying the non-production of some goods. Indeed, the conditions necessary for a perfect market system may be too rigorous in the first place, and extremely difficult to uphold in practice (Tresch, 1981: 6).

Market failure is brought about by the existence of the following factors (Brown & Jackson, 1986: 24):

- Common property resources;
- Public goods;
- Externalities;
- Decreasing costs/increasing returns to scale in the case of monopoly and other sorts of imperfect competition, including natural monopoly.

2.2.2.1 Common property resources

Intrinsic to the whole notion of the market is the theory of property rights. Property rights bestow upon the individual the right of ownership over some good and, in so doing, other individuals are excluded from the enjoyment of the benefits of the good. When individuals exchange goods in market transactions, they are essentially exchanging property rights.

For goods which are common property, property rights cannot be given to any single individual. In the case of common property goods, a group of individuals possesses an unrestrained right to the enjoyment of all associated benefits arising from the good. As each member of the group is equally entitled to the benefits of the good and has an equal property right in the ownership of the good, no single individual may sell his right to the benefits of the good to another member of the group.

Owing to the fact that the good is free, it may very well be over-exploited, so that if scarce resources are involved, common property rights may result in resources being misused, as the case of the premature exhaustion of natural resources and congestion. This phenomenon is the "tragedy of the commons". The tragedy of the commons refers to the unregulated behaviour of individuals intent on maximising their own utility and pursuing their own self-interests and which results in a deterioration or depletion of the common resource. It thus becomes the role of government to regulate the behaviour of the individuals (for a brief description of the regulation function of government, see Section 2.3.4), and so to minimise the depletion of the common good and reduce the tragedy of the commons. The role of government therefore becomes one of allocation of the use of the resource between individuals and intertemporally; in this way, the common interest of the members of the group is maximised.

The issue of public goods is a critical issue in this dissertation and will be explored in more detail in Section 2.5. For the present, the subject is introduced in terms of the discussion on market failure.

2.2.2.2 Public goods

The most important source of market failure discussed in this section with reference to the subject of this dissertation is that of public goods - this subject is dealt with in greater depth later in this chapter.

However, for the present, one of the conditions for the efficient performance of the market is that of exclusion. This means that where an individual pays a price for a good, that individual purchases the right of consumption of the good. The individuals who do not pay for the good in question are excluded from its consumption. For the exclusion principle to apply, property rights must exist. A second condition is that in the market for private goods consumers bid for goods, a process which implies rivalry in consumption (Musgrave & Musgrave, 1989: 42-43). This means that one individual's consumption of the good in question diminishes another individual's consumption of the good. Where a good or service exhibits both excludability and rivalness, it will almost certainly be provided by the private sector in a mixed economy. A substantial number of items in an economy fall into this category.

Where the market fails to allocate resources and provide goods because it is inefficient to do so, or where the price of the good is in excess of what the individual will pay, or where the good cannot be consumed by one individual alone this situation is termed market failure (Musgrave & Musgrave, 1989: 42). Therefore, the market does not always manage to provide all goods, as is the case with national defence where the protection of the state is afforded to all individuals living as citizens in the state. Quite clearly, national defence is a good which cannot be purchased by an individual for his exclusive consumption.

Public goods can be defined in terms of two criteria, then, namely nonexcludability and nonrivalness in consumption.

Whereas property rights in the case of a private good means that the individual in whom ownership of the good is invested can exclude all other individuals from enjoyment of the good, in the case of a public good the technical features of excludability break down. This

break down occurs when it is technically impossible to exclude other beneficiaries, as in the case of national defence, or in the case where even though technically feasible, exclusion may be extremely expensive.

Public goods, and therefore the failure of the market, also arises when there is nonrivalness in consumption, which occurs in the case of the indivisibility of certain goods between individuals. In other words, one individual's consumption of the good does not affect the consumption of the good by other individuals. The addition of more users, subject to a capacity constraint of course, to the facility does not increase the variable cost of producing a nonrival good and so marginal costs are not increased. Examples of goods which are nonrival in consumption would be an uncongested bridge or under-utilised road.

Goods which are nonrival in consumption are not automatically nonexcludable. The uncongested bridge is nonrival up to a capacity constraint, but exclusion in the form of a toll gate would be perfectly feasible.

The example of a common property resource given in the previous section in the tragedy of the commons is an example of a nonexcludable good, which is rival in consumption otherwise the tragedy would never have occurred in the first place. Quite clearly, cattle belonging to one individual grazing on a public meadow or common are in competition with cattle belonging to other individuals once the facility becomes overcrowded and overutilised due to its nonexcludability.

Thus, the situation of market failure arises when there is nonexcludability and nonrivalness in consumption of the goods in question. Goods which exhibit the characteristics of nonrivalness in consumption and nonexcludability in whatever measures are termed public goods (also known as social goods). The issue of externalities and the failure of the market is examined next.

2.2.2.3 Externalities

Pure public and pure private goods as such are not the only types of goods prevalent in any

mixed economy, with a great many goods being described as being mixed. These mixed goods have elements of "privateness" about them and, like private goods, can also be associated with externalities or "spill-over" effects. Rosen (1992: 93) suggests that an externality occurs when the activity of one entity, be it an individual or an organisation, has an impact on the welfare of another individual, group of individuals or organisations in a way that is external to the market. These externalities influence the decisions of consumers and producers in ways which result in allocations of resources which differ to varying extents from those which would otherwise have been the case under perfectly competitive market conditions with no externalities (i.e. differ from the situation under Pareto efficiency). An externality would then arise when the production or consumption activities of one party impact upon the production or utility functions of another party. Examples quoted are those of a smoking chimney polluting the atmosphere or factory effluent polluting a river, thereby affecting fish stocks downstream. These examples would be termed negative externalities or disbenefits, whilst positive externalities or benefits can also arise (Brown & Jackson, 1986: 31).

Market failures are then generated by externalities if the effects are not transmitted via the price mechanism, and government intervention is required to correct the situation. Rosen (1992: 92-93) mentions the concept of "pecuniary externalities" which he defines as "(e)ffects on welfare that are transmitted via prices...". If the welfare effects caused by the externalities are taken into account in the formulation of prices, then the externality is said to be internalised.

In this way, externalities provide a role for government of an allocation nature. In the case of pollution, property rights could be sold by government to parties whose economic activities affect the environment in this manner. The additional cost associated with this would be met by the polluting party, resulting in him having to revise his production decisions through the reduction of output levels and, in so doing, pollution levels. Just as government intervention occurs in the case of negative externalities, it can also occur to encourage positive externalities.

Rosen (1992: 94) also makes the point that public goods can be regarded as a special type

of externality, in certain instances. If an individual, or organisation for that matter, is responsible for an externality which has an impact on all other individuals in the economy, then that externality is a pure public good. The criteria of nonrivalness in consumption and nonexcludability are fully met because, firstly, all individuals are affected and, secondly, none are excluded from the effects. However, Rosen (ibid: 94) is at pains to maintain a distinction between public goods and externalities as well. Pure public goods will indeed be synonymous with externalities when the impact of the activity is felt by all participants within the economy. However, when the impacts are only felt by an individual or confined to a group of individuals directly on the receiving end then, quite clearly, this is a case of externalities which can be internalised through appropriate price adjustments, and not a public good (ibid: 94).

2.2.2.4 Market imperfections and natural monopoly

Market failure also occurs in the case of market imperfections. A case of such an imperfection would be that of where the market possesses natural monopoly characteristics. Bannock, et al (1987: 291) define natural monopoly as the situation where the market is characterised by technical attributes which effectively preclude the efficient existence of more than one producer in the market. This would normally be the case in the supply of such utilities as water, gas, electricity and, of course, roads. The case of natural monopoly and roads is discussed in more detail in Section 3.4 of this dissertation.

2.2.3 Concluding remarks

The case of market failure brought about by whatever cause necessitates the need for a role for government. Buchanan and Flowers (1987) compare the authorities to an individual by referring to the authority as a "government unit" (p. 3) or separate entity. As such, the authority concerned (or government) not only raises and spends money on the provision of certain public goods, but is also forced, like the individual, to prioritise amongst the various needs so as to optimise the utilisation of limited resources. Thus, market failure of one sort or another gives rise to the four kinds of government activity described in all standard texts on public economics: allocation, distribution, stabilisation and regulation.

2.3 THE PRINCIPAL ROLES OF GOVERNMENT IN PUBLIC FINANCE THEORY

Government has a number of important roles to play in the economy in terms of public finance theory in order that economic activity may be facilitated: namely the allocation of resources, the distribution of resources, the stabilisation of the economy and the regulatory role. These are now discussed briefly.

2.3.1 Allocative role of government

The allocative role of government stems from the premise that the market system cannot provide certain types of goods. These goods are termed public goods or social goods (Musgrave & Musgrave, 1989: 45-47). Various types of public goods exist, from those which the market system completely fails to provide to those which can only be provided inefficiently. The characteristics of pure public goods and their nature have been discussed briefly in Section 2.2.2.2 and will be dealt with at greater length later in this chapter. For the present, the discussion will be limited to the fact that the market system deals with transactions between individuals involved in the exchange of private goods at an agreed price; other individuals are excluded from the benefits of private goods and the goods themselves are divisible and there is rivalry in consumption. In the case of public goods, property rights are not vested in particular individuals and the market is unable to function adequately in the provision of such goods. Thus, government may have an allocatory role to fulfil in the case where a market produces more or less of a particular good than is required by voters, or where a market completely fails to exist so that a desired good is not produced at all.

With respect to allocative efficiency, government is therefore obliged to ensure that:

- resources are allocated so as to provide a certain level of public goods; and
- resources are allocated between different types of public goods so that a particular mix of public goods is attained.

(a) Allocation and the level of public goods

The split between private goods and public goods may be illustrated utilising a national production possibility curve as is depicted in Figure 2.1. With reference to Figure 2.1, the vertical axis represents the level of goods and services produced for the use of the public sector, while the horizontal axis measures the level of goods and services produced for the use of the private sector. A minimum level of public goods, OX, is necessary to ensure a maximum level of private goods. Below this optimal level of OX, the production of private sector goods would be difficult as a properly functioning economic system could not be guaranteed. The edge of the production possibility curve represents different combinations of private and public goods which could be attained by the economy in question. For example, the two combinations A and B differ inasmuch as point B implies a higher level of public goods provision than point A and less private goods than could be achieved at point A. The choice between combinations is decided upon in the democratic, mixed economy system by the process of voting by the electorate, either between options in the case of a referendum, or between political parties each of which have a defined platform of prospective policies. The notion of voting is discussed in more detail in Section 2.6.3 of this dissertation.

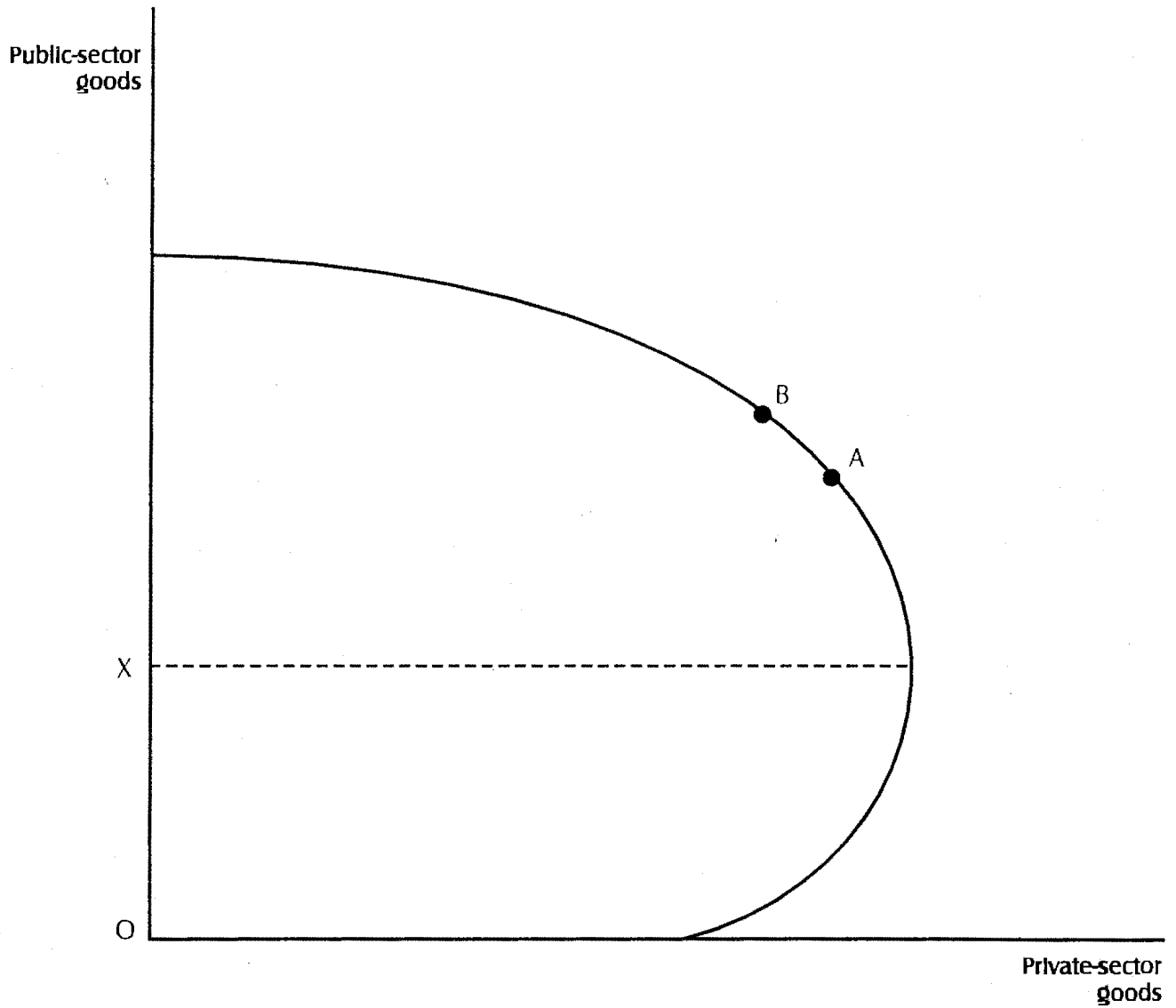


Figure 2.1: National production of private goods and public goods

Source: Davie and Duncombe (1972: 12).

(b) Allocation and the particular mix of public goods

The next issue in the allocation process is the mix of public goods and the price which should be asked for them. The difficulty here lies in determining the correct contribution which should be exacted from those members of society who benefit from the provision of certain public goods, thereby eliminating the so-called "free-rider" problem (the free-rider issue is discussed in more detail later in this chapter). This would prevent the "tragedy of the commons" whereby a number of individuals have equal access to a common property. As the good in question is freely available to all, the resource is over-utilised and deteriorates rapidly and the unregulated behaviour of each individual (as a free-rider) results in a sub-optimal position for the entire community or group as a whole (Brown & Jackson, 1986: 24-26). In this regard, Musgrave and Musgrave (1989: 48) point to the usefulness of the political process as a means whereby the most preferable mix of public goods may be obtained via a voting process (e.g. majority voting). In practical terms, such a procedure would determine how much of the total national resources available would be devoted to defence, education and medical facilities. Voting would then occur according to the allocation policies advocated by various political players.

2.3.2 Distribution role of government

The distributive role of government involves the distribution of income and wealth which the particular society deems justifiable. Distribution policy issues are extremely significant in budgetary debates generally, and with respect to the determination of taxation and transfer policies in particular. Where policy adjustments are not employed to arrange otherwise, the distribution of income and wealth in the economy depends upon factor endowments such as earnings capacity and accumulated wealth. The distribution of income based upon this factor endowment is, in turn, influenced by factor prices which are determined in the (imperfect) market such that returns on the factors will not equal the marginal product.

A major difference between the allocation and the distribution function of government revolves around the issue of what constitutes a just distribution of income. Whereas allocation

efficiency is primarily an economic question, the pattern of distribution is a subjective one. Where questions of efficiency are concerned, income distribution is often ignored or taken as a given. However, there is a tradeoff between equity, which may be a policy objective, and efficiency (see discussion in Musgrave & Musgrave, 1989: 74-76).

Thus, the electorate may feel that the government should alter the distribution of incomes and welfare resulting from the market system because they perceive the situation to be unjust, and are prepared to sacrifice the efficiency of this outcome for that which their sense of social justice deems more equitable.

As regards the distribution which society deems just, Musgrave and Musgrave (1989: 71-74) suggest that a distinction must be drawn between two principles: (a) factor inputs valued according to competitive factor pricing are required for efficient factor usage, and (b) that income distribution should be fixed entirely by the market. The first of the two is deemed by the authors to be a universal economic principle regardless of the type of economic system involved. The second is regarded as problematic in the sense that factor prices, however they may be determined, may result in a distribution which may not be acceptable. Thus, adjustments of some kind will be required to bring the distribution into line with the societal prescription.

Once the income distribution perceived to be most appropriate to the society has been selected, the government has a number of instruments which can be utilised to attempt to attain the envisaged end-state, such as taxation transfers, progressive taxation the proceeds of which are used for social schemes/projects aimed at the upliftment of the disadvantaged, as well as taxes levied on goods used by the wealthy members of the society (Davie & Duncombe, 1972: 15).

2.3.3 Stabilisation role of government

The stabilisation function of government is concerned with macroeconomic aspects and involves ensuring a level of stability to the economy, such as an adequate rate of economic growth, a measure of price stability and maximisation of employment. Government would

then be called upon to correct a period of inflation or unemployment through stabilisation policy aimed at addressing the particular range of problems. Stabilisation policy has increased in importance since the 1930s when high levels of unemployment and price instability became more widespread. Part of this naturally involves the regulation of certain aspects of economic activity which will facilitate stability. The instruments most frequently utilised in this role fall under two main headings, namely monetary on the one hand and fiscal on the other. Elements of monetary policy which could be used would be those aimed at the money supply and the aggregate level of demand, such as interest rates and money supply levels. Fiscal policy instruments also affect the level of demand in the economy. An increase in the level of public expenditure will result in an increase in the level of demand through both the public and then the private sector of the economy. Similarly, an increase in the level of taxation will result in a reduction in the level of demand as disposable incomes fall and individuals spend less.

2.3.4 Regulatory role of government

The regulatory role played by government is that of administering the system of justice which regulates the behaviour of individuals in their economic transactions with one another, either through the enforcement of property rights or the regulation of competition for example. The regulation role of government is part of the reason for the term "mixed economy", indicating as it does some level of government involvement.

2.3.5 Concluding remarks

With regard to the four functions of government outlined above, it is the allocation function which is of importance in this dissertation. This point is emphasised because, of the four functions, the stabilisation and regulatory roles are irrelevant to the debate around road financing and will consequently be ignored henceforth. However, this is not so in the case of the distribution role. Vehicles using roads are often taxed or subsidised in various ways for reasons of equity. Thus, they are taxed because of external costs they impose on the environment through pollution for example which then has to be redressed by government. They are subsidised due to the benefits accruing to low income groups from the availability of transport.

The utilisation of such instruments as taxes and subsidies, however, is a separate issue from that of how and by whom road infrastructure is provided and paid for. As a point of illustration, a tax on fuel would be akin to one on tobacco products, while a subsidy on public transport would be similar to a subsidy on health care. The issue of whether these goods and services are provided by the public or private sectors, or whether the tax or price routes are employed to finance them, has little to do with the issue of whether they ought to be taxed or subsidised. Rather, the point is that society is in favour of health care and may be opposed to the use of tobacco. Thus, the intervention by government in the transport sector for distribution purposes occurs due to market factors which are quite distinct from those factors which may oblige it to take up an allocation role, and it is for this reason that the concerns of allocation and distribution should be kept separate. The relevance of the allocation and distribution functions of government in the financing of roads are also dealt with later in Sections 4.2.3 and 6.3.1.

Having established what roles government can play in a mixed economy, it is important to consider the various levels at which government activity can take place.

2.4 THE THREE FUNCTIONAL LEVELS OF GOVERNMENT IN A DEMOCRACY

The role of government in a mixed economy is not different from the general role of government put forward by Pigou (1949), namely that:

"In every developed society there is some form of government organisation, which may or may not represent the members of the society collectively, but certainly has coercive authority over them individually. As a rule the government organisation is broken up into a central government with large powers and a number of local government authorities with limited powers. The governing authority, whether central or local, is endowed with functions and duties, the detailed nature of which varies in different places. These duties involve the expenditure and, consequently, require also the raising of revenue." (Pigou, 1949: 1).

As Pigou points out in his work, government is normally split into a number of levels, i.e. central and local in the case outlined above, each with defined powers.

Government in a mixed economy with a democratic political dispensation has essentially three functional levels of activity forming what is termed a multi-tiered structure (Shah, 1994: 5-7):

- Central/Federal
- Provincial/State
- Municipal/Local

The distinction between central and local made by Pigou can logically be extended to include all levels of government in existence, i.e. central, provincial and local. At each of these levels, the authority concerned is generally charged with the roles explored in the preceding section, namely that of allocation, distribution and stabilisation. The responsibilities and functions allotted to each of these levels varies substantially internationally as suggested by Pigou.

This section comprises an examination and appraisal of the centralised versus the decentralised approaches to government, the assignment of expenditure and taxation functions between levels of government, and the workings of transfers between the various levels of government.

2.4.1 Types of government

The terminology used to describe the type of government can vary according to the division of powers and responsibilities amongst the levels of government, but the two most common types are those of a unitary or federal nature. A unitary government can be a single or multi-level governmental system in which the control of government lies at a central level. This can mean that decisions are effectively taken at central level in some instances, with the role of all other levels being confined to that of overseeing implementation of policy or execution of all functions for the benefit of the central authorities. Alternatively, it can also imply a measure of autonomy for the sub-national levels of government where decision making is decentralised to the provinces, but overall power is still concentrated very much at the centre,

e.g. China. Other examples of more democratic multi-level governments under unitary constitutions are New Zealand and the United Kingdom. A federal system of government, on the other hand, inevitably implies a reasonable amount of autonomy for the subnational levels of government, with greater decentralised decision making to various degrees at all levels of government, although the arrangement of powers and responsibilities will vary according to the model of federalism adopted (Shah, 1994: 5-7). Thus, democratic societies with mixed economies can be of a unitary or federal nature, in which authority and functions are centralised or decentralised to varying extents (see Musgrave, 1986: 3-64, and Shah, 1994, for a more detailed discussion on fiscal federalism).

2.4.2 Centralisation versus decentralisation

The current trend in World Bank thinking in this regard is directed towards fiscal federalism with a significant amount of decentralisation. It is suggested in Boadway, et al, (1994: 45) that developing economies are, on the whole, more centralised than developed economies. In addressing the question of economic growth, it is argued in Shah (1994: 1) that decentralisation should be the norm and centralisation the exception and then only in certain circumstances. This is because the advantages of decentralisation are held to be sufficient to outweigh those of a centralised system. Whilst a centralised structure can be useful to attain equity in the economy, and can go some way towards optimising a co-ordinated approach to the implementation of policy, the power of the central authority can lead to inefficiencies owing to the difficulty of managing local issues at a central level, as well as conflict between central and local objectives.

The justification for the emphasis on decentralisation in the context of a federal structure lies in the view that "Economic theory suggests that decision making should occur at the lowest level of government consistent with the goals of allocative efficiency, reflecting economies of scale and benefit-cost spillouts" (Shah, 1994: 1). The combination of a federal system with a fair measure of decentralisation is put forward as the model for developing countries in both Boadway (1994) and Shah (1994) presumably because it provides a level of allocative efficiency, thereby avoiding the political pitfalls of a highly centralised system.

2.4.3 Advantages and disadvantages of decentralisation

In a federal economy, the assignment of both expenditure and taxation responsibilities is necessary as it can vary appreciably depending on the situation in that particular country. Decentralisation of expenditure responsibilities to lower levels of government is most appropriate because of (Boadway, 1994: 18-20):

- the existence of local public goods versus national public goods;
- quasi-private goods which can be provided more efficiently at lower levels of government;
- local preferences for redistribution which best be addressed at lower levels; and
- the need for fiscal and political accountability which can only be provided at a lower level of government if it is to be effective.

By the same token, the decentralisation of expenditure can be criticised for a number of reasons (i.e. arguments which could be raised in defence of centralisation of expenditure functions) (ibid: 20-21):

- spillovers of benefits between local areas will be substantially reduced as priorities will be focused specifically on a lower level, possibly resulting in a skewed development between states and local areas;
- the benefits of economies of scale may be lost;
- lack of co-ordination with federal equity responsibilities.

Similarly, the decentralisation of taxation responsibilities has advantages and disadvantages. An important feature of the assignment of taxation functions is that they can be done independently of those of expenditure functions. This feature enables the decentralisation of

taxation responsibilities to be set at a level which differs from that which applies to expenditure, and which could be more appropriate to the particular situation.

Moreover, the level of decentralisation can vary to the extent that the administration of the taxation system may be done centrally, whilst the determination of tax bases and tax rates can be done at a federal or state level. For example, the federal government could be responsible for the administration and collection of taxes for itself and the lower levels, and could even identify the tax base set the appropriate rate. The states could then apply their own tax rate to the federal tax liability - a practice known as "piggy-backing" (ibid: 22).

However, while the decentralisation of taxation functions has the advantages set out above, it can also lead to inefficiencies. Factors of production may be tempted to locate certain areas on the basis of tax rates and structures alone, resulting in a skewed allocation of these factors across states and impacting negatively on the efficiency of the national economy as a whole. Where differential tax structures are deliberately utilised, these are known as "beggar-thy-neighbour" policies. Such practices can also result in fiscal inequities as the different rates levied result in variations in disposable incomes across the economy.

2.4.4 Assignment of expenditure and taxation functions

The actual assignment of expenditure and taxation functions varies substantially across countries, depending on the objectives of the levels of government involved. Shah (1994: 10-12) proposes that the assignment of expenditure functions between levels of government should be in accordance with a number of guiding principles:

- the level allowing for the most efficient provision of public goods and services, i.e. that level "having control over the minimum geographic area that would internalise benefits and costs of such provision" (ibid: 10). The application of this criterion is subject to the limitations of spatial externalities, economies of scale, as well as administrative and compliance costs;
- the level of fiscal efficiency resulting from the expenditure assignment, i.e. to counter

the inefficiencies introduced by differential fiscal arrangements between jurisdictional areas;

- what is required to attain some level of horizontal equity across regions, i.e. to counter the differential net fiscal benefits which can accrue to individuals in ostensibly similar income groups in different areas;
- the redistributive role of the public sector;
- the need to provide quasi-private goods;
- the extent to which the internal common market of the country needs to be preserved;
- the spending power of the central government, i.e. the extent to which the latter will be able to influence lower levels of government through its capacity to fund lower level projects.

The actual assignment of expenditures obviously varies a great deal, but Shah also proposes a conceptual assignment (1994: 12), in terms of which public goods such as defence, foreign policy, monetary policy and immigration policy are federal responsibilities at a policy and administration level, whilst industry, education and road infrastructure are dealt with by federal authorities on a policy level, with administration and provision of these goods being a state and local matter.

The principles which determine the assignment of taxes in a federal system are (Shah, 1994: 18-19):

- efficiency in tax administration - i.e. that level of government which will ensure the highest level of efficiency in tax administration;
- fiscal need - revenue means should be matched as close as possible to revenue needs;

Shah also sets out the principles consistent with Musgrave's criteria of efficiency and equity (ibid: 18):

- the centralisation of progressive redistributive taxes, as well as those necessary for economic stabilisation;
- the centralisation of taxes on mobile factors of production;
- residence-based taxes should be levied by states;
- taxes on immobile factors of production should be levied by local authorities;
- benefit taxes and user charges should be levied at all levels where appropriate.

In practical terms, taxes such as customs duties and corporate income taxes should then be the complete responsibility of central government, whilst user charges can be determined and administered at whatever level of government (national, provincial or local) deemed appropriate (Shah, 1994: 19 provides a detailed breakdown of the level of responsibility for various types of tax).

The assignment of expenditure and taxation functions amongst the various levels of government varies appreciably but is one of the major issues in a federal system which is decentralised to an extent. The suggested arrangement put forward by Shah (1994: 18) and Boadway (1994: 36) is the centralisation of tax collections, and the decentralisation of expenditure assignments.

2.4.5 Intergovernmental transfers

A further aspect of multi-level government dealt with in the literature is that of intergovernmental transfers which occur when lower levels of government require supplementary funding. Shah (1994: 24-39) deals with this subject at length. The mechanisms of the transfers involved are of a two-tiered nature, i.e. those from the federal authority to the states, and then those from the states to local authorities. In other words, transfers are best undertaken between authorities with direct links between them, which facilitates administration and seeks to optimise efficiency in their use (ibid: 36-37). Transfers range from grants of a conditional or unconditional nonmatching type to those of an equalising nature.

Thus, intergovernmental transfers from the federal authority can be linked to conditions attached to their use (also specific-purpose grants), and can also be of a matching type. Equalising transfers are aimed at addressing the differential net fiscal benefits mentioned earlier which can lead to disparities between states.

2.4.6 Assignment of functions to levels of government

At a central level (Federal in the United States), government is responsible for items such as defence, national health policy, national education policy, national roads and the like. At a provincial level (state level in the United States) the elected provincial authority is responsible for demarcated provincial road and transport infrastructure, administration of health facilities and education facilities, enforcement of law and order amongst other activities. Local authorities are normally devoted to the provision of such services as local law enforcement, urban road and transport infrastructure and services, and local welfare and community facilities. The level of autonomy enjoyed by the authority varies from country to country, with states in the United States able to exercise considerable authority in both the formulation of policy as well as implementation of policy. A fundamental component in government activity at all of these levels is not only expenditure on the provision of public goods, but the raising of the necessary revenue required for the provision of these facilities.

The discussion will now revolve around the definition and characteristics of public goods in terms of the criteria of nonrivalness in consumption and nonexcludability. Thus, the section sets out how, utilising these two criteria, goods may be classified as pure public goods, nonpure/quasi/mixed public goods and pure private goods.

2.5 DEFINITION OF PUBLIC GOODS AND THEIR CHARACTERISTICS

In Section 2.2.2 it was stated that the market fails in a number of respects to allocate resources efficiently. Government, therefore, has a role to play. Public goods were identified as one of the important rationales for government intervention.

Just as market failure is brought about by nonrivalness in consumption and nonexcludability,

so the need for public goods arises. Thus, this section will set out the principal characteristics of public goods, these being nonrivalness in consumption and nonexcludability.

2.5.1 Nonrivalness in consumption

According to Due and Friedlaender (1981: 25), the underlying characteristic of public goods is that of nonappropriability. That is, once public goods are made available, they are equally available to all individuals. Thus, the consumption of the good by one individual does not reduce the amount of the good available to other consumers. Besides, this criterion, public goods also have the following characteristics which are quoted in the public finance literature most often. Samuelson (1954) defined a public good as being such that "each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good" (see Due & Friedlaender, 1981: 25).

The consumption of public goods is therefore held to be nonrival (nonrivalness in consumption is also referred to as jointness in supply). This means that the consumption of the good by any one individual will not reduce the benefit derived by any other individual from consumption of the same good. Owing to the fact that all benefits which may be derived from consumption of the good are available to all individuals without interference in the consumption of the good by others, any exclusion would be inefficient and therefore inappropriate (Musgrave & Musgrave, 1989: 43). Schmitz (1991: 55-56) addresses the issue of the characteristics of a public good by distinguishing between what he terms a collective good and a public good. The attribute of nonrivalness in consumption is reserved for a collective good, whilst a public good is defined as a collective good which is nonexclusive in consumption.

Efficient resource use implies that price equals marginal cost. Because nonrivalness in consumption is a result of the inherent indivisibility of the good, the addition of one more user/consumer (given capacity limitations) will not increase the variable cost of providing the good and so marginal costs do not rise (Brown & Jackson, 1986: 29). Thus, in the case of public goods, marginal cost (the cost of introducing an extra consumer of the good) will be zero, as will the price. However, in this context, Hyman (1987: 116) draws a distinction

between the marginal costs of distributing the public good and the marginal costs of producing the public good. The marginal costs of distributing the public good to an additional consumer are indeed zero. The marginal costs of producing additional units of the good will be positive due to the fact that more resources will be required to produce additional units. What this implies for the optimal usage of the good is that while the marginal cost of additional consumers of the good is indeed zero, additional consumers of the good can only be added for as long as no congestion or crowding occurs in the consumption of the good which could affect the enjoyment of benefits of the good by the existing consumers.

Examples of such goods would be a national monument, national defence, or a bridge or road, provided that there is no congestion in the case of the latter two which would interfere with consumption of the good by any one individual.

The nonrivalness in consumption of public goods is also dealt with through the emphasis on the indivisibility of these goods. In 1890, Mazzola suggested that public goods should be "complementary and indivisible. The services of law and order, public health, etc., are contributory causes to private satisfactions. But although their consumption produces individual satisfaction, the quantities consumed by each individual cannot be divided up and measured." (Kiesling, 1992: 9). Similarly, Bowen (in Kiesling, 1992: 10) also classified public goods in terms of indivisibility:

"Social goods...are not divisible into units that can be the unique possession of individuals...Consequently, these goods cannot easily be sold to individual consumers and the quantities available to different individuals cannot be adjusted according to their respective tastes."

Owing to the indivisibility of pure public goods, it is then impossible to increase the amount of the good consumed by one individual without simultaneously increasing the amounts consumed by other individuals. Any additional enjoyment that accrues to any one individual from the consumption of a given amount of the good shall not have any effect on the enjoyment of other individuals. Also, all consumers must consume the total amount of the good provided. Adding one or more users, up to the level of full capacity, does not add to the

variable costs of production, and thus also not to marginal costs. An example of this would be a noncrowded bridge. An important point is that individuals are not able to determine, on the basis of their own preferences, the total amount of the public good to consume. Thus, the amount of a public good consumed will depend on the choice of the individuals as a whole, so agreement is required on this such that all individuals will accept the amount of the good to be provided.

However, the cost of providing the good must still be borne. As this cannot be done through the normal operation of the market, provision is required by means of the budget mechanism (Musgrave & Musgrave, 1989: 48).

2.5.2 Nonexcludability

The market failure which results in the need to provide public goods is also contingent upon the nonexcludability of public goods. Nonexcludability means that it is impossible, for whatever reason, to exclude any individual from use of the good. In the case of a pure public good, nonexcludability will accompany nonrivalness in consumption, as is the case in national defence where each citizen's enjoyment of protection by the state is guaranteed and no one individual can be excluded from it.

Nonexcludability also arises where consumption of the good is rival but exclusion, even if appropriate, is not feasible (Musgrave & Musgrave, 1989: 43-44). This is because not all goods which are rival in consumption lend themselves to exclusion. Due and Friedlaender (1981: 25) regard nonexcludability simply in terms of the infeasibility of exclusion. In cases where exclusion is possible but impractical or difficult to administer, public provision is necessary until techniques enabling exclusion can be found and applied. Musgrave and Musgrave (1989: 43-44) use the example of a congested city centre street during peak rush hour. In this case, the use of the available space is rival as road users interfere with one another's use of the available road space. However, exclusion, whilst theoretically justifiable in order to price the use of the facility, is impossible and prohibitively expensive.

The absence of exclusion can contribute to market failure in the case where consumers are

not forced to reveal their preferences for the good by bidding. Particularly in the case of a large number of consumers, the level of provision will not necessarily be affected by one individual not paying. In this manner, the notion of the free-rider comes about. If a number of consumers behave in this way, the level of demand for the good becomes difficult if not impossible to determine, and an alternative system of provision is required.

Schmidtz' (1991: 55-56) concept of a public good follows on from his definition of a collective good being a good which exhibits nonrivalness in consumption, and a public good being a collective good which is nonexclusive in consumption. Thus, nonrivalness in consumption is taken as a precondition for nonexclusion in this particular definition.

Brown and Jackson (1986: 28) approach the notion of a public good with an emphasis on property rights, or rather the lack thereof. Whereas private goods are characterised by a strong set of enforceable property rights, there is no such ability to exclude others from enjoying the benefits of the good in the case of pure public goods. Coupled with this is the contention that public goods are also nonrejectable, i.e. individuals cannot exclude themselves from enjoying the good even if they desire to do so. Also, it may be too expensive a process to exclude individuals from partaking of the good. Again, national defence is perhaps the example of a public good that is quoted most often because no individual can be excluded from the benefits of this protection.

2.5.3 Pure public goods and nonpure/quasi/mixed public goods

So far the distinction has been between private and public goods. Public goods, however, differ in their degree of publicness and there can be distinguished two main types of public goods, namely pure and nonpure/quasi/mixed public goods. These are distinct from private goods which possess both rivalness in consumption and excludability.

A pure public good has been defined as a good whose benefits are consumed by all members of a community as soon as it is produced for, or by, any one individual. It is also costly to exclude individuals from the benefits of consumption (Hyman, 1987: 115). This is in contrast to a pure private good where the benefits accrue to the individual who consumes the good

after an amount has been paid for the desired portion of the good.

However, what constitutes a pure public good is not determined strictly in terms of the criteria of nonrivalness in consumption and nonexcludability, the presence of which will produce differing results. Thus, the diagram below presents the characteristics of several types of goods, ranging from the pure public good, which is deemed to require nonrivalness and nonexcludability as prerequisites; to excludable/nonrival goods for which exclusion would be technically feasible and not too expensive; common property resources which are rival but nonexcludable goods; and goods which are neither rival nor excludable (pure private goods).

Figure 2.2 outlines the process by which goods may be classified as either private, public or mixed goods and is useful in that it will be utilised later as a means of deciding whether roads can be classified as a private, mixed or pure public good.

As the objective of this section is to explore the characteristics of public goods, the relationship between the conditions of nonrivalness and nonexcludability has to be examined.

The characteristics of nonrivalness and nonexcludability need not appear together for a good to be deemed public, although both do often appear together. Thus, it is difficult to identify which of the two is the basic, underlying prerequisite, although Schmidt (1991: 55-56) and Musgrave and Musgrave (1989: 43) suggested it to be that of nonrivalness. Indeed on this point, nonrivalness in consumption does have a decisive role inasmuch as it does render exclusion inappropriate even where the latter may be technically feasible.

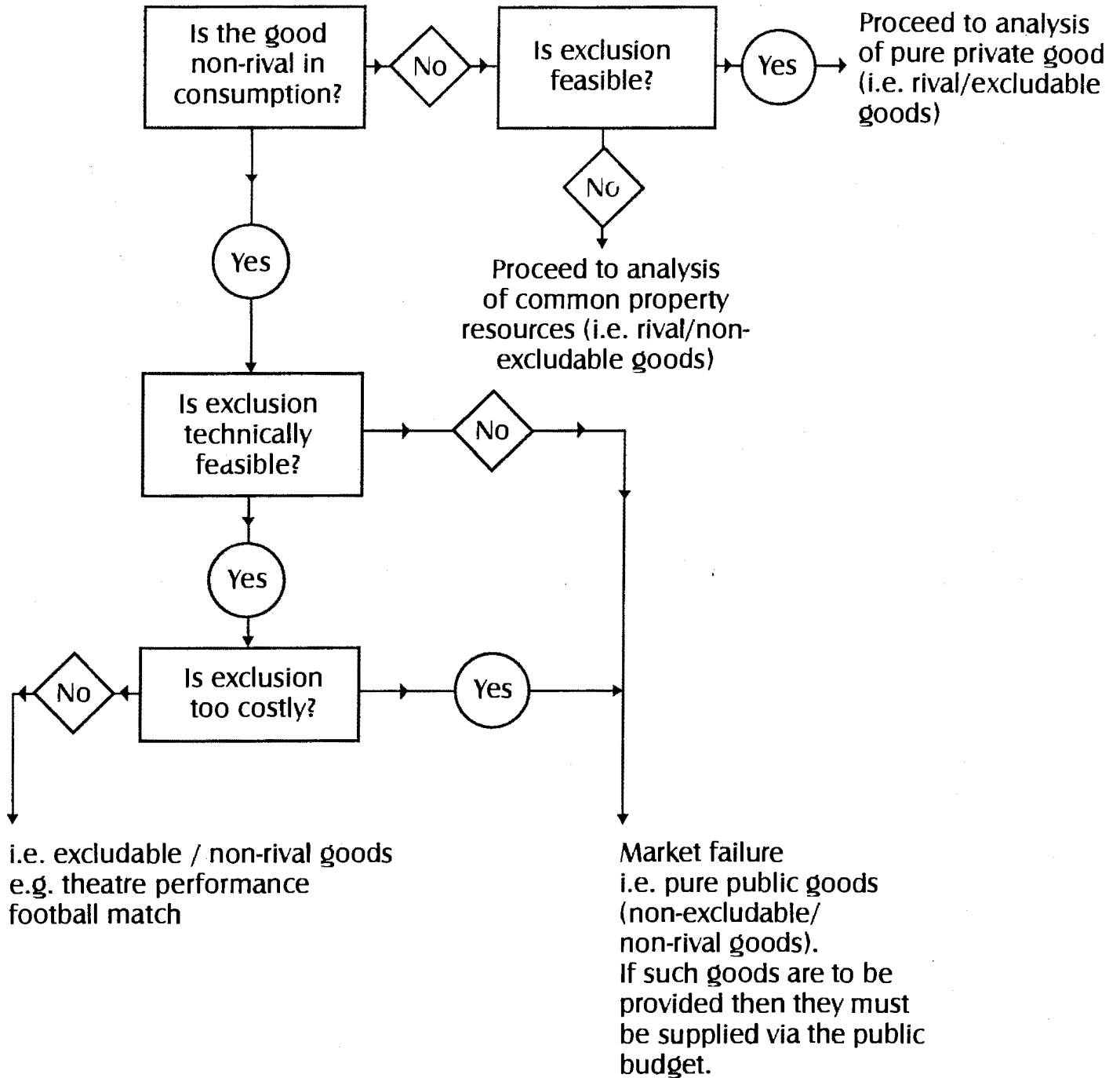


Figure 2.2: Definitions of types of goods through rivalness and excludability

Source: Brown and Jackson (1986: 30)

The various classifications of goods in terms of nonrivalness and nonexcludability are shown in the following matrix in Table 2.1:

Table 2.1: Matrix for the classification of goods in terms of nonrivalness and nonexcludability:

CHARACTERISTIC	EXCLUDABLE	NONEXCLUDABLE
RIVAL	<p>Pure private goods (Case 1)</p> <ul style="list-style-type: none"> • Exclusion costs are low • Produced by private firms • Distributed via markets • Financed out of revenues from sales <p><u>Examples:</u> food, shoes.</p>	<p>Mixed goods (Case 2)</p> <ul style="list-style-type: none"> • Goods whose benefits are collectively consumed but which are subject to congestion/crowding • Produced by private firms or directly by the public sector • Distributed via the market or directly via public budgets • Financed out of revenues from sales, e.g. fees for right to use service, or financed out of tax revenues <p><u>Examples:</u> public recreation facilities, common property resources.</p>
NONRIVAL	<p>Mixed goods (Club theory) (Case 3)</p> <ul style="list-style-type: none"> • Private goods with externalities • Produced by private firms • Distributed via markets with subsidies or corrective taxes • Financed by revenues from sales <p><u>Examples:</u> schools, health facilities.</p>	<p>Pure public goods (Case 4)</p> <ul style="list-style-type: none"> • High exclusion costs • Produced directly by government or by private firms under contract to government • Distributed via public budget • Financed out of compulsory tax revenues <p><u>Example:</u> national defence.</p>

Source: Brown and Jackson (1986: 35); Musgrave and Musgrave (1989: 44).

With reference to Table 2.1, the case of the **pure private good** (case 1) represents the classic

private good characterised by rivalness in consumption and feasible exclusion. The case of the **mixed good** (case 2) is characterised by rivalness in consumption but exclusion is not feasible for whatever reason. The case of **mixed goods** (Club theory - case 3) is the situation of nonrivalness in consumption but where exclusion is not only technically feasible but also appropriate. Finally, the case of the **pure public good** (Case 4) is the case of a public good characterised by both nonrivalness in consumption and firm nonexcludability (due to exclusion being impossible, impractical or expensive). Musgrave and Musgrave (1989: 44) suggest that whilst cases 2, 3 and 4 are all examples of mixed and public goods (displaying elements of publicness, as well as privateness in cases 2 and 3), cases 3 and 4 are regarded as such without reservation due to the existence of nonrivalness in consumption; case 2 on the other hand would not readily be regarded as a public good. Thus, a public good would seem to require at least nonrivalness in consumption to be classified as a true public good. These four cases are dealt with in a similar manner by Peston (1972).

This also gives rise to the issue of different types of public goods, if not all public goods are necessarily pure. Public goods which fit into category 2 outlined above could be termed quasi-public goods or nonpure public goods for example. Public goods which comply with all of the characteristics set out above would be termed pure public goods. Those goods which exhibit elements of rivalness in consumption or for which exclusion would not only be feasible but appropriate could be termed nonpure public goods (with elements of privateness about them).

The relation between the characteristics of a pure public good and the concept of market failure also needs to be examined. From the preceding discussion on characteristics of the various types of goods, it is possible to suggest that a pure public good can be provided collectively by a private voluntary scheme or publicly through the budget. In the first case, a public good would not be provided by a producer who wishes to maximise his profits as exclusion of individuals not paying for the consumption of the good is impossible. In order to secure the provision of the good, however, a group of individuals who do wish to consume the good and pay for the benefits to be derived therefrom could come together and provide the good on a voluntary basis. Once the group grows beyond a certain optimal size, the problem of free-riders occurs and the voluntary arrangement begins to disintegrate. In this

way, public sector provision via the budget becomes necessary so as to ensure the provision of the good, although this does not imply production by the public sector (Brown & Jackson, 1986: 30).

Thus far in this chapter we have established that there are public, private and nonpure/mixed goods. For the sake of completeness, the provision and pricing of public goods will be briefly examined next.

2.6 PROVISION OF PUBLIC GOODS

This section is concerned with the provision of public goods. This entails aspects of the financing and pricing of public goods which must be considered distinct from the production of public goods.

2.6.1 Theoretical approaches to provision of public goods

A number of approaches to the provision of public goods will be examined in this section, including those of Wicksell, Lindahl and Samuelson as well as other relevant approaches.

Theoretical approaches to the provision of public goods date back to Adam Smith (1776) as outlined earlier in this chapter. Indeed, Smith's reference to the expenditure side of government activity was significant. Smith seems to have fully appreciated the occurrence of market failure as a result of the nature of public goods and the need for public provision, although such aspects as the free-rider problem were not dealt with in terms of his work (Musgrave, 1986: 319). Subsequent work on the expenditure side of public sector activity did not occur for some time, Mill and Ricardo being preoccupied with taxation aspects.

2.6.1.1 Wicksell-Lindahl (partial equilibrium) approach

Both the Wicksellian and the Lindahl approaches have been described as normative, due to their emphasis on the need to provide levels of public goods and taxation levels which are just and will serve to ensure a just income distribution (see Roberts, 1974; Rosen, 1992).

The Wicksell-Lindahl model for the provision of a public good is based on two individuals A and B, who can also be regarded as two political parties advocating different levels of taxation and public good provision. The situation between the individuals or parties is presented in Figure 2.3. With reference to Figure 2.3, the vertical axis (h) is A's portion of the total cost of providing the public good, whilst B's tax responsibility is (1-h). The horizontal or x axis (represented by G) refers to the quantity of public goods provided, as well as the level of public expenditures. The curves AA and BB are the demand curves for the public good of the respective individuals. The curves are compiled in the following manner. Each of the individuals has a utility function U which is made up of certain levels of public goods (G) and private goods (X) so that (ibid):

$$U^A = \phi^A(X^A, G)$$

$$U^B = \phi^B(X^B, G)$$

Where:

X^A = vector of private goods consumed by A;

X^B = vector of private goods consumed by B;

G = vector of public goods.

The objective of the individuals is to maximise their utilities within the constraints of their respective budgets and this could be presented in the following way (ibid):

$$Y^A \geq pX^A + hG$$

$$Y^B \geq pX^B + (1 - h)G$$

where:

Y = income levels of individuals A and B respectively;

p = vector for private goods prices.

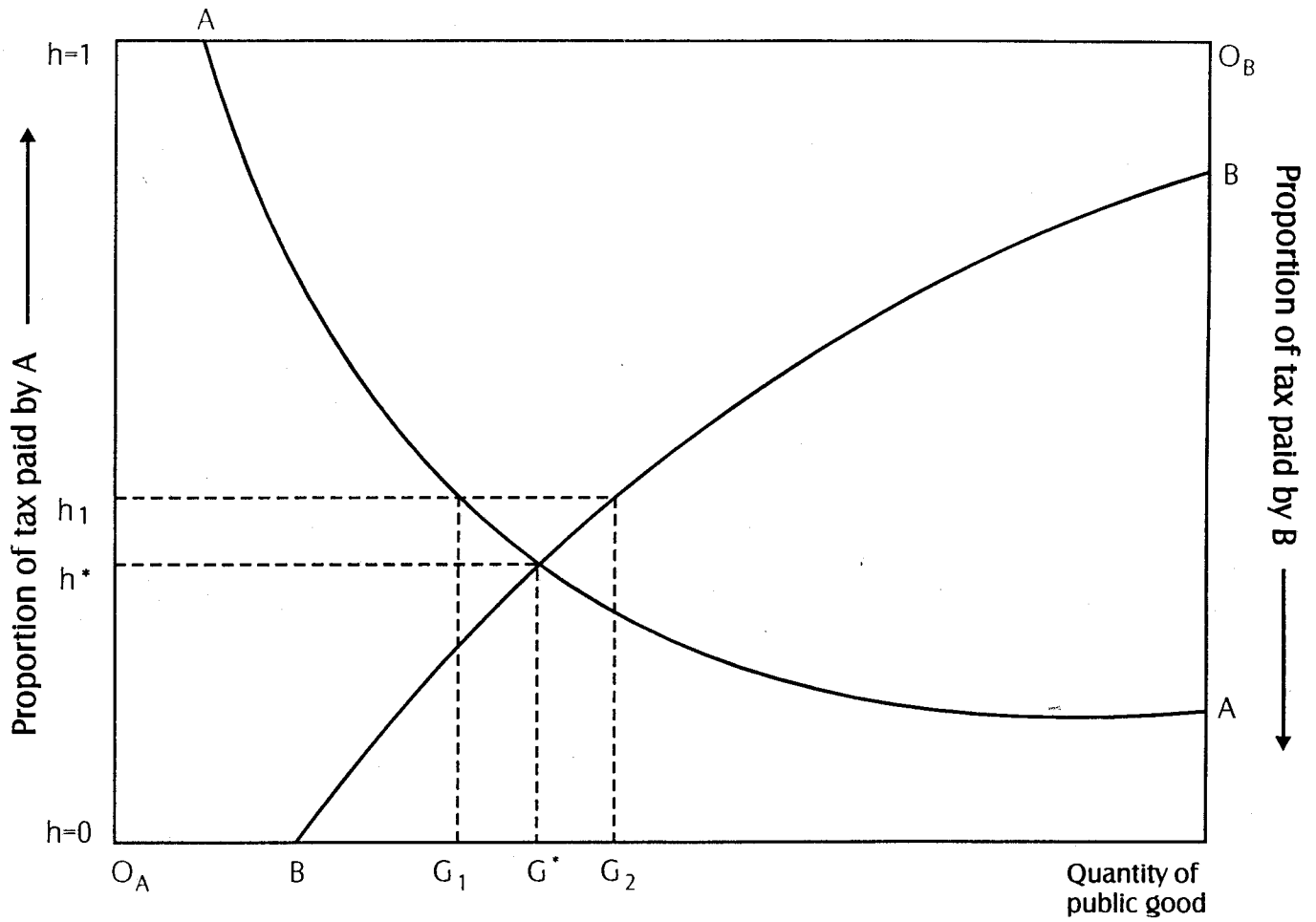


Figure 2.3: Wicksell-Lindahl model for the provision of a public good

Source: Brown and Jackson (1986: 62)

In Figure 2.3, the demand curves for the individuals are generated by varying the tax share (h) and keeping all other variables constant. An equilibrium tax share between the two individuals comes about at point h^* , and the equilibrium amount of public good at G^* , this point being termed the Lindahl equilibrium. Other points, such as a tax share of h_1 for individual A would result in a level of public goods of G_1 for A and level of G_2 for B. These preferences are then altered via a process of negotiation or some other resolution process until point h^* (the Lindahl equilibrium) is eventually reached (Musgrave, 1986: 5; Brown & Jackson, 1986: 61-64). The Lindahl equilibrium is therefore termed a Pareto-efficient outcome because it is dependent upon the acceptance of all individuals. If one group of individuals are in danger of being made worse off by any particular outcome, they are able to block the decision until they are satisfied.

This bargaining process necessary to move towards equilibrium is one of the weaknesses of the model in that such a process would take time and the method of adjusting taxation shares is also bound to be a difficult one practically. The Lindahl approach is termed a partial equilibrium analysis. Some work has been done to place it in a general equilibrium framework by Roberts, amongst others but this will not be explored in greater detail in this dissertation.

The Lindahl notion of public goods was, then, dependent upon the establishment of a pricing rule which would be determined as a result of a process of "voluntary bargaining" amongst a number of individuals or between two parties. In other words, the tax prices arrived at through the exchange process followed between the individuals, each with their own offer curves for public goods, would be where price ratios equal marginal rates of substitution. For this price dispensation eventually conceived to be just, the distribution of income or property would need to be just, lest an inequitable solution be arrived at between the two parties or amongst the individuals (Musgrave, 1986: 322-324).

The Wicksell-Lindahl approaches have been complimented for attempting to linking the analysis put forward to actual decision making process in functioning democracies. In seeking to determine the principles necessary for a "just" level of output for public goods and a "just" tax dispensation between individuals, prescription and description have been confused in the models (Brown & Jackson, 1986: 61). Furthermore, it has been argued that the unanimity

principle so central to the model will be extremely expensive to undertake in reality due to the time needed to establish true universal acceptance, thereby causing the loss of other benefits in the interim. Also, the operation of the mechanism to bring the system back to equilibrium are not obvious, e.g. how the tax distribution ought to be altered to ensure a return to equilibrium is not addressed. For a more detailed critique of the Wicksell-Lindahl approach see Brown and Jackson (1986: 61-64).

2.6.1.2 Samuelson (general equilibrium) approach

The Samuelson model for the provision of public goods (or collective consumption goods as they were termed) appeared after all these previous attempts. Samuelson's concern was with the efficient allocation of resources with both private and public goods in mind. For Samuelson, public goods were those goods for which each individual's consumption was equally related to the total, rather than as a cumulative total as would be the case with private goods. For efficiency purposes, this means that for a private good, the marginal rate of transformation in production equals the marginal rate of substitution in consumption which would be the same for all consumers of the good. For public goods, the marginal rate of transformation will equal the sum of the marginal rates of substitution and these will differ amongst consumers of the good. This approach therefore differs from earlier approaches in terms of the Pareto efficiency condition.

Brown and Jackson (1986: 57) set out the differences between private and public good allocation (for Pareto optimal conditions) in terms of marginal rate of substitution (MRS) and marginal rate of transformation (MRT). In their representation of allocation of goods, the authors suggested that a free market allocation of private goods would occur such that each individual would attempt to maximise utility by buying goods until the individual MRS equalled the common price ratio (depicted by MRT in production). This would occur when the MRS of each individual (in this case A and B for the goods in question) is equal and this would, in turn, equal the MRT, so that:

$$MRS^A = MRS^B = MRT$$

This situation would not apply to the provision of public goods. For the optimal provision of public goods to occur, the individual must be charged a tax price equal to his MRS which will be unique to that individual. Also, if consumers of the goods know they are dealing with public goods, they will be tempted to conceal their true preferences due to the lack of a linkage between the consumption of public goods and the payment therefor.

Thus, in the case of an economy in which public goods, private goods and many individuals prevail, the condition for the optimal supply of public goods is that the sum of the marginal rates of substitution must equal the marginal rate of transformation such that (ibid):

$$\Sigma MRS_{jk}^i = MRT_{jk}$$

Where:

ΣMRS_{jk}^i - relates to the summation of MRS for the number of individual consumers $i=1$ through to n for any pair of commodities j and k .

In other words, Brown and Jackson (1986: 58) argue, if the marginal rate of substitution represents the marginal benefit accruing to the individual from a marginal increase in the quantity of the public good, then it follows that because everyone consumes the public good the marginal benefits of all individuals must be summed together.

In the absence of the market, the optimal amount of the public good will be where $\Sigma MRS = MRT$ (the Pareto optimal condition) (Due & Friedlaender, 1981: 28). This means that for public goods, the individual's MRS between private and public goods will be set equal to the individual's tax share (i.e. the MRT between the public good and the private good). For more detailed work on this aspect, see Hyman (1987: 70-72).

Samuelson also went further (Musgrave, 1986: 322-324) by separating the issues of maximisation and implementation. As regards allocation and distribution these are held to occur simultaneously, which differed from Wicksell's argument that a just distribution was a prerequisite. For the mechanism of preference revelation Samuelson considered as naive the Wicksellian proposition that voting on issues should take place with cognition of both the

taxation and expenditure sides of the budgetary process, but to do so will at least enable voting to take place with participants fully aware of the consequences. Samuelson's model has been termed a "neoclassical generalisation of the earlier models of Wicksell and Lindahl" (Brown & Jackson, 1986: 61) and did not go far enough in relating its analysis to the process of decision making prevalent in working democracies.

The Samuelson approach is based upon a number of assumptions one of which is that a central authority exists that knows exactly the price each individual will pay for a public good. The utility functions of all individuals would similarly be known so that the optimal level of public goods could be provided. Such depth of knowledge would be required for a Pareto-optimal supply of goods to be afforded. This assumption has been criticised as impossible in the real world. Another assumption utilised in the Samuelson analysis concerns the willingness of each individual to accurately reveal their preferences for public goods. The problems associated with this assumption are related to those of the preceding one, in that individuals will be unwilling to reveal their true preferences as it will be to their advantage to refrain from doing just that, with individuals behaving as "free-riders". This prevents the central authority from compiling a set of prices for public goods and the whole system falls into difficulty (Brown & Jackson, 1986: 59).

Preference revelation and price setting, then, becomes one of the important features of public good provision and the use of voting in this regard will also be examined later in this section.

2.6.2 Free-rider problem and voluntary contribution and provision

An aspect of the provision of public goods is the problem of the free-rider. The case of public goods is unlike the provision of private goods, where the consumer purchases a specified amount and is responsible for paying for the amount purchased. In the case of public goods, consumption is nonrival and the goods are provided from the proceeds of taxation revenues and exclusion cannot occur. Owing to the fact that consumers benefit equally from the consumption of the public good and that reliance is placed upon the individual's willingness to contribute to the provision of the public good, some consumers may be tempted to withhold any contribution to the provision of the good secure in the knowledge that they will

benefit to an equal extent as those who have paid towards the provision of the good. The individuals who withhold contributions towards the cost of providing a public good whilst still benefitting from consumption of the good are termed free-riders (Hyman, 1987: 128-129). Free-riders are also called easy riders by Cornes and Sandler (1984: 580-598).

Free-riding therefore arises if there is a lack of incentives in providing a contribution to the provision of the good (Clarke, 1980: 3) or, in other words, a strong incentive not to contribute to the provision (Buchanan, 1967: 87). Free-riding is tempting to individuals in the short term at least for as long as there are no penalties levied upon such individuals by the community (Hyman, 1987: 128-129).

The issue of incentives in the decision to free-ride leads on to the so-called prisoner's dilemma (Clarke, 1980: 5; Buchanan, 1967: 87; Schmitz, 1991: 62). This phenomenon would involve a number of free-riders who refrain from contributing to the provision of a public good in the belief that if they did so, they could be supporting the provision of a good which would be freely available to other individuals who did not contribute. If the number of free-riders is a large proportion of the total, nonprovision of the good could result for want of contributions, thereby rendering all worse off (Hyman, 1987: 128-129).

De Jasay (1990: 4-5) has suggested that the group of free-riders on one hand, and those members of the group who do contribute (whom he terms "suckers") may not, in any event, be gaining or losing directly as not all free-riders will benefit to the same extent, nor will all contributors be complete "losers".

The size of the group/community relative to the number of free-riders is important, then, for the reason outlined above. The larger the total group/community the greater the potential number of free-riders and the more difficult it becomes to obtain consensus on voluntary contributions (Browning & Browning, 1979: 24).

Also, the strength of the incentive to free-ride and that of the prisoner's dilemma would also play a part. The relative size (or proportion) of the free-riders to the total group is also important as it could likewise negate the idea of the voluntary financing of the good. Thus,

the solution to this problem could lie in enforcing contribution to the provision of the good.

Thus, in view of the fact that individuals can prefer to abstain from revealing their exact preferences and in so doing behave as free-riders, a mechanism for the revelation of preferences is required. The price mechanism fails to reveal the preferences of individuals as regards public goods and so cannot be employed to perform this function so a substitute is needed. Voting is utilised as a useful mechanism in this regard.

2.6.3 Demand revelation by voting

The individual preferences for public goods vary according to a number of factors, such as tastes of the individuals making up the communities concerned; the information available to the individuals to enable them to make a decision (see Clarke, 1980: 47, for full discussion on this aspect); the degree of uncertainty of the consequences of governmental activity (Clarke, 1980: 47-48; Due & Friedlaender 1981: 34-35); the underlying philosophy of government.

Furthermore, the public and private sectors respond differently to the options open to them regarding public goods and their provision and the taxes associated with those choices which the individuals will be forced to pay. These differences revolve around (Due & Friedlaender, 1981: 34):

- The inability of the consumer to control the amount of public goods purchased:
Whereas the consumer of a private good decides on the amount of good and purchase price, the amount of a public good and the tax price are determined by government on the basis of overall preferences.
- The nature and knowledge of benefits accruing from consumption:
The benefits accruing to individuals from consumption of private goods are easily distinguishable and accrue to the consumer who pays for them. The benefits from consumption of a public good accrue to the community as a group as the goods are consumed collectively and the benefits are indivisible. Thus, some individuals may not

benefit from the public good at all or may be unaware of the benefits accruing.

- **Uncertainty surrounding public goods:**
There is uncertainty of the amount of benefit accruing from public goods to individuals, as well as uncertainty of the taxes paid by individuals to the provision of the good.
- **Motivation of community interest:**
Public goods are, overall, provided in the interests of the community rather than the interests of any one individual.
- **Combination of allocation and distributional activities of government:**
Public goods can be provided for the purposes of both allocation and distribution activities.

Because of these differences and the prevalence of free-riding, preferences are of course not revealed in their entirety. This necessitates the use of voting as an alternative mechanism.

In a democratic system, individuals as voters are able to express their preferences for different combinations of public as well as private goods through elections when they are given the opportunity to elect to government office the political party with the policy programme package which most closely resembles their particular set of preferences, at all levels of political activity. Thereafter the preferences of the community are dealt with through the government setting out the amounts of public goods which will be provided and the taxes to be extracted from the community in the form of a budget compiled and administered by central treasury or some such entity at provincial or local level. In this way, a political party is elected to hold office through the concept of majority voting (see Buchanan, 1967: 104-106; Buchanan & Flowers, 1980: 173-175; Pommerehne & Schneider, 1984: 109; Mueller, 1984: 69). Clarke (1980: 47-48) has outlined the conditions for an efficient outcome under majority voting versus efficiency in terms of the median and mean voter.

The process of voting as outlined here does have limitations. The impossibility theorem put

forward by Arrow contends that it is impossible for a voting system to produce a consistent set of preferences for a group from the individual preferences of members of which the group is composed (Bannock, et al, 1987: 194; Buchanan & Flowers, 1980: 125). Arrow's theorem suggested that no voting system can be devised which will be both rational and egalitarian, due to the fact that it is impossible for the ranking of a number of individual options to be obtained which will indicate the choice of the society for an efficient allocation of resources to occur.

A simple majority voting system, although egalitarian in nature is also hampered by the voting paradox, also referred to as Condorcet's paradox, which implies an inconsistent ordering of preferences because of the problem of intransitivity. The notion of intransitivity can be demonstrated through the use of the following example. Assuming three individuals A, B and C who will vote on three options, namely defence, health and housing, the following ranking is obtained:

	<u>A</u>	<u>B</u>	<u>C</u>
Defence	1	2	3
Health	2	3	1
Housing	3	1	2

(Adapted from: Bannock, et al, 1987: 307; Buchanan & Flowers, 1980: 125; Brown & Jackson, 1986: 78).

An attempt at ranking the options set out above through a process of majority voting would be impossible in that just as defence will be preferable to health and health preferable to housing, so housing will be preferable to defence (Bannock, et al, 1987: 308). Intransitivity then renders the majority voting process unable to throw up a distinct preference for the society, except if voting occurs in a certain order (see Due & Friedlaender, 1981: 48, for a list of conditions necessary for majority voting to reflect the preferences of the majority). As transitive preferences are a prerequisite for the derivation of meaningful indifference curves, the paradox of voting explains why the theory of optimal behaviour for individual preferences is not automatically extended to democratic societies.

However, Brown and Jackson (1986: 79) also point out that Arrow's work went further than simply restating what the Condorcet paradox has held since the eighteenth century:

"If we exclude the possibility of interpersonal comparisons of utility, then the only methods of passing from individual tastes to social preferences which will be defined for a wide range of sets of individual orderings are either imposed or dictatorial" (Brown & Jackson 1986: 79).

The case of simple majority voting just outlined is also termed the cyclical majority possibility (Buchanan & Flowers 1980: 125) because it results in different preferences. The difficulties of the paradox of voting and the cyclical majority can be overcome through the use of the simple majority voting system if preferences are single peaked (see also Musgrave & Musgrave, 1989: 90, and Brown & Jackson, 1986: 79, for detailed analysis of the single peaked preference rule).

Other methods utilised to overcome the difficulties associated with simple majority voting and the paradox of voting include the notion of point voting, which would involve the allocation of points to the issues by each voter (Musgrave & Musgrave, 1989: 95; Brown & Jackson, 1986: 83) so as to produce a single result. Vote trading (or log rolling) between members of legislatures and between political parties is widely used as a means of securing the respective objectives of individuals or political entities in the voting process (Brown & Jackson, 1986: 83). Vote trading will be especially important in the context of the passing of legislation which can result in the one party having to alter its stance on a particular issue so as to obtain co-operation on other issues from political opponents.

2.7 CONCLUDING REMARKS

The stage has thus been set for the criteria of nonrivalness in consumption and nonexcludability to be applied to roads as a class of goods so as to determine whether they are pure public goods, or whether they are nonpure/mixed goods. Whilst the argument can be made that the choice between these options can ultimately only be expressed through consumer preferences, economic theory can be used to determine the feasibility and

appropriateness of these routes. This feasibility will depend on the degree of publicness or privateness of roads as a class of goods.

The criteria of public goods, nonrivalness in consumption and nonexcludability, are therefore applied to roads so as to determine whether roads exhibit the characteristics of pure public goods or whether roads possess elements of privateness to make them nonpure/quasi/mixed public goods. This is the subject of Chapter 3.

CHAPTER 3

THE APPLICATION OF THE THEORY OF PUBLIC GOODS TO THE CASE OF ROADS

3.1 INTRODUCTION

This chapter will consist of an application of the economic theory of public goods to the question of road infrastructure so that the status of roads as public goods may be determined. The status of roads as a pure public good, nonpure/mixed public good or private good is the central issue to be considered in deciding how road infrastructure is to be financed and is a critical issue within this chapter as it underpins the selection of financing mechanisms which is dealt with in Chapter 4.

Thus, the issue within this chapter will be to examine whether roads are, in fact, pure public goods in terms of the definition and characteristics of the latter in the public finance literature. This means that roads will be examined in terms of the extent to which they exhibit elements of the two characteristics of pure public goods, namely nonexcludability and nonrivalness. This will facilitate the classification of roads according to whether they exhibit elements of publicness or privateness in terms of the criteria.

3.2 ROADS AS PURE PUBLIC GOODS

In terms of the literature, a number of views abound in this regard. Newman (1968: 102) for example deals at length with the role which can be played by a programme of public works geared to absorb excess labour within the construction industry in time of economic recession. Road infrastructure could be a part of such a programme so could be provided as a public good in this case. However, the opposition to most schemes of state expenditure advocated by such classical economists as Say and Ricardo is cited by the same author and is attributed to the wasteful state excesses witnessed by these earlier writers. The obligations of a democratic government will naturally be different to those of an autocratic monarchy with respect to the provision of infrastructure.

Plehn (1926) lists "Public highways" (p. X) as one example of a public good provided by government along with defence and educational facilities and to be provided by tax revenues. The distinction can be drawn between items of current expenditure such as goods and services which are paid for by government and subsequently used up and items of capital expenditure such as schools, hospitals and roads which are utilised by the community for a lengthy period (Sandford, 1984: 16-17). Roads are listed by Hockley (1970: 71-72) as a major public social service, along with social security, public health, education and housing.

However, in order to determine the extent to which roads are pure public goods, it is necessary to recall the two criteria for public goods, that is nonexcludability and nonrivalness in consumption. For roads to be classified as pure public goods, they should possess both of these attributes as was outlined in Table 2.1. If it is accepted that roads possess both of these characteristics, they ought then to be considered as a pure public good such as, for example, defence. The work of Walters (1968) has covered this aspect of roads as public goods:

"If there is a road system on which my car does not in any way interfere with anyone else's car (or pedestrian or cyclist, etc.) and if it doesn't damage the road surface, then we can all independently enjoy the services of the road. Roads are then a pure public good. If my car gets in someone's way, however, my enjoyment of the road reduces someone else's enjoyment. The services of the road are then *not* a pure public good; they exhibit some degree of congestion. In practice, it seems that many rural and interurban roads do in fact approximate to being pure public goods; congestion is so infrequent and small that it can be ignored. For these roads, therefore, no price should be charged *for their use*. Any price exacted would discourage someone from enjoying road services and so it would amount to throwing these valuable services away" (Walters, 1968: 16-17).

The above contribution to the debate on roads as public goods by Walters is particularly useful as it suggests that some roads are indeed pure public goods if they possess the critical feature of nonrivalness in consumption. That is, there is nonrivalness in consumption so long as road users do not interfere with one another's consumption of the good or use of the road, i.e. through congestion. This would be applicable in the case of uncongested and little-used

rural, interurban or urban roads. Exclusion of users from the use of the road is, in these circumstances, impractical, infeasible and inappropriate due to the costs involved and the need for basic access to certain communities, thereby ensuring that the criterion of nonexcludability is also met. In these situations, the cost imposed by an additional road user would be negligible not only in terms of congestion but also in terms of damage to the road. Thus, Walters' argument is that due to the fact that the marginal cost of using an uncongested (rural) road is zero, the price of use of that facility should be zero.

The case referred to by Walters of an uncongested rural or interurban road which could qualify as a pure public good, then, would apply to the relatively undeveloped areas of a country. Such roads would give access to rural communities and the benefits conferred from use of the road would extend beyond the actual road users to those who derive indirect benefits from the existence of the road through access to amenities and so on, giving the road a further element of publicness in terms of its developmental value. These roads would be of a fairly low engineering standard (i.e. gravel or dirt), with low levels of traffic. These indirect benefits are termed positive externalities, and would then be a case of the linkage between externalities and public goods referred to in Section 2.2.2.3.

In terms of the criteria of nonrivalness in consumption and nonexcludability, rural and interurban roads with extremely low traffic volumes do indeed possess the characteristics of pure public goods. However, as implied by Walters in the passage quoted in this section, some road types do have elements of privateness in terms of rivalness and excludability, the following section will elaborate more fully on roads as nonpure public goods and will deal with those roads displaying these elements of privateness.

3.3 ROADS AS NONPURE PUBLIC GOODS

Before the discussion on the extent to which roads possess elements of privateness, the point must be made that, from a common property resource point of view (see Section 2.2.2.1 for discussion on common property resources), property rights cannot be assigned to any one individual. Roads, however, are not of this nature as it is completely feasible for an individual to construct a road and then exclude other individuals from the use of that road unless they

pay for the privilege either through licensing or some other road user charge - see Chapter 4. The implication of this is that the argument behind common property resources does not constitute a valid argument in favour of the provision of roads by the public sector. Roads may, of course, be built by government and be made open to the road-using general public as a common property resource with use being paid for indirectly, but this is simply an option for government.

Returning to the issue of roads a nonpure public good, as Walters (1968: 16-17) has pointed out in the preceding section, certain roads do not entirely conform to the criteria of nonrivalness in consumption and are not pure public goods. These roads are those which are:

- congested or well-utilised, necessitating expenditure for maintenance due to damage caused by heavy use;
- of a reasonable engineering standard to cope with traffic volumes;
- therefore associated with a level of economic development.

The status of roads as public utilities or public goods has been considered at some length by other writers on public finance such as Buchanan and Flowers (1980: 409-411). They point out that the traditional view of roads as pure public goods because of its availability to one and all once constructed is valid, but only until congestion rises to the point where road usage by one individual affects the use of the road by other individuals, a similar point to that of Walters. Consumption is therefore rival in that there are relatively few roads where upgrading has not yet been necessitated by the pressure of traffic that results in one road user's utility being diminished by the presence of other users. Buchanan and Flowers (*ibid*: 409-411) also suggest that the view of roads as a fully public good in all cases was correct before the motor vehicle revolution and massive increases in vehicle numbers which occurred after World War I and especially since World War II, which has resulted in congestion, thereby affecting the nonrival nature of roads.

From the application of the two criteria of pure public goods, i.e. nonrivalness in consumption

and nonexcludability, it becomes apparent that roads as a good possess elements of privateness. Thus, if roads are set against these two criteria in terms of the four case matrix presented earlier in Table 2.1, congested inner city roads and well-utilised interurban roads possess distinct elements of privateness in that they are rival in consumption. This is because where the road is congested or well-utilised, users impinge on one another's use of the road to a greater or lesser extent, either by getting in each other's way and slowing one another down, or because the use of the road by many vehicles causes damage to the road, thereby impacting on the level of enjoyment which users derive from the use of the road.

However, direct exclusion is not feasible in many cases. Musgrave and Musgrave (1989: 43) use the case of a congested city centre street to show that congestion would indeed make for a situation of rivalness in consumption amongst road users. Exclusion, the authors argue, would be efficient and should be applied to allocate the resource. This would mean that the available road space would be priced and those who value it most would be able to purchase it. However, Musgrave and Musgrave (*ibid*) argue, such exclusion would be impossible and prohibitively expensive. However, it must be noted that technologies have been developed to facilitate electronic charging - see Section 4.8.2. Also, excludability, for example by way of a toll tariff would be quite feasible in the case of a well-utilised interurban road provided usage was high enough to offset the expense in setting up the toll collection facilities and administration costs. Also, exclusion in the form of a fuel levy for example is effective in that road users are completely unable to gain access to roads if they do not pay the levy, and exclusion in the form of a fuel levy is both feasible and generally inexpensive.

In terms of the public finance literature, Shoup (1969: 67-68) refers to highways and street construction and maintenance as examples of government services suggesting that they could be public goods but does acknowledge that exclusion is possible although difficult in some cases. The example of a public good put forward by Peters (1971: 143-144) is that of defence where, it is argued, it is impossible to exclude any single individual from the benefits of the good. Changes in the provision of defence can be attained through political rather than market action, which is not the case with road infrastructure where exclusion is also possible. However, it has been argued that a number of goods other than national defence do not entirely meet the criteria set out for public goods in terms of nonrivalness and

nonexcludability to varying degrees, but are and should be provided by government (Steiner, 1974: 246). Examples of such goods are: roads, schools, recreational facilities and housing from which individuals can be excluded. Steiner goes on to add that the "concept of the perfect collective consumption good, while sufficient to justify public expenditure, is not necessary nor does it embrace much of what public expenditure policy concerns" (p. 246). Thus, Steiner's classification of roads as a public good depends upon his definition of public goods: "Any publicly induced or provided collective good is a public good" (p. 247). He is correct when he maintains that not all goods provided by government meet the criteria set out for a public good and although his definition of public goods at first seems rather loose, he is advocating that the more rigorous definition of public goods should not be applied to such items as roads. Indeed, Steiner's argument is that if the criterion of nonexcludability is applied, there are precious few public goods which could be termed "pure" and financed by general taxation, other than defence for example.

Furthermore, if it is accepted that in the consumption of a pure public good, equal amounts of the good are consumed by each individual, then not all types of roads can be construed as pure public goods. Certain individuals benefit indirectly from roads and others benefit directly from the consumption of the good. Also, even amongst those individuals who are road users, benefits are not equally bestowed. Roads are, however, characterised by the notion of the free-rider to the extent that an individual not willing to contribute to the provision of the good is able to derive benefit from the consumption of the good, both directly and indirectly.

Thus, the type of roads or road networks involved are extremely important in determining whether roads are pure or nonpure public goods (possess elements of privateness). Uncongested roads are pure public goods because the marginal cost of road use is effectively zero, there is nonrivalness in consumption and exclusion, although feasible, is undesirable as Walters has argued. This argument is also based on the notion of positive externalities discussed earlier. This would be the case in relatively undeveloped areas where roads provide basic access to communities. In the case of developed roads characterised by high volumes of usage, in many cases to the point where congestion results, some form of pricing becomes necessary because these roads possess elements of privateness in that consumption is rival (in terms of interference with one another's use/enjoyment of the road or in terms of damage to

the road caused by usage) and exclusion is both feasible and desirable. This also means that if a road is congested during peak hour usage, it is characterised by elements of privateness; during off-peak usage, it may very well possess strong attributes of publicness. This lays the foundation for peak period charging.

However, the criteria of nonrivalness and nonexcludability are not the only considerations. The market form is also important. This is because even if not all road types conform to the criteria of pure public goods, they cannot be provided by the market as pure private goods. This is because the market for roads would not be a competitive market but would be characterised by elements of natural monopoly.

3.4 ELEMENTS OF NATURAL MONOPOLY IN THE CASE OF ROADS

In the context of a natural monopoly, the government will opt to produce the good rather than leave it to a private monopoly (Rosen, 1992: 338). Natural monopoly is one of the situations where government intervention is required due to market failure mentioned in Section 2.2.2. Production of the good by government occurs in the case of a good which is characterised by decreasing average costs which means the greater the level of output of the good, the lower the unit cost. Given these conditions, the market is clearly not a competitive one, with a single producer able to take advantage of the economies of scale and supply the production requirements of the good over a large area. Examples cited by Rosen (ibid) of goods characterised by natural monopoly features are roads, bridges and electricity. In the case of electricity, the situation is often one of private sector production and government regulation, whilst in the case of roads, it is one of public sector production (see Rosen, 1992: 338-339 for a more detailed diagrammatic representation here).

Natural monopoly, defined in terms of microeconomic theory, would then be the result of a number of factors (Due & Friedlaender, 1981: 85):

- the presence of long term decreasing costs caused by a declining unit cost of additional capacity as the size of the facility increases;

- unutilised capacity which exists which can absorb future increases in use;
- the likelihood of severe competition which would occur if new entrance to the market is attempted in an environment where investment requirements are large and fixed and where some capacity would be in excess. In the case where capital could not be withdrawn easily, an organisation would simply keep operating as returns on the capital invested would be needed, thereby encouraging a rate war which would be damaging to the participants.

Natural monopoly also arises where the facilities concerned are too costly to be supplied by more than one supplier who will be constrained by a lack of mobility. These factors make for natural monopoly as it will be economically wasteful for more than one supplier and so natural monopolies are allowed to function with price setting conducted by government, together with a fair amount of regulation.

Like Churchill (1972: 9), Due and Friedlaender (1981: 86) approach the problem of defining roads in terms of whether roads possess features of a natural monopoly. Indeed these authors are at pains to emphasise that pure public goods cannot be sold to the users of the goods due to the features of nonrivalness and nonexcludability where the benefit of the good is concerned. The output of natural monopolies are divisible with elements of what could be termed privateness. A critical feature of a natural monopoly would be the excludability aspect as this will make it possible to exclude from the benefits of the good those who do not wish to pay for the usage thereof. The government is then able to set a price to the good and the market mechanism is left to allocate the product of the natural monopoly as efficiently as possible. This would differ from the case of a public good, where the good would be distributed freely and financed entirely by the proceeds of taxation. The problems which arise in the case of natural monopolies relate to the price which government must charge those individuals making use of the product of the natural monopoly, as well as the relationship between prices and marginal costs in such government-controlled activities.

3.5 CONCLUSIONS ON THE APPLICATION OF PUBLIC GOODS THEORY TO THE CASE OF ROADS

The theory of public goods has been applied to the case of roads in this chapter. The application of the criteria of pure public goods, namely nonrivalness in consumption and nonexcludability, to the case of roads has shown that not all roads are pure public goods. Indeed, it is argued in this dissertation that uncongested rural and interurban roads display the nonrivalness in consumption and nonexcludability characteristic of pure public goods and can also be termed "basic access" roads (see Section 6.3.1). Congested city streets and well-utilised interurban roads possess elements of privateness in that they are characterised by rivalness in consumption and the level of excludability which can be obtained is variable; these roads are then nonpure public goods with varying but, in some cases, strong elements of privateness and are termed "highly developed" roads in Section 6.3.1. It has also been argued that the market for roads also possesses natural monopoly characteristics. The classification of certain roads as pure or nonpure public goods, coupled with the fact that the market for roads has natural monopoly characteristics, has important implications for the financing of the various types of roads. The financing of roads is the subject of the next chapter.

CHAPTER 4

PUBLIC FINANCE PRINCIPLES OF FINANCING ROADS

4.1 INTRODUCTION

In the previous chapter, it was argued that the financing of roads should be undertaken according to the degree of publicness roads exhibit. This chapter deals with the principles and methods associated with the financing of roads. This includes:

- the financing of those roads which are pure public goods through general taxation and general fund financing; and
- the financing of roads which possess characteristics of privateness as nonpure public goods, the market for which has natural monopoly features, through user charges.

However in financing public goods, certain broad principles of taxation are applicable and these are set out below.

4.2 THE PRINCIPLES OF TAXATION

It was noted in the preceding chapter that because of the notion of free-riding, payments for public goods have to be compulsory. This section examines the underlying principles and ways in which payments are made to fund the provision of public goods.

4.2.1 The justification for taxes

Taxes are the means employed by government to raise the revenue required to finance public goods. There are two basic principles which serve to guide the levying of taxes and which serve as justification for the levying of taxes. These principles are the benefit principle and the ability to pay principle.

4.2.1.1 The benefit principle

This principle, dating back to Adam Smith and other writers involves the taxpayer contributing to taxation according to the benefits received from public goods (Musgrave & Musgrave, 1989: 219; Hunter & Allen, 1940: 188; Hockley, 1970: 100). Originally fairly extensively utilised as a canon of taxation (Kiesling, 1992: 37), the benefit principle seems to have declined in use as a guiding principle in the structure of taxes since the middle of the nineteenth century as the ability to pay principle has become more popular (Kiesling, 1992: 33).

Problems with the measurement of benefits accruing to various individuals have been highlighted, as well as the capacity of these beneficiaries of government services to pay for what they receive (Stiglitz, 1988: 404; Cauley, 1960: 77; Hunter & Allen, 1940: 188-189). The problem of free-riding in the context of the benefit principle is a major one due to the possibility of benefits actually received being understated by taxpayers (Brown & Jackson, 1986: 253). Dalton (1966: 62) considers the case of old age pensions, which would be such a government service, but for which it would be inequitable to levy taxes on all the eventual recipients. For this reason, it is obvious that transfer payments aimed at the attainment of the government's distributional objectives cannot be financed according to this principle, as it is primarily directed towards the allocational aspect of government activity (Peters, 1971: 168; Tresch, 1981: 115). The direction of provision of public goods will be dictated by the demand or priorities of the particular community (Hockley, 1970: 100). Where externalities are minimal and the beneficiaries of the public goods are easily identified, the benefit principle has something to recommend it, i.e. where exclusion is possible (Davie & Duncombe, 1972: 145).

The question of exactly what benefits should be utilised is considered in some detail by Tresch (1981: 115), who suggests the use of marginal benefits as the optimal tax base, as opposed to total or average. Buchanan and Flowers (1980: 109-110) advise against the use of the benefit principle in strictly total benefit terms. This is because the assumption that, according to the benefit principle, total taxes levied on individuals should equal the total real benefits accruing to individuals from the provision of public goods is incorrect. Incorrect

because it ignores the existence of a "taxpayer's surplus" remaining in the form of surplus real benefits after taxes are paid. This means that the total real benefits provided by a public good exceed the total cost of providing the public good (e.g. a police service). Buchanan and Flowers (ibid: 109) contend that equating total benefit with total cost is to confuse "value in use" with "value in exchange". Also, the application of the benefit rationale in terms of proportional taxation is questioned, albeit to a lesser extent, because Buchanan and Flowers (ibid: 110) maintain that it is impossible to measure total benefits and allocate taxation liabilities proportionately. The authors conclude that the most appropriate basis for taxation would be that of the marginal or incremental benefit received not the total benefit. In other words, an individual taxpayer would be required to pay a "tax price" for each unit of a given public good which is set equal to the marginal or incremental benefit accruing to the individual from a unit of the good. This "tax price" would be independent of total benefit received from all units of the public good. Buchanan and Flowers (1980: 109) also point to the inherent advantage of the principle in connecting decisions on taxation with levels of expenditure.

Thus, Brown and Jackson (1986: 252) make the point that the benefit principle is grounded in the voluntary exchange or price theory of public finance and deals with the costs and benefits of public sector activities faced by citizen voters. This assumes that individuals will adjust their consumption of public or private goods until the marginal benefit from consumption equals marginal cost; this means that each individual should pay tax according to the benefit derived from the consumption of public goods. The benefit approach to taxation is therefore akin to the market approach to the payment of a price for goods purchased. The benefit principle of taxation is, moreover, closer to the allocation function of government as it is concerned with the efficient allocation of resources to public and private sector activities, thereby ignoring the distribution (or redistribution) function of government.

4.2.1.2 The ability to pay principle

Musgrave and Musgrave (1989: 243) suggest that the benefit principle is limited in its application, which then opens the way for the ability to pay option. Similarly, Davie and Duncombe (1972: 148) emphasise that the ability to pay principle is necessary in cases where

the benefit principle is irrelevant, in that benefits cannot be utilised as a basis for taxation as it is difficult to distinguish who benefits from the government expenditure on provision of public goods. Indeed, Newman's (1968: 325) interpretation of Adam Smith's work viz-à-viz taxation has suggested that where expenses of government cannot be allocated to individuals according to the benefits derived, these expenses should be financed from taxation levied according to the ability to pay principle. In addition, if beneficiaries cannot be identified and taxed accordingly, taxes will have to assume the form of compulsory payments completely divorced from the benefits which may accrue. As such, taxes will be obtained from the taxpayers in terms of the ability of the individuals to pay taxes, with the final contributions or rates of taxation to be a political decision (Hockley, 1970: 101).

The ability to pay principle is possibly the most widely accepted and oldest taxation principle (Buchanan & Flowers, 1980: 106; Hunter & Allen, 1940: 189; Cauley, 1960: 77) and normally holds that the distribution of taxation in the economy should be based upon the ability of the individual to pay. In its turn, the ability to pay would be measured by the income or wealth of the individual (Cauley, 1960: 77). Whilst the ownership of fixed assets is important, the value of these assets for taxation purposes would lie in their income significance. One of the critical issues which are dealt with in the application of the principle is the extent of any additional amount which more wealthy members of the community should pay in terms of progressive taxation, as this is determined by their ability to pay (Buchanan & Flowers 1980: 263-264). An important feature of the principle is that it does not set out the levels of taxation, but only the overall guidelines required (Buchanan & Flowers, 1980: 108).

The ability of the individual to pay can be measured in terms of the sacrifice incurred by the taxpayer of paying taxes. This aspect can be measured by the principles of equal sacrifice, proportional sacrifice and the minimum sacrifice (Dalton, 1966: 63). Peters (1971: 165) regards the ability to pay principle as the most important "canon of taxation" and advocates the use of proportional, progressive and regressive taxation as three ways in which ability to pay can be applied. The ability to pay approach is therefore in line with the redistribution function of government and, by definition, the notion of equity. The importance of the ability to pay principle in ensuring equity in taxation is discussed further in Section 4.2.3.

It was argued above that tax payments are compulsory charges. In discussing these charges, a number of criteria are used to ensure a desirable or "good" tax system. The three most important canons of a good tax system are: administrative efficiency, allocative efficiency and equity. These will be referred to briefly below. In addition, there is flexibility (or the stabilisation aspect), certainty, political responsibility and invisibility (Stiglitz, 1988: 390; Margo Commission, 1987: 50-51), but these will not be included in the discussion.

4.2.2 The criteria necessary for good taxes

Once the justification for taxation has been determined, in terms of benefit accruing or the ability to pay, the taxes must satisfy the principal criteria of administrative efficiency, allocative efficiency and equity in order to qualify as "good" taxes.

4.2.2.1 Administrative efficiency

This principle holds that the cost incurred in the course of collection of revenues should be as low as possible (Brown & Jackson, 1986: 242). The costs incurred comprise two parts, namely the cost to the government of collection on one hand, and the cost incurred by the individual in meeting the obligation of payment (Davie & Duncombe, 1972: 142). The latter will include resources utilised in the course of compliance with taxation requirements, as well as the resources expended in avoiding these obligations (Due & Friedlaender, 1981: 233). In this context, simplicity is an important characteristic in that the tax must be simple to administer and easily comprehensible to those having to pay the tax (Brown & Jackson, 1986: 241).

4.2.2.2 Allocative efficiency and neutrality

Due and Friedlaender (1981: 230-231) suggest that taxes can be divided into two groups, those that are aimed at Pareto optimality and those aimed at the objective of equity. For taxes to achieve Pareto optimality, in other words allocative efficiency, they should either move the economy towards Pareto optimality where this has not been attained or minimise the shift away from it where this condition has been attained.

Thus, it is important that, if Pareto optimality prevails, taxation should be neutral or must not distort relative prices. However if there is market failure, i.e. the situation is not Pareto optimal, then taxes should be non-neutral. That is, taxes should then be aimed at moving the economy back to Pareto optimality and allocative efficiency. The problem in attempting to attain allocative efficiency, or Pareto optimality, is that the tax structure itself may very well be distortionary. Therefore, in the absence of "neutral, lump-sum" taxes (Due & Friedlaender, 1981: 230) the methods chosen by government to finance expenditures will of themselves create distortions and inefficiencies. Thus, it is argued that rather than trying to attain the Pareto-optimal allocation of resources, the government should opt for a second-best resource allocation which minimises the effects of the distortionary tax structure (ibid).

Davie and Duncombe (1972: 138) contend that while neutrality of taxes is important for allocative efficiency, "economic policy may require conscious departures from neutrality to promote the attainment of goals other than those related to allocative efficiency", and also go on to discuss instances of where departures from neutrality can improve resource allocation using the theory of second-best (Davie & Duncombe, 1972: 139-140). (see Davie & Duncombe, 1972: 140-142 for a discussion of departures from neutrality in the pursuit of objectives other than those of allocative efficiency).

4.2.2.3 Equity

Brown and Jackson (1986: 241) argue that a tax should be "fair". In attempting to define "fairness", the authors suggest the use of horizontal and vertical equity principles. Horizontal equity demands that individuals with equal situations should be treated in the same fashion, whilst vertical equity dictates that individuals in differing situations should be treated fairly (Due & Friedlaender, 1981: 233-234); that is, their situations with respect to income and wealth. The equity principles, however, do not imply identical tax rates but fairness in taxation with respect to equal incomes and with respect to differing incomes.

Thus, equity in taxation would mean that, in terms of horizontal equity, individuals with equal incomes (ability to pay) should be equally liable for taxation (Rosen, 1992: 347; Musgrave & Musgrave, 1989: 223). In terms of vertical equity, individuals with different levels of

income (ability to pay) should be liable for taxation according to their respective incomes (ability to pay) (Musgrave & Musgrave, 1989: 228-229).

4.2.3 Conclusions on the relevance of the principles of taxation

The significance of the benefit and ability to pay approaches is that they bestow upon government the justification to levy taxes. That is, government requires tax revenues to fund activities and can tax according to whether the individual benefits from the public goods consumed, or in terms of the individual's ability to pay.

Having determined whether the individual should pay tax (i.e. if the individual receives no benefit from public goods or has no ability to pay he should not be taxed), the next important step is to ensure that the taxes levied conform to certain criteria necessary for "good" taxes. The three most important criteria for taxes to be considered as "good" taxes are whether these taxes promote allocative efficiency, equity and are administratively efficient to levy.

Relating all of this back to the allocative and distribution functions of government, it becomes clear that the benefit approach to taxation is aimed at ensuring the efficient allocation of resources, is essentially voluntary and, therefore, is closest to the allocation function of government and the allocative efficiency criterion of taxation. The ability to pay approach, however, is strongly linked to the distribution (redistribution) function of government and the notion of equity in taxation - "Unequals...should be treated unequally while equals were to be treated equally." (Brown & Jackson, 1986: 253).

Now that the basis for the levying of taxes has been considered, the financing of pure and nonpure public goods will be dealt with.

4.3 FINANCING OF ROADS AS PURE PUBLIC GOODS THROUGH GENERAL TAXATION

This section describes the financing of public goods through general taxation. In Chapter 3, it was argued that uncongested rural and interurban roads, as well as poorly utilised urban

roads, exhibit the characteristics of nonrivalness in consumption and nonexcludability which place them firmly in the category of pure public goods. The rationale for the financing of pure public goods is that of general taxes and that is the aspect which is examined in this section.

General taxes are taxes which are levied on all "components of the economic base" (Hyman, 1987: 314) and are not aimed at any specific purpose whatsoever. Thus, general taxation ideally permits no exclusions or exemptions from the tax base. An example of a general tax would be an income tax which is levied on all individuals, or a value added tax on all goods and services and all are obliged to pay (Brown & Jackson, 1986: 244). General taxes differ from selective taxes which are aimed at specific sections of the tax base. An example would be an excise tax which is a tax on the manufacture or sale of a particular good (Hyman, 1987: 315).

Pure public goods should be financed by general taxation for a number of reasons. Public goods come about due to the failure of the market to provide certain goods, as has been explained in Section 2.2.2. Public goods are goods which possess the characteristics of nonrivalness in consumption and nonexcludability, hence the failure of the market to provide goods for collective consumption. Individuals simply cannot finance public goods which benefit the community at large because they cannot afford to do so, and they will not finance the consumption of other individuals. In other words, when both nonrivalness in consumption and nonexcludability are present, the good or service in question will have to be provided by the public sector and financed out of general government revenues, because these properties make it impossible for a private person or institution to recoup the costs of production. Thus, general taxes are the only feasible means of financing pure public goods which benefit the community as a whole.

The financing of public goods, such as defence, through general taxation involves taxation in various forms, whether it be on individuals or on various goods and services (e.g. sales taxes), and allocations of expenditure from the general pool of revenue to functions or levels of government depending on the priorities of government. This method, known as general fund financing, is without any linkage between the sources of revenue and the allocation of expenditure and is the opposite of earmarked or dedicated funding which links particular

expenditures with specific tax revenues (The general fund financing versus earmarked revenues debate is dealt with in detail in Chapter 5 of this dissertation).

The concept of financing roads as pure public goods through general tax revenues will not be considered in more detail in this dissertation. The discussion now turns to the financing of roads as nonpure public goods.

4.4 FINANCING OF ROADS AS NONPURE PUBLIC GOODS THROUGH USER CHARGES

It has been argued in the previous section that if certain road types display the characteristics of pure public goods then they should be funded by general tax revenues. Alternatively, it is argued in this section, that if certain road types do not possess the characteristics of pure public goods, or display elements of privateness, then they should be financed as such by user charges.

For any good or service that is produced or consumed in an economy, the production and consumption activities can be organised in one of two basic ways: private goods which are provided by the market through what can be termed the "price route"; public goods which are provided by government when the market fails through what can be termed the "tax route".

In terms of the "price route", consumers pay for what they get, and get what they pay for. This direct correspondence between payments and receipts ensures that there is no wasted effort in the economy. Effective demand (that is, desire accompanied by ready cash) for goods and services drives their production, so that someone is willing and able to pay for everything that is produced. This outcome, termed allocative efficiency, is an automatic result of the guidance of the numerous market transactions which make up the economy by the "invisible hand", which in turn is made up of the signals that pricing generates. User charging, being just a special form of pricing, also generates such signals, and the markets in which it is applied should, therefore, also operate efficiently.

In terms of the "tax route", however, pricing has little role to play, and there is no direct

relationship between payments and receipts. Accordingly, there is no "invisible hand" to constrain production so as to match effective demand. The state, rather than individual consumers, takes responsibility for the payments required to make production possible. This requires a great deal of careful planning in order to achieve efficiency in production and it is extremely difficult to achieve. User charging would not be employed in a market in which it was desired to apply the "tax route" approach to production and consumption. Rather, production in that market would be financed out of general tax revenues. There would be no reason to expect that market to tend towards efficient outcomes. The implication of this is that roads as public goods will need to be funded from revenue received from general taxes, i.e. funded according to the level perceived by central Treasury to be necessary for roads as against all other budget priorities, i.e. general fund financing. This approach is akin to that of a strongly central-planned economy and could be termed the "tax route" to road provision.

That nonpure public goods should be financed by user charges is based on the premise that nonpure public goods possess elements of privateness in terms of the two stated properties of public goods, namely nonrivalness in consumption and nonexcludability. Nonpure public goods are rival in consumption or excludable in terms of the consumers of those goods. Indeed, a congested interurban or urban road possesses elements of rivalness in consumption and excludability to varying extents as was argued in Chapter 3. In view of this, these sorts of roads are nonpure public goods and their use should be priced amongst road users. Quite clearly, the general taxpayer should not be called upon to finance a good which is not a pure public good, because the cost of that good ought to be borne by those prepared to pay directly for its use in proportion to the benefit they derive from the good. This means that "any governmental service yielding at least partial direct benefits can be financed by charges instead of general taxes or, if the use of charges per se is difficult, by a tax directly related to use" (Due & Friedlaender, 1981: 87). Thus, the appropriate means of financing nonpure public goods is that of user charges and the rationale for this is explored next.

4.4.1 The rationale for user charges

The prices which government would charge for the benefits of these natural monopolies are called user charges and will be dealt with in greater detail further in this chapter. Suffice to

say, Due and Friedlaender (1981: 86-87) argue that because such goods as education, sewerage and roads yield direct benefits to their users and display features of natural monopolies they can be financed by user charges rather than by general taxes, or at least by taxes which are directly related to the use of the goods. Buchanan and Flowers (1980: 409-411) refer to "highway services" (by inference, roads) as "essentially *public utilities*" which can be provided from the proceeds of user charges, because some form of pricing of roads will be possible. Just as pricing is employed to ration scarce resources, so the rationale for user charging lies in its ability to ration scarce road financing resources. Thus, roads would seem to fit into the area of a natural monopoly to be financed by user charges, instead of as pure public goods to be financed through general taxation.

The utilisation of user charges as a pricing mechanism is applicable under certain conditions:

"First, the benefits of the public expenditures must accrue primarily to particular individuals rather than to the general public. Second, it must be feasible to exclude non-payers from receiving the individual benefits of the program. If a specific good or service has these two characteristics, then user-charge financing may be technically feasible. However, economic feasibility must be determined by comparing the necessary costs of administering the user-charge system to the efficiency and equity gains expected from substituting user charges for general taxes" (Advisory Commission on Intergovernmental Relations, 1987: 25).

Similarly, a number of guidelines which can be used for deciding on whether it is appropriate to utilise user charges for the funding of public goods are provided by Due and Friedlaender (1981: 89). Firstly, the authors advocate the application of the pricing mechanism as a means of allocating the good through user charges, rather than free provision funded by taxation in cases where:

- benefits are mostly direct and charges will not result in the loss of external benefits to any great extent;
- demand is fairly elastic, which facilitates efficient resource allocation through prices

and minimises excessive utilisation;

- lower-income groups are not seriously disadvantaged through the application of charges;
- the collection costs of the charges employed are fairly low, or alternative use-related taxes can be employed.

However, user charges should be applied with caution where:

- external benefits are seriously reduced through the utilisation of charges;
- demand is inelastic so that resource allocation through pricing is difficult, in which case charges may be employed in order to attain equity objectives;
- the situation of lower-income groups dictates that they receive the good so that equity objectives may be satisfied;
- costs of collection associated with charges are fairly high and alternative use-related tax instruments cannot be substituted.

Hitherto, the discussion in this dissertation has shown that not all road types overwhelmingly display all the characteristics of pure public goods to the extent that they can be provided through general taxation. In fact, roads also possess certain elements of private goods which makes pricing possible, in the context of a natural monopoly. Because beneficiaries from the use of roads can be identified, i.e. road users, user charges can be employed to finance non-pure public goods, as opposed to conventional pricing.

This conclusion is supported by Scheurkogel (1966: 322): "The private and divisible nature of highway services are not always fully recognised. Highway services are primarily private although provided by government...The public attribute of highway services is historical in character and stems from the regulation of the operation of the system and not from the

support of the service itself".

The critical conclusion that has been drawn at this point relates not so much to the ownership of roads, but more that as non-pure public goods, roads can be financed through the price route, rather than simply through general taxes. In this way, the objective of allocative efficiency can be pursued in the financing of roads. User charging is an acceptable means of achieving this objective. As an alternative means of financing roads, i.e. those roads which do not qualify as pure public goods but possess elements of privateness, the concept of user charging is examined in more detail.

4.5 AN EVALUATION OF USER CHARGING

4.5.1 Advantages of user charging

Market prices in the context of private goods ration the goods or services among potential buyers, while also playing a part in the determination of quantities of goods and services produced. User charges are held to have the potential to create short and long run efficiency related benefits of a similar nature in the public context. They are also deemed to be a fair and equitable method by which the beneficiaries of public goods may pay for the enjoyment of the same (Advisory Commission on Intergovernmental Relations, 1987: 27), which is firmly in accordance with the benefit principle of taxation set out in Section 4.2.1.1 of this dissertation.

User charging possesses the following advantages on a practical level:

- Investment decisions by government can be facilitated. Existing roads could become overutilised if provided at no cost to the user, resulting in increased demand for increased road space;
- Charges which limit the use made of roads will prevent wastage resulting from congestion, as well as serving to influence locational decisions which favour greater distances from resources and markets;

- User charging frees up general tax revenues for other priorities;
- User charging targets those users who benefit directly from the service although the burden on low income users will be a mitigating factor;
- User charges can assist in the optimal allocation of traffic between roads and other modes.

4.5.2 Disadvantages of user charging

User charges, it is argued, have one imagined disadvantage, and two real ones.

The imagined disadvantage stems from the mistaken belief that roads are a genuinely "public" type of good, and consequently best financed through the Treasury. As will be shown throughout this dissertation, this is not true. Roads have substantial elements of privateness and in principle are quite amenable to user charging.

However, there are two additional and fundamental disadvantages with respect to user charges:

- user charges can be extremely difficult to implement;
- user charges can be inequitable.

The question of implemmentability will be left until Section 4.8. As for whether user charges are inequitable, this will depend upon the broader economic policies and practices that are in place. Requiring consumers of goods to pay for what they get is only inequitable if they cannot afford to do so. In a perfect world, they would be able to afford transport because a properly functioning system of welfare payments would be in place for the poorer groups in society. Hence, in such a world, it would be unnecessary to subsidise the delivery of transport services for these groups as an indirect method of wealth redistribution, and such methods are unattractive from the viewpoint of economic theory.

In many countries, as in South Africa, it must be recognised that a proper welfare system does not exist, and that it is indeed necessary to fall back on the subsidisation of the poor's basic needs, of which roads are clearly one, as a means of redistribution. Therefore, the blanket implementation of user charging for roads would be inconsistent with the need for subsidisation of the poor. Thus, there is here a stark example of the more general tradeoff that has occupied economists for decades - namely that between efficiency and equity. How this tradeoff may be made is the subject of the discussion in Section 6.3.1.

4.6 APPLICATION OF USER CHARGING TO ROADS

User charges are what Musgrave and Musgrave (1989: 240) term "specific benefit taxes" due to the fact that the charges involved are for particular benefits attained from the use of the public good. This technique is deemed by these authors to be feasible under the following conditions:

"The case for finance by direct charges to the user is clear-cut where the goods or services provided by government are in the nature of private goods, i.e. where consumption is wholly rival. Benefits can be imputed to a particular user which can be asked to pay. The issuance of licenses, the financing of municipal transportation, and the provision of airport facilities are more or less in this category".

From the definition outlined above, it is clear that certain road types will qualify for user charges or specific benefit taxes. These road types are those which display elements of privateness, i.e. congested and well-utilised interurban and urban roads.

A number of aspects of transport exist which provide justification for user charging. These are:

- (1) The benefit that is derived from the usage of roads. This is extremely important and will be expanded upon later in this section;
- (2) The benefit conferred by access. This is regarded as a basis for user charging by

Heggie (1991: 16), at least in the context of local roads. Accordingly, Heggie argues for the financing for investment in local roads through land value taxes, development of local roads by property developers, levies on agricultural marketing boards and farming co-operatives and general tax revenues. Operation and maintenance will be financed from general tax revenues.

From the literature, it seems difficult to distinguish between access charges and general local taxes. The notion of assigning a portion of costs to non-road users is examined by Meyer, Kain and Wohl (1966: 68):

"Inasmuch as a basic roadway would always be needed to serve the abutting properties with local access for fire and police vehicles...and other service vehicles as well, it seems reasonable to consider the costs of the basic roadway simply as a welfare service and thus to recoup them through property taxes and general revenue funds, rather than from vehicle taxation."

It is important to note that non-users of roads do not receive the services which make use of roads entirely free of charge. This is because where users providing service to non-users are charged for using roads, these costs are passed on to the consumers/non-users. This is the case for commercial road users, as well as for the services referred to by Meyer, Kain and Wohl above. In conclusion on this point, it would appear that the link between road provision and the levies listed by Heggie is not a particularly strong one. The levies proposed could be viewed as components of local general taxes out of which expenditure on roads would simply be one of a number of budgetary items, or as charges for road usage, as opposed to access. In order that this problem may be avoided, it therefore becomes essential that road user charges be set at an appropriate and adequate level, so as to avoid having to employ the theoretically weak "access levies". A more detailed discussion on access charges is contained in Johnson and Hoel (1987), and Transportation Research Board (1985).

- (3) Another aspect of road transport which may render levies or charges necessary are externalities in the form of environmental costs. This would include noise and air

pollution, as well as accident externalities, all resulting from normal road usage. These factors will be ignored in the context of this dissertation as it is suggested that true user charges should be determined as distinct from additional costs such as environmental costs which would then be added further.

(4) The benefit obtained by those because others use transport. This is an attempt to internalise externalities which result from the use of roads by others. Johnson and Hoel (1987: 73-76) suggest six techniques which attempt to identify the beneficiaries and assess some of the benefits obtained. The techniques are:

- Connector fees charged to property owners with property adjacent to roads;
- Negotiated investments whereby a developer undertakes to fund an improvement to his development;
- Special benefit assessment which holds that the costs of road development should be met by the properties benefitting from the development;
- Transportation corporations which are usually established to develop transport facilities;
- Tax increment financing which originates from the notion that public improvements act as catalysts of development in their surrounding areas which serves to increase property tax revenues;
- Impact requirements which are met by developers so as to offset or compensate for the impact of their particular developments.

The employment of levies such as those outlined above should be undertaken with care, although they do have some merit. It is preferable to include charges which can be associated with real positive externalities so as to avoid the difficulties which can result from access levies. Thus, although access levies do have some potential in the local context, they will not

be dealt with in any detail in this dissertation because: firstly, they can only be utilised in specific local circumstances and, secondly, their contribution to road financing is relatively insignificant in the context of a road funding problem, which is the principal objective of this dissertation.

The case has been put forward in this chapter roads classified as pure public goods in terms of the criteria of nonexcludability and nonrivalness can be funded out of general taxation revenues. However, roads have also been shown to exhibit significant elements of privateness and natural monopoly, and can be priced in terms of user charges. The consensus of the authorities consulted in the literature is that roads do have the characteristics common to natural monopolies which can be funded by user charges. Indeed no less an authority than Musgrave and Musgrave (1989: 169) point out that user charge financing conforms to the benefits principle of taxation and go on to outline the typical road user charging instruments which are utilised in the United States, i.e. fuel levy and licence fees and this subject is discussed further on in this chapter.

Before the road user charging techniques and instruments are described in detail, however, the principal methods for setting user charges are briefly outlined in the next section.

4.7 METHODS OF SETTING USER CHARGES FOR ROADS

The issue at this point is what the basis of the pricing of road use should be. Newbery (1990: 22) suggests that as road space is a valuable and scarce resource, pricing is a means by which it may be rationed. This can be achieved through:

- marginal cost pricing, which involves the setting of price equal to the cost of producing one extra unit of the item. Marginal cost is the opportunity cost to society of producing the item, in this case road infrastructure. This can be achieved by means of a price being set at the marginal social cost of using the road network which will be aimed at ensuring that users only make use of the road when it is absolutely necessary.

- average cost pricing, whereby price is set equal to average cost. This implies that total revenue will equal total cost, as price multiplied by quantity will be the same as average cost multiplied by quantity.

Road user charges ought to comprise two main components. Firstly, the marginal social cost of the vehicle making a particular trip. This would include the direct cost associated with the use of the vehicle (e.g. vehicle operating cost, travel time, amongst others) which is paid for by the vehicle owner and is termed the private cost of road use. Secondly, other (indirect) social costs exist, some of which shall be paid for by the road user, such as congestion, others to be borne by the authority, and others by the society at large. (See Newbery, 1990: 27 for a discussion of the short-run marginal congestion cost).

4.7.1 Marginal cost pricing

The rule involved in the theory of marginal cost pricing begins with the situation where in the case of perfect competition, equilibrium will occur when $P = MC$, as this is the condition for the optimum allocation of resources. If the price of the good is the cost to consumers (road users) of purchasing it, they will purchase (use) it only if they value it more than or as much as the price attached to it. If the price of the good (use of the road) is below marginal cost, consumers (users) will purchase the item even if the value they attach to it is less than that of the goods that could have been made in its place. If price exceeds marginal cost, consumers (users) who value it more than it costs to make will refrain from purchasing (using) it. For efficient allocation of resources, marginal cost pricing ($P = MC$) is necessary (Bannock, et al, 1987: 257).

Rosen (1992: 340) outlines the situation when marginal cost pricing ($P = MC$) can lead to problems. In the case of a natural monopoly, marginal cost pricing in line with the efficiency criterion can result in production with an associated price level which is lower than average cost. This will imply that a loss is continually incurred.

This situation can be addressed through the use of marginal cost pricing with lump sum taxes. This would involve charging a price equal to marginal cost, and meeting the aforementioned

shortfall with lump sum taxes. However, this approach runs into difficulties because lump sum taxes are impossible overall, which would mean that income or commodity taxes would of necessity have to be substituted. This would introduce distortionary effects which could negate the efficiency gains achieved through the use of marginal cost pricing. Also, the use of the proceeds of general taxes in the provision of a good which only benefits the users of the good (as in the case of roads) violates the benefit principle.

Musgrave and Musgrave (1989: 169-171) point out that user-based charges ordinarily would increase the charge above the efficient price level and output would be below the optimum. In order that this problem may be circumvented, techniques must be utilised that recover costs from users, while minimising efficiency losses which would result from charging the price associated with marginal cost pricing. These techniques include the "two-part tariff". A two-part tariff comprises a flat charge to be paid if the individual wishes to make use of the facility at all, and would take the place of a lump-sum tax on users. The rationale behind a two-part tariff is that it would have a substitution effect only on the choice of the individual to make use of the facility or to abstain completely and would not affect the level of usage. This would be the case where the demand for access would be less elastic than the demand relating to level of usage. If the loss with marginal cost pricing is small and the number of users large, the flat fee can be set at a level which would exclude few potential users.

The implications of all this for roads is that the road user should be charged according to the costs resulting from his use of the road system (Scheurkogel, 1966: 296). According to Buchanan (Scheurkogel, 1966: 297) marginal cost for road funding comprises two components:

- the direct marginal cost associated with the road user; and
- the indirect costs imposed on other road users.

Applying marginal cost pricing principles to road financing is a complex issue, and is dealt with by Freeman (1981: 66) in some detail, both in terms of the short run and in the long run. For the purposes of this dissertation, marginal and average cost pricing applied to roads will draw on Freeman's work in respect of what is termed "the pragmatic school of marginalist

theory" (ibid: 66). As the name suggests, the pragmatists "are economists who recognise that true marginal cost pricing may not be feasible in the transportation sector" (ibid: 66) due to the presence of constraints of an administrative or investment nature or because prices in certain sectors of the economy are not derived according to marginal cost principles. The objective of pragmatic marginal cost pricing is then one of optimal second best, whereby charges are set in proportion to marginal costs so as to maximise welfare, rather than equal to marginal cost as would otherwise be the case. The pragmatic approach is needed in the case of roads due to the fact that true marginal cost pricing cannot be applied in view of the magnitude of the cost implications of calculating and collecting charges for each user. The focus should then be in terms of practical efficiency which would entail separating the more major and easily identifiable costs (separable costs) from total costs for each class of road user.

The value of the pricing mechanism for roads lies in the fact that the "pricing rule tells us how to make the best use of existing resources, including the existing stock of roads. It allocates the limited services of the road to those willing to pay for them" (Walters, 1968: 32). If there is no limit to the number of times each user can use the road, then the price should be zero, so that each user can utilise the road as and when he wishes. Walters suggests that with "continuous and divisible roads" a price set at zero and excess capacity would occur only in the event of an oversupply of roads. This would be rectified in due course by the road authority (supplier) who would then allow part of the road network to deteriorate to the point where supply matches demand better. Walters goes on to examine the issue of divisibility of roads in great detail, and introduces the concepts of the "putty road" (roads being automatically able to expand in capacity with increased use) and "lumpiness" in road provision (provision of roads occurring in unavoidable lumps, not in minute increases) (ibid: 32 - 40).

The determination of prices is important in that the pricing of roads as a natural monopoly should be such that use of roads is not restricted unnecessarily, resulting in "underutilized" capacity on one hand, and should be priced so as to ration road space between users in the case of an undersupply on the other (Churchill, 1972: 9-10). Government, however, may utilise its monopoly position and set prices at levels which would assist in attaining objectives

such as maximisation of revenue, or redistribution of income. The pricing of road services, Churchill maintains, should correspond with the value of the resource consumed due to the use of the road. The real economic costs of road use will be the damage done to the road by the road user. In the case of multiple users, additional costs will be carried by the other users of the facility. These costs will be equal to the variable maintenance costs as well as the costs of congestion. The price to be charged to cover these costs will be the economic user charge (EUC) and is the price to be charged which will optimise resource allocation. This notion is nothing out of the ordinary, it is simply an application of $P = MC$. Whilst the utilisation of the EUC ($P = MC$) is necessary for the maximisation of net benefits for use of the road network, it can lead to excessive net benefits being obtained from certain parts of the road network. The question then becomes one of redistributing the amount of net benefits obtained by using the EUC, in order to cover those parts of the road network which underrecovered and operated in deficit. This is a road funding issue as opposed to the optimisation of resource allocation by pricing roads at MC. Indeed, Berechman and Pines (1991: 180), via a process of derivation, conclude that marginal cost pricing of roads is much like the application of marginal cost pricing of any private good.

4.7.2 Average cost pricing

Average cost pricing is the most widely used basis for natural monopoly pricing in the United States (see Rosen, 1992: 341). Average cost pricing has the advantage that, unlike marginal cost pricing, it will not involve a loss situation, as the price level is simply set in accordance with average cost. This means that neither excess profits or losses are made. However, the point to note is that the level of output will be less than that associated with the marginal cost pricing scenario (ibid: 340).

Tresch (1991: 205) attributes the popular preference for average cost pricing because of the fact that as:

"...decreasing cost services are exclusive, so that nonusers can easily be distinguished from users, and intensive users distinguished from nonintensive users...average cost pricing satisfies the intent of the benefits received principle, whereas marginal cost

pricing does not. If people adopt this point of view, and believe that the equity gains from average cost pricing outweigh its efficiency losses relative to marginal cost pricing, then average cost pricing is entirely reasonable." (ibid: 205).

For roads, the concept of average cost pricing involves the allocation of total expenditures to the various road user classes such that the revenue obtained will be equal to total expenditures. This will mean that each user will pay the average cost of road use and each group of road user will pay its average cost of road use (Freeman, 1981: 68). Thus, the objective of average cost pricing applied to roads would be the equalisation of total revenue (price multiplied by output) on the one hand, and total cost (average cost multiplied by output) on the other (Scheurkogel, 1966: 295). The process of allocating costs will be in terms of either the benefit principle or the willingness to pay approach.

Freeman points out (1980: 69) that in terms of economic theory, there is little evidence, if any, to support covering costs. If economic efficiency implies charging to cover marginal costs, little justification exists for ensuring that total revenue from user charges should be equal to total costs. In the case of many rural roads, charges would be insufficient to cover total costs due to low traffic volumes, whereas in urban areas revenues from charges could be adequate depending upon the volume of traffic. If an attempt is made to balance the accounts for both rural and urban roads, this would lead to the relevant authority having to set charges for rural roads above the economic level which could discourage users and lead to sub-optimal usage of the rural road network, depending upon the demand elasticities of the users. Congestion tolls in urban areas using marginal cost pricing could result in surplus revenue. This situation may not be entirely attractive since if these revenues are invested in the urban road network, diminishing returns could set in. However, Scheurkogel's view of average cost pricing is that it could result in insatiable demand on congested urban roads as demand for road use would simply continue to rise. As an alternative, he recommends marginal cost pricing as this would ensure that the road user would be obliged to pay only for the cost of his using the road network (1966: 296).

Another argument for covering the cost of roads, aside from the economic efficiency approach, is that if rail is required to cover cost, then for reason of equity roads too should

cover its cost. This could be termed the balanced budget approach. A further reason for following a balanced budget approach is to encourage a measure of restraint in demands for an extended road network in that users will be forced to pay for any increases to the network. Finally, the responsibility for road taxes should be spread equitably, with payment in accordance with the benefits derived by the group of user. However, it could be argued that equity cannot be used as a principle on which to base user charging as different modes cannot be expected to behave the same as they face different market structures. For this reason, the average cost pricing principle is preferable to the extent that the cost of funding road infrastructure should be met by user charges and not through general taxes. This does not discount the utilisation of marginal cost pricing, as average cost pricing and marginal cost pricing can be reconciled if more than one pricing method can be used. This would be the case where users are obliged to pay for maintenance through short run marginal costs (e.g. fuel levies) and through long run costs of road provision as road users (e.g. licence fees). If this is possible, this goes some way towards meeting the logical requirements of both the marginal and average cost pricing principles. The logic behind this is that the road network is extended in response to average vehicle ownership and use and it is appropriate that vehicle owners pay for their membership of that group; also, the actual use of roads imposes costs and these costs have to be met. Thus, a strict, exclusive choice between the two options of marginal and average cost pricing does not have to occur.

Having examined the rationale behind the concept of user charges and the reasoning behind the setting of user charges, the actual techniques of charging road users are examined as this is a critical component in the financing of roads as nonpure public goods.

4.8 TECHNIQUES OF ROAD USER CHARGING

Having set out the basis for the user charging principle to be applied to roads, it is important that the instruments or techniques which can be used for this purpose be identified, described and analysed in terms of the criteria which will enable their usefulness and applicability to be assessed. This section sets out the main instruments of user charging and comprises an evaluation of each of the user charging techniques concerned.

A number of practical user charging techniques exist, but the methods which will be described in this dissertation are those relating to vehicle ownership and use. These user charging techniques can be classified accordingly (Varma & Sinha, 1990: 293-297):

- First tier charges - charges relating to vehicle ownership;
- Second tier charges - charges relating to vehicle use; and
- Third tier charges - attempt to account for the differences in benefits or costs occasioned by vehicle classes.

The user charges which fit into each of these categories are:

- First tier charges:
 - Licence fees.
- Second tier charges:
 - Fuel levies;
 - Taxes on motor vehicle tyres, spare parts and lubricants;
 - Tolls;
 - Parking fees;
 - Area licensing schemes;
 - Electronic charging systems.
- Third tier charges:
 - Weight-distance charges.

The criteria in terms of which the user charging techniques will be analysed are (an alternative, but not significantly different list of criteria is contained in Kane & Cooper, 1987):

- Allocative efficiency (matching road revenues with expenditures);
- Vertical and horizontal equity (incidence within categories of road users and between categories of road users);
- Practical considerations (affordability, vulnerability to evasion);
- Extent to which the technique is generally applicable (application to particular road types);
- Potential as a source of revenue.

4.8.1 First tier charges: charges based on vehicle ownership

4.8.1.1 Licence fees

Licence fees are second to fuel levies (see Section 4.8.2.1) as the most important source of user-based funds (Cauley, 1960: 195) and are utilised extensively in many countries as a user charge. Licence fees are most frequently employed in the form of an annual payment by the owner of a vehicle which permits the vehicle access to the road network and so enables its use of the road, regardless of the use made of the vehicle thereafter or, rather, the distance covered by the vehicle in question (Walters, 1968: 215; Cauley, 1960: 195). This type of licence is referred to by Bahl and Linn (1992: 200-201) and Churchill (1972: 76-77) as a non-restrictive licence, as distinct from a restrictive licence which would be similar to a toll fee levied for the use of a particular piece of road and linked directly to this.

The levying of licence fees is seldom done as a flat rate charge across all vehicle types and can be varied according to a number of factors. The level of a licence fee can be based upon the class of vehicle, regardless of the value of the vehicle which may be held to be inequitable (Walters, 1968: 216) although it would be in accordance with the benefit principle of taxation. Alternatively, the licence fee can be tied to the value of the vehicle. This would be relatively easy to assess in the case of new vehicles, but would be difficult for older

vehicles, thereby necessitating the use of depreciation schedules by the authorities (Walters, 1968: 216). Licence fees based upon the capacity of the vehicle are also possible. The capacity of the vehicle could be measured in terms of weight or engine power and would be utilised as a proxy for the associated higher variable maintenance costs and fuel use respectively (Bahl & Linn, 1992: 201). Variations of these methods which have been applied in Central America are documented (Churchill, 1972: 77).

Allocative efficiency

Licence fees have been evaluated by Cnossen (1977: 64) according to whether they are based upon value, weight or power. The aforementioned author has deemed them to be unsuitable as a variable maintenance charge if levied by value, particularly in the case of heavy vehicles, as the value of the vehicle is an unsound basis for road user charging. Licence fees based upon vehicle weight have been deemed fair proxies for direct pricing if varied with the payload capacity of heavy vehicles, but this basis would be unsatisfactory in the case of light vehicles as weight differentials would be smaller and more difficult to distinguish. Power-based licence fees are regarded as poor proxies for direct pricing unless linked to the power/weight ratio of vehicles. Both power- and weight-based licence fees do, however, conform adequately to the benefit principle of taxation (Davie & Duncombe, 1972: 341).

Equity

In terms of enhancing vertical equity, licence fees can be useful in the sense that they do allow for the variation of fees according to the value, size, power and type of vehicle. This is especially the case for charging vehicles in accordance with damage inflicted upon road infrastructure, although the technique is not specific enough to pinpoint vehicle types directly and, in so doing, ensure complete equity between vehicle classes. Horizontal equity is not enhanced by licence fees as the latter vary with the characteristics of the vehicle and not its usage and, in itself, usage (i.e. distance covered) can vary widely within categories of vehicles. This is especially important in the case of heavy vehicles due to the damage which can be wrought by these vehicles on road surfaces.

Practical considerations and general applicability

Licence fees do possess other advantages in the form of simplicity of administration and

certainty of payment. Similarly, they are also relatively simple to understand and are easily determined by users. Licence fees can, in principle, be levied at all levels of government, national, provincial and local, and have an added advantage in that they can easily be collected by one of these tiers on behalf of the others on an agency basis.

Potential as a source of revenue

One important issue regarding the levying of licence fees is that of state or provincial differences in magnitude in the level of licence fees. Variations in the level of licence fees between provinces can lead to a skewed distribution of vehicle registrations between these states or provinces. The same sort of problem would be more accentuated at a local level where licence fee differentials between local authorities could be exploited very easily.

Other charges relating to vehicle ownership, such as vehicle inspection fees and vehicle transfer taxes, as well as charges relating to vehicle acquisition such as excise duties, import duties and sales taxes will not be included in this chapter as they are not directly tied to the use of road infrastructure. That is, the payment of these would not guarantee access to roads as is the case with the licence fee.

Licence fees are extremely useful techniques of user charging for roads, although the extent to which they satisfy the criteria of allocative efficiency and equity do vary. They also have considerable practical advantages, are a reasonable source of revenue and are extremely simple to administer and collect.

4.8.2 Second tier charges: charges based on vehicle use

4.8.2.1 Fuel levies

Charges levied on fuel are the most important of the road user charges as they are the greatest source of revenue amongst the road user charges, and the simplest to administer. In most countries, the fuel levy comprises over half the revenues collected from road users (Heggie, 1992: 2). Indeed, fuel levies are an extremely significant source of revenue in their own right when compared to other sources outside of the roads arena, particularly at a Federal and State

level in the United States (Musgrave & Musgrave, 1989: 395-396). Fuel levies are also extensively utilised in the countries of the European Union and constitute an integral component of the revenues obtained from road users (HMSO, 1993: 19). Fuel levies are also an important revenue source in Africa, although not all funds obtained from this source are channelled back into road infrastructure (Heggie, 1995: 65-67). The issues around the use of earmarking, dedicated and special funds are discussed in the next chapter of this dissertation.

Fuel levies are generally charged per unit of fuel sold and can consist of a number of possibilities:

- a flat rate levy charged on each unit of fuel sold across all vehicle fuel types (i.e. a flat rate per gallon/litre of fuel sold);
- a charge levied according to different fuel types, based on different vehicle characteristics, i.e. varied levies for diesel and petrol fuel, as they are used mostly by heavy and light vehicle types respectively. In many countries the levy on diesel fuel is proportionately smaller than that on petrol (Churchill, 1972: 64) in order to encourage economic activity through the use of diesel in commercial vehicles on one hand, or to discourage the use of small, petrol-driven vehicles which contribute to urban traffic congestion;
- a charge levied according to different grades of petrol (octane levels), reflecting differences in costs of production between grades of fuel (Walters, 1968: 209-211).

Allocative efficiency

Fuel levies comply with the criterion of allocative efficiency due to the fact that fuel consumption varies per vehicle/kilometre, in doing so, reflecting the degree of usage of the facility. Thus the total fuel levy paid by a road user depends upon the distance and speed travelled, vehicle weight (because there is a positive relationship between vehicle weight and fuel consumption) and the amount of congestion on the routes utilised (because vehicles use more fuel with congestion).

Thus, one of the principal advantages of the fuel levy as an instrument of user charging is that it reflects usage of road infrastructure to a significant extent (Stanley, 1993:41; Cnossen, 1977:63). This is because the more use that is made of the road, the more fuel of whatever type is required to power the vehicle in question. The more fuel that is required, the greater the amount levied in payment of the charge (Newman, 1968: 323). However, it has been argued that the relationship between these variables is not particularly well reflected in the structure of fuel levies as they have been implemented internationally (see for example Varma & Sinha, 1990: 296).

If fuel levies are applied as a flat rate specific charge, they do not reflect the actual cost of road use as they fail to take into account important variables such as vehicle size, road surface and effects on road maintenance (heavy vehicles causing more damage to the road surface). This deficiency can be overcome if these differences are taken into account.

In the case of less developed countries (LDCs), Gronau (1994: 256-266) argues that fuel levies should primarily be set at a level which adequately covers the externality which is that of damage to roads inflicted by heavy vehicles, and less attention should be given to aspects such as urban road congestion. This is because damage to road infrastructure by heavy vehicles is a much more immediate problem than that of urban road congestion in these countries.

Diesel engines are generally acknowledged as being more efficient than petrol engines which enables diesel-engined vehicles to travel greater distances. As a great many diesel-engined vehicles are heavy commercial vehicles, the fuel charge levied upon these vehicles should, it is argued, reflect the proportionately greater road maintenance occasioned by the greater distances travelled by heavy vehicles on roads and the impact of this usage (Walters, 1968: 210). This must be set against the commercial effects. The same argument as above has been applied to the case of differing octane levels in petrol. Higher octane levels enable improved engine performance and greater fuel efficiency resulting in greater distances which can be covered by these vehicles. This suggests that levies on higher octane fuels should be greater than those on lower octane levels in order to take these factors into account. The exact calculation of the optimal level of fuel levies which would reflect these factors would be of

an extremely complex technical nature, however.

In addition, the effect of fuel levies on non-transport users such as agricultural users is important (Due & Friedlaender, 1981: 399), although it could be argued that roads would also be utilised to transport agricultural produce to market, whilst the practical implications of differentiating between transport and non-transport usage would be insurmountable, especially in developing countries (Newbery, 1988:133).

Equity

With respect to the extent to which fuel levies contribute towards equity, a number of factors should be included in the analysis. Certainly, in terms of vertical equity, fuel levies on petrol are progressive in impact especially in low-income developing countries due to their incidence on passenger cars, whilst levies on diesel fuel can be regressive if diesel fuel is extensively utilised in public transport, or by commercial hauliers transporting commodities utilised by low income consumers (Cnossen, 1977: 63).

Horizontal equity is enhanced by fuel levies to the extent that road users utilising different vehicle classes pay more in accordance with greater use of road facilities. However, fuel levies are unable to differentiate between road surface types, resulting in users of poorer quality gravel roads being penalised due to the higher vehicle operating costs associated with using these roads, and the fact that these roads are often used by rural, low-income communities. In mitigation, it can be argued that the volume of traffic making use of the paved portion of the national road network would be much higher than that utilising unpaved roads, so that if the economic user charge is set in accordance with the variable maintenance cost of paved roads, marginal cost could be approximated to some extent (Cnossen, 1977: 62). In terms of equity, then, fuel levies conform to the benefit principle because road users are obliged to pay for the fuel their vehicles utilise, and therefore pay in accordance with the benefit they derive from road use (Due & Friedlaender, 1981: 233-234).

Practical considerations and general applicability

Another major attraction of fuel levies as a user charge is the ease of collection, enforcement and administration associated with them (Heggie, 1995: 63). If they are levied at the port of

entry into a country or at a refinery level, they are exceptionally easy to collect (Churchill, 1972: 70) on a per unit basis, and the charge is simply recovered from the road user. If the production of fuel is controlled by a public enterprise, moreover, fuel levies are suggested to be even more simple to administer (Bahl & Linn, 1992: 198).

The scope for avoidance of fuel levies is reasonable if the point of collection is at the point of sale or at the retail level, and not at the port of entry or at the refinery (Walters, 1968: 210). The costs associated with administering the fuel levy will be higher at the retail level. This should not be confused with the point of payment, where the road user is obliged to make payment at the point of purchase, largely unavoidable in any event. Owing to their ease of administration, fuel levies can be implemented at all levels of government, although as in the case of licence fees, differentials at a local level could lead road users to purchase in certain local areas as opposed to others. This would not be a problem at provincial level.

Potential as a source of revenue

Fuel levies were first introduced at a State level in the United States, and were then utilised as a Federal taxation instrument thereafter. Indeed, fuel taxes levied at a State level are still immensely important in the United States as a source of revenue (Aronsen & Hilley, 1986: 91). Fuel taxes are also being examined as a potential source of road funds in Australia, also at a State and Federal level (Stanley, 1993: 43). As with the United States, this involves the possible use of earmarking as a means of channelling funding from fuel levies.

Furthermore, fuel levies have proved to be adequate sources of revenue because the demand for fuel is relatively price inelastic (Buehler, 1948: 424; Aronsen & Hilley 1986: 90-94). However, this does not imply an inexhaustible source of funds, because increases in the fuel price due to higher fuel levies can simply be passed on to consumers of products being transported, in the case of commercial usage of diesel and petrol. The level of the fuel levy will also depend upon whether it is being utilised as a user charge or simply for general revenue raising, the latter not being the objective in terms of this dissertation.

However, the long term sustainability of the fuel levy as a source of funds for roads has become rather uncertain due to the increasing emphasis on environmental concerns and energy

conservation (Varma & Sinha, 1990: 301) as well as the trend towards more fuel efficient technologies, which may make the usage of alternative sources of revenue for roads that much more necessary in the future. However, fuel levies do remain the most significant source of revenue for road funds for the foreseeable future, due to their capacity to secure funds, as well as their ease of collection and administration.

4.8.2.2 Charges on motor vehicle spares, tyres and lubricants

Charges on spares, tyres and engine lubricants will be dealt with under one heading as they are related to vehicle and, hence, road use, and are of relatively minor significance in terms of their capacity to raise revenue.

Charges on spare parts are possible and a case for them can be put forward to the extent that they can be linked to the operation of a vehicle in which they are being used and, therefore, to the use of the road network. Of course, the same sort of case could be used for lubricant charges which are also similar to fuel levies in that they are charges based on engine use.

Allocative efficiency

In evaluating these charges in terms of allocative efficiency, the charges levied on tyres and vehicle spare parts are good proxies for distinguishing between different types of roads and in this regard, tyre charges are especially useful to the extent that they closely approximate the relative variable maintenance costs of different road surfaces (Cnossen, 1977: 66; Churchill, 1972: 72). Lubricant charges likewise enhance allocative efficiency, but the effect of these charges could be rather insignificant.

Equity

In terms of the criterion of vertical equity, tyre charges will have a proportional effect, whilst a spares charge is likely to be regressive, given that older vehicles requiring more spare parts could be owned by poorer members of the community (Cnossen, 1977: 64). A lubricants charge would have a similar impact to that on fuel as outlined above, but its effect would be insignificant. All three types of charges would perform well in terms of horizontal equity, although again, the effect of lubricant charges would be insignificant.

Practical considerations and potential as a source of revenue

The importance of these charges in terms of revenue is reasonable, with the exception of lubricants charges which will be insignificant in this regard. Finally, the charges listed in this section will be fairly simple to administer, but in the case of lubricants charges the revenue raised may not justify the costs of administration. This explains their lack of extensive utilisation as user charging techniques.

4.8.2.3 Toll charges

Tolls are one of the major funding instruments for roads (Stanley, 1993: 32) and are perhaps the best known, most well-tried and certainly the most direct user charging instrument which can be employed (Walters, 1968: 208). Tolls involve the payment of a set fee by the users of a facility at a location on the facility itself, i.e. at point of use, are route specific and have traditionally been levied for the use of sections of road, bridges and tunnels (Mitchell, 1989: 16).

Toll charges have been utilised extensively in some form throughout Europe since the 13th century at least (Mitchell, 1989: 16), whilst Adam Smith in his work *The Wealth of Nations* (1776) advocated the use of tolls paid by the users of roads (Walton & Euritt, 1990: 265). The 18th and 19th centuries saw increased application of toll roads and bridges in both the United Kingdom (see Albert, 1972; Williams, 1995: 117-118) and the United States, and tolls were even applied in South Africa to a limited extent during the early 19th century (Mitchell, 1989: 16-17). Indeed, the early form of road toll charges, traditionally called turnpikes, were applied to private and local rural roads and bridges. The situation in the United States changed from about 1875 when the viability of turnpike roads became more difficult, not least due to the spread of railways, and public funding of roads became the norm (Walton & Euritt, 1990: 265-266), with a similar pattern occurring in the United Kingdom.

Toll roads have enjoyed something of a resurgence in a number of countries since World War II, notably the United States, and on the motorway network of Continental Europe. Examples of major toll projects are the Golden Gate and Bay Bridges at San Francisco in the United States and the relatively extensive toll road networks of that country. Of the European

motorway network of some 40000 kilometres, approximately 30% (13500 km) is now tolled of which 90% is in France, Italy and Spain (HMSO, 1993: 20). The International Bridge, Tunnel and Turnpike Association (IBTTA) in the United States has estimated that the construction of some 45000 kilometres of toll highways was planned as at 1994, the value of the projects being approximately US\$120 billion (World Highways, 1994: 11). At present, conventional tolls are not extensively used in the United Kingdom apart from some estuarial crossings, bridges and tunnels, such as the Mersey Tunnels, the Forth Bridge and the Queen Elizabeth II Bridge at Dartford. The only tolled road now in use in the United Kingdom is the Birmingham Northern Relief Road. A number of toll projects were implemented in South Africa during the late 1980s and early 1990s as a way of initiating new freeway road development (Mitchell, 1989: 19). Tolls are utilised to some extent at a State level in Australia (Stanley, 1993: 35) where they fund the use of a particular road as a direct user charging instrument. The contention in this case is that tolls should be used to fund State arterial routes.

Toll projects usually include the use of the "open" or "closed" systems of levying payments. The open tolling system involves a one-off payment as the user enters the toll project for his use of the facility; the closed system of toll payment involves the issue of a ticket as the user enters the project and payment as the user exits the project, with the toll varying according to the extent of use indicated by the ticket. (For a more detailed description of open and closed toll systems, see Munro, 1975: 602; HMSO, 1993: 27).

Two schools of thought exist in respect of the charging of tolls over the life of the toll facility. The first suggests that tolls should be levied from the start and, once the road has "paid for itself" the toll should be lifted completely. The difficulty with this option is that a road is never paid for completely, in that maintenance still needs to be carried out over the lifespan of the road, and after 25 years, complete rehabilitation or reconstruction is necessary. The other method would be to gradually increase toll payments for the road as traffic volumes (and congestion) increase, the argument being that road space should be priced whatever the lifespan of the road. (Walters, 1968: 219). For a description of the data requirements and procedures and all technical aspects involved in assessments of individual toll road projects see Munro (1975).

Most toll projects are interurban highways with limited access (entry and exit points) (Stanley, 1993: 43) and this is believed to enhance efficiency of revenue collection. Conventional toll roads used in Continental Europe are constructed with few toll plazas for this reason. The limited access aspect has led to arguments in favour of a free road alongside the toll road, aimed at giving road users a choice of whether they wish to pay the toll or use the alternative route and possibly endure some measure of congestion (Walters, 1968: 218). If the toll road is not well-utilised, it may be inefficient to levy tolls which restrict use of the road and very few toll routes are situated on roads that are congested. Tolls are, however, applicable to urban expressways, but not on downtown streets (where they would be impractical). For this reason, they are not a good instrument for congestion charging as such (Walters, 1968: 208).

Thus, while interurban freeways are good candidates for tolling, the concept has also been applied to urban freeways in other countries (See Ayland, 1989). However, prerequisites for this are limited access and reasonably high traffic volumes. This view is echoed in Stanley (1993: 39) where tolls are identified as being appropriate in the case of urban arterial routes, as well as on major interurban roads. However, interurban toll roads can be difficult to justify due to the lack of congestion on them in some cases (Walters, 1968: 220). Thus, although toll roads have been developed in several countries as outlined, their application must be confined to urban and interurban roads with good potential patronage and where it is practically feasible to set them up (Walton & Euritt, 1990: 273). A variation of toll charges is peak-period congestion tolls. These are discussed in detail by Cohen (1987). (See also Section 3.3 for peak period charging).

The approach to toll road projects that has steadily emerged is in the form of concession agreements between the government and toll operators which allow for private operation of the toll roads (collection of revenues) and public ownership of the roads themselves. Such agreements have been utilised in countries such as Spain, where funding has consisted of equity, loan and government bond types (see Munro, 1975). However, the impetus towards private sector involvement has increased internationally due to constraints of public funding sources (Walton & Euritt, 1990: 267-268). Internationally, the private sector is increasingly being seen as playing a greater role in the future, especially in the form of design, build, finance and operate (DBFO) contracts (HMSO, 1993: 34) as likely management efficiencies

are deemed higher.

In the United Kingdom, the swing towards private sector funding has also been due to the limitations of the Public Sector Borrowing Requirement (PSBR) which has been unable to accommodate substantial increases in public funding of transport infrastructure projects (Chartered Institute of Transport, 1993: 1). Hitherto, over the last seven years, the number of transport infrastructure projects financed by the private sector has not been overwhelmingly high (Chartered Institute of Transport, 1993: 1), but the trend is undeniable nonetheless and is a possible long term course of action.

The various types of private sector participation are several, such as build, own, operate and transfer (BOOT); build, operate and transfer (BOT), design, build, finance and operate (DBFO); design, build, operate and maintain (DBOM); and finance, design, build, operate and maintain (FDBOM) (Chartered Institute of Transport, 1993: 21). The option selected would depend upon the extent of private sector involvement preferred. In Canada, build-operate arrangements on toll projects involving the private sector have been identified as a possible means of funding certain major urban and inter-urban road projects (World Highways, April 1994: 9), and BOOT toll projects are envisaged in India (ibid: 11) and other parts of the developing world in the form of BOT projects (World Highways, May-June 1994: 31-34).

However, the private sector should not be seen as a panacea for road funding and taken for granted, as some reservations have been expressed in this regard in the document compiled by a Working Party of the Chartered Institute of Transport on the role of private investment in transport infrastructure (Chartered Institute of Transport, 1993). The document questions whether private sector participation in road investment will be forthcoming to the extent envisaged by the government in the United Kingdom, due to the high levels of risk and uncertainty of revenues associated with major toll road projects (Chartered Institute of Transport, 1993: 3-4; 17-19), the lack of an established market in tolled roads in the United Kingdom (ibid: 7) and the lengthy pay-back periods and cash flow uncertainty arising from demand which can take years to increase to magnitudes acceptable to private sector investors (ibid: 17). There is also a fair measure of doubt as to whether conventional toll roads are feasible in the United Kingdom given these limitations, as they have been largely untried this

century, unlike the tolled estuarial crossings (bridges) which have the advantage of being veritable monopolies due to the lack of feasible alternatives (ibid: 17). The arrangement put forward by the working group was aimed at "co-investment" which would involve both government and private sector co-operation in various forms in order to encourage and reassure private sector investment, ranging from government involvement only in the consultation process necessary in this type of investment (ibid: 8), to transfer by government "of a network of roads to tolled status within the public sector, the creation of a number of companies owning significant shares of this network and the subsequent privatisation of those companies" (ibid: 19).

The aforementioned Working Party also downplayed the use of conventional methods of toll charges, or payment by the road user at point of use, in favour of "shadow tolling" which would entail the government paying the private sector road operator according to the extent to which the road in question has been used (ibid: 13). The latter method was proposed as it could reduce the risk and uncertainty associated with conventional toll projects, especially in the initial phase of their operation (ibid: 24). Similarly, questions raised in the United States over possibilities of excessive tolls and poorly maintained facilities on private toll roads has resulted in the formulation of the concept of general access fees (Walton & Euritt, 1990: 275) which would operate on the same principle as shadow tolls.

Apart from toll projects, there are other ways in which the private sector can become involved in road provision, such as property developers who can fund access roads to their properties due to the benefits that will be obtained from this (See Walton & Euritt, 1990: 275; Johnson & Hoel, 1987: 73). These methods will not be examined extensively in this dissertation as they are relatively insignificant instruments of funding in terms of their capacity to generate revenue. Suffice to say that stability in funding is a key criterion when alternative sources of funds for roads are being sought.

The application of toll charges to roads with substantially high traffic volumes is entirely in accordance with the user charging principles established in the previous chapters, i.e. that roads displaying elements of "privateness" should be effectively priced and their users charged accordingly so as to achieve efficient road provision. This argument is particularly strong in

cases where revenues generated exceed collection costs, because high quality, high volume roads with limited access do benefit users in the high income categories.

Allocative efficiency

In terms of allocative efficiency, road tolls may be a fair proxy for a direct variable maintenance charge if the toll varies per vehicle-kilometre (Cnossen, 1977: 65) but do not have much practical application as a congestion charge in the downtown city centre context. They do, however, conform adequately to the benefit principle if applied effectively, in terms of charging for the use of the road.

Equity

As regards vertical equity, the incidence of tolls is seen as regressive by some authors, e.g. Cnossen (1977: 64) because, by charging all passenger cars the same rate for example, it falls foul of the ability to pay principle as income disparities between road users are not taken into account. Small (1983: 107), on the other hand, argues that congestion tolls are not regressive in their impact upon the poor as the incidence of this type of charging should fall on road users with some form of employment or economic activity; where the impacts are detrimental in this respect, this effect can be mitigated with suitable adjustments upon implementation. Indeed, tolls on interurban roads characterised by high traffic volumes have the potential to be somewhat progressive overall as their incidence will be on those road users who can afford to pay for long distance travel. With respect to horizontal equity, toll charging is deemed to perform well as it bears close approximation to direct charging. Tolls do allow for the employment of a differential pricing system enabling heavy vehicles to pay more for use of a particular road (Markman, 1984: 31). Toll roads can be insulated from the political process to some extent, as traffic determines revenue and facilitates long term planning, and are also fully eligible for privatisation which can lead to improved levels of operation and maintenance, etc. (Markman, 1984: 33).

In the main, it is argued that tolls are not appropriate in developing countries (Walters, 1968: 219). The only likely cases envisaged by Walters would be urban tollways where congestion could be a problem. The provision of alternative routes is out of the question in developing countries, as this would involve a duplication of facilities which would mean a waste of

scarce resources. Tolls are fairly inelastic, especially in the case of transport of a particular raw material on the route as this is simply passed on to consumers. Furthermore, tolls in a developing country can be a problem in terms of affordability for the user. For example, tolls charged in Latin America have been substantial and, it is argued, have limited development along the affected routes (Churchill, 1972: 80).

Practical considerations and potential as a source of revenue

The administrative costs of tolls have been one of the main disadvantages (Walters, 1968: 219; Markman, 1984: 32), especially if access points are numerous (see also Mitchell, 1989: 58). The land requirements for toll plazas have been raised as an argument against conventional toll charging in countries in which land is at a premium, such as the United Kingdom (HMSO, 1993: 24) due to the many lanes needed to minimise time delays. Time delays for toll road users have been cited as another disadvantage of conventional tolls, as road users are obliged to halt their journeys in order to pay the toll. This results in time costs, particularly in developed countries where time cost estimates are substantial, as well as in increased vehicle operating costs arising from the need to halt the vehicle and then accelerate back to normal speed once the journey is resumed (ibid). It is for these and other reasons such as high traffic volumes, the disruption that construction and operation of toll booths would cause, that conventional tolling, with toll charges being collected at point of use, has been ruled out as a possibility in the United Kingdom except in certain circumstances in the foreseeable future. Rather, electronic charging methods applied as a means to facilitate revenue collection have been selected as being of greater potential for the United Kingdom (ibid: 28), utilising an open and a closed system (see ibid: 26-28 for technical details). Electronic charging systems are dealt with later in this section, and the technology has much to recommend it in the context of toll charging.

4.8.2.4 Parking charges

Parking charges are recouped from vehicles using downtown urban streets (privately-owned parking garages are excluded from the analysis), and are extracted from them by local authorities as a charge for the parking of the vehicle in the vicinity. The magnitude of the charge varies according to time in most cases. Charges for parking are levied in the form of

the traditional parking metre with a nominal charge attached depending on the amount of time required (Johnson & Hoel, 1987: 80). Such charges have been applied in many countries around the world.

Allocative efficiency

As a variable maintenance charge, parking charges are deemed to be unsuitable for application but have some potential as a proxy for a congestion charge, if they are varied according to time and location (Cnossen, 1977: 65). Parking charges have traditionally been applied by local authorities in many countries as a nominal charge based on time and aimed at recovering a limited part of the costs involved so as not to discourage economic activity in urban centres. However, this has resulted in excess demand for parking in urban centres, with a concomitant waste of time spent on queuing. To correct this, parking charges are reasonably flexible and can be used to enhance allocative efficiency. This could be accomplished through their being used to penalise parking during peak demand hours, or day-long parking. Barrett (1992: 8) argues in this regard that parking charges are potentially an important device by which demand management can correct the inefficient allocation of resources which occurs during peak period road use in the urban context. In pricing the use of urban roads in this manner, it is envisaged that the result will be "a spread of demand and...additional funds for the public purse" (ibid: 8). In effect, the pricing of parking when demand exceeds supply will allocate the good to those who value it most highly, thereby eliminating the problems associated with queuing. Also, the level of the charge should, then, exceed costs if the charge is to be effective as a revenue raising device (Advisory Commission on Intergovernmental Relations, 1987: 49).

Equity

Parking charges are generally regarded as regressive in their effect upon vertical equity (Cnossen, 1977: 65), but this can be avoided if wealth and poverty are spatially concentrated. In terms of horizontal equity, parking charges are held to be reasonably equitable in their impact upon users in the same class.

Practical considerations and potential as a source of revenue

Ease of administration (parking charges can be distinguished from general taxes easily) is an advantage of parking charges but, when set at nominal levels, they are not cost-effective. This is due to the fact that policing and enforcement costs are necessarily high because of the ease of evasion (Heggie, 1995: 63). The application of parking charges is, by its very nature, limited to local authorities.

4.8.2.5 Area licensing schemes

Area licensing schemes (ALS) are a relatively new method of urban road user charging which has been applied to any great extent only in Singapore. The method has involved the use of road pricing based on a cordon around the city centre which restricts the entry of vehicles into the area by means of manned or electronic checkpoints during certain hours. During restricted hours, the restricted categories of vehicles have to purchase and display area licences in order to gain access to the city centre (Gopinath Menon, et al, 1993: 44).

Obviously, the principal objective of the system is to limit congestion and environmental/emissions effects as the number of vehicles permitted access to urban centres would be restricted. However, the use of area licensing in terms of funding would be significant in the urban context as it would provide a source of funds, roads would be effectively priced thereby achieving more efficient use of limited road space (Armstrong-Wright, 1986: 123-124) and the amount of traffic could be controlled, facilitating the management of urban roads. A key component of the success of this effort is the improvement of public transport so as to discourage road users from making use of private vehicles (this is examined in detail in Armstrong-Wright, 1986: 123-124).

Allocative efficiency

Area licensing schemes seem to exhibit characteristics of allocative efficiency and, as such, do have merit as a demand management instrument (Barrett, 1992: 8).

Equity

If these schemes are modified to differentiate adequately between private and public forms of transport and vehicle types, they could avoid regressivity and therefore enhance vertical equity. The proceeds from ALS are easily separable from general tax revenues (Heggie, 1995: 63). In a developing country context, the costs of the system could be prohibitive; similarly, enforcement could also prove difficult. As far as horizontal equity is concerned, ALS should perform well.

Practical considerations and potential as a source of revenue

The nature of the schemes dictates that ALS is limited to urban areas, so the device would be for the use of local authorities. Finally, although area licensing has proved successful in Singapore, it has experienced difficulties in being adopted in other countries. Local authorities in other countries have been deterred by the prospect of public opposition to such schemes and have not ventured beyond the investigation stage (Armstrong-Wright, 1986: 123-127).

4.8.2.6 Electronic charging systems

Electronic charging involves the use of technology to record the frequency of use of a facility by a particular vehicle, as well as facilitating charging for the use of the facility. Technologies used range from card-based systems by users against which their use of the facility is recorded and payment is debited, to systems fitted onto the vehicle which enable it to be identified each time the vehicle makes use of the facility, and for charges to be debited against the account of the vehicle owner accordingly.

As stated earlier in the chapter, electronic charging is regarded as more feasible for road user charging in the United Kingdom than conventional tolls collected manually at toll booths (HMSO, 1993: 26). (Such systems have been applied to the Bergen ring road toll projects in Norway). This is because electronic charging would eliminate the need for land for toll plazas, as well as the equipment usually required at toll booths. Thus, the collection costs would be less than for conventional tolls, as road users would pay for their use of the road system on account. Vehicle operating costs would also be lower as vehicles would not be required to halt or interrupt their journeys.

Implementation of electronic road pricing

The more technical aspects of these sophisticated road charging schemes can be found in texts such as Ayland (1989), Catling and Roth (1987), and Henion and Koos (1987). A recent and comprehensive review of direct road pricing is contained in European Conference of Ministers of Transport (1989). It can, however, be stated that these methods are technically feasible but do face the barriers of cost and political acceptability before they can be extensively adopted.

The situation has been exacerbated in recent years as the demand for and costs of urban transport have risen, creating immense burdens for local authorities. This, Armstrong-Wright (1986: 123-124) maintains, has occurred as road users on the whole do not pay the true costs associated with the use of the road. That is, the user of the private car has simply to meet the operating cost of his vehicle and has not been called upon to account for the extra costs imposed by him on other road users in terms of congestion. Road pricing through electronic systems could be introduced to help correct this imbalance. However, as Armstrong-Wright admits, the idea of road pricing has been touted as a solution for some time. The obstacles to its implementation have been of a technical, administrative and political nature. Also, the charges imposed upon individual road users would need to be related to the spread of road use and extent of congestion which will vary immensely and be extremely difficult to calculate and collect.

Of the areas of difficulty identified above, political acceptability seems to be particularly lacking with respect to electronic road pricing and yet it is ultimately crucial as Morrison (1986: 93-95) points out: "political realities are primarily responsible for blocking implementation of road pricing...". This public opposition to road pricing may be due to the perception that its benefits accrue to government, rather than to private citizens, whereas those citizens clearly bear the costs of the system. Fixler (1987: 119) has also cited a lack of confidence by policy makers to implement road pricing despite the latter's potential as a solution to the urban congestion problem. If dedicated funding was applied to tie revenues directly to road expenditures perhaps this opposition could be overcome.

Similarly, Button (1982) and Jones (1991) have argued that the benefits to be derived from electronic road pricing as a means of alleviating congestion and thereby benefitting the public

are strong and these advantages should be communicated to the public. A component of such a system would be that of a dedicated fund of some kind which could persuade the road user of the benefits which can occur. Newbery (1990: 31) ascribes the unwillingness to accept road pricing a result of poor communication between the authorities and the public. Once these advantages are made known, they could help to ensure that such measures are accepted smoothly.

Thus, the necessity of linking the two components of electronic road pricing, i.e. political acceptability on the one hand and on the other the implementation of a set of user charging instruments the revenues from which shall be utilised for the maintenance and improvement of the road system, are the key to success for any such scheme as Politano (1986: 394), and European Conference of Ministers of Transport (1989: 35) points out below:

"There has generally been a negative 'public' reaction to the idea of road user charges; so much so that only a few substantial schemes have been introduced so far, and in special situations:

- (i) where there is strong political leadership (e.g. Singapore), or
- (ii) the scheme is presented primarily as a revenue-raising device linked to hypothecated spending on new road construction (e.g. Bergen), or
- (iii) where some form of traffic restraint - but not usually price-based - has been accepted because of severe congestion and/or environmental problems (e.g. Athens or Florence)."

Allocative efficiency

Electronic charging systems, it is argued, do comply with the criterion of allocative efficiency. This is because they force road users to pay for the journeys they undertake, as well as for the costs imposed on other road users through congestion, and the implications for the provision of road infrastructure. In other words, road users will make use of the roads only when it is necessary, reducing congestion on the road and thereby reducing the cost of using the road for those users who cannot avoid it; where road infrastructure provision is inadequate, the revenue raised from a pricing system would indicate where there an economic

demand for more roads exists and would provide the finance to pay for them. Road pricing, then, enables costs and payments to be assigned to users directly in accordance with use (European Conference of Ministers, 1989: 9-10). Thus, electronic charging would seem to possess features of allocative efficiency.

Equity

As far as vertical equity is concerned, electronic charging is regressive in that, from a social viewpoint, road pricing favours those members of the community with high incomes who are able to pay the high charges. However, to limit these effects, certain vehicles such as those utilised for public transport could be exempt from paying the charges. The criterion of horizontal equity is satisfied by this instrument.

Practical considerations and potential as a source of revenue

Practical considerations should not be a problem as the technology already exists and has been utilised. Even in South Africa, electronic equipment providing vehicle identification is currently being installed at an increasing rate in heavy goods vehicles for a variety of reasons (see for example SA Transport, October 1992). This could, in due course, facilitate the introduction of charging based on automatic vehicle identification in this country. The cost of implementing the system need not necessarily be a constraint as Cohen (1987: 240) points out, although it would obviously be a practical consideration for developing countries owing to the technological requirements of the system:

"the actual costs of road pricing systems may be quite small, certainly not inherently more expensive than electricity, water or telephone monitoring or metering systems".

The administration costs of such systems should also be fairly low (Heggie, 1995: 63). Enforcement is a weakness in the system, as it would require fairly stringent monitoring and enforcement for fee evasion.

4.8.3 Third tier charges: charges which account for the differences in benefits or costs occasioned by vehicle classes

Third tier or third structure charges are one of the less commonly used instruments of road user charging and attempt to account for differences in benefits derived or costs occasioned by various vehicles classes. The underlying rationale for a third tier charge is that it would complement the normal user charging combination of first and second tier charges of a licence fee and fuel levy, in the process ensuring a more efficient user charging system. This is because a two tier charging system of a licence fee and fuel levy can undertax heavy vehicles and can be rather inequitable between users in the same weight groups. Third tier charges are generally more difficult to administer than a fuel levy or licence fee and can be classified in several categories: gross receipts taxes, mileage taxes and fuel surtaxes. These are discussed in more detail in US Department of Transportation (1968). The consensus reached in this document was that, in practical terms, an optimal combination of user charges would be that of weight and fuels charges for small vehicles, and fuel and mileage charges for heavy vehicles, as a means of arriving at an improved distribution of road user costs. The US Department of Transportation study concluded that the most promising third tier charge is the weight-distance charge. In this section, the latter shall be the only third tier charge to be examined as this is the only example which has been employed to any extent, which has the most potential and is the most practical to administer.

4.8.3.1 Weight-distance charges

Weight-distance charges have been utilised in a number of countries, namely New Zealand, Iceland, Norway and Sweden. The technique involves the purchase for all diesel vehicles of a licence which is graduated according to axle configuration and gross vehicle weight (based on the premise that heavy vehicles do more damage to the road) (Fwa & Sinha, 1987). The charges are then calculated from the distance information captured in sealed hub odometers or other distance metres. The charge rate will increase with vehicle weight (Heggie, 1991: 19; Heggie, 1995: 64). The system of weight-distance charges is most advanced in Iceland and New Zealand, where the revenue generated from the sale of weight-distance licences is kept separate from that of general taxes and is paid into a special account utilised for expenditure

on roads. The application of the system in Norway and Sweden is similar, although the proceeds are not channelled into a separate road funding account.

Allocative efficiency

The weight-distance charge is directly related to road use and is easily distinguishable from general taxes and, like tolls, recognised by those having to pay the fee (Heggie, 1995: 63). Evaluating the weight-distance charge in terms of the criterion of allocative efficiency, the technique has much to recommend it. The reason for employing third-tier charges to user charging systems has been to improve the allocative efficiency of those systems, the contention being that the traditional two-tier set-up not being able to impose an appropriate burden on different classes of vehicle according to their respective cost impacts on the road infrastructure.

The difficulty just described has, to a significant extent, been due to the fact that the components of the vehicle's weight (covered by licence fees) and distance travelled (represented by fuel levies) is separated in the two tier system, complicating the assignment of cost responsibility (Varma & Sinha, 1990: 297). The weight-distance charge attempts to combine the two measures of impact. Thus, the weight-distance charge does serve to enhance allocative efficiency.

Equity

The criterion of vertical equity is also satisfied by the weight-distance charge to the extent that it aims to attribute fair road-use charges to vehicles in different weight classes. The weight-distance charge seems to be equitable horizontally, extracting the same amount of revenue from road users making similar demands on road infrastructure, one of the main advantages of this charge. However, it performs poorly in terms of income redistribution and could indeed be regressive as the impact of the charge will almost certainly be passed on to the consumers of the goods transported.

Practical considerations and potential as a source of revenue

The weight-distance charge is not without its administrative problems, however. Evasion is simple and can be accomplished by purchasing a licence for a lesser weight than actually

conveyed. Therefore, enforcement is a critical component of the system. Weight-distance charges were introduced in states in the United States in the 1930s but were later withdrawn from use due to the practical difficulties experienced such as high costs of administration and high rates of evasion (Varma & Sinha, 1990: 297). This problem could be overcome by improvements in data capture methods and technologies which have come about in recent years and which have been capitalised upon by the countries presently utilising these charges. In New Zealand, collection and enforcement costs are estimated at 5 per cent of gross revenues and evasion is approximately 10-20 per cent (Heggie, 1991: 19; Heggie, 1995: 64). Cnossen (1977: 64), on the other hand, argues that the collection costs involved are high because of the need for stringent weight and distance checks to ensure enforcement. As the technique has been applied fairly successfully in the countries named previously, there seems to be no reason why it could not be implemented in any country with an efficient taxation administration (Heggie, 1992: 6) and effective enforcement. The use of electronic vehicle identification technology in heavy vehicles, dealt with earlier in this chapter, will facilitate weight-distance charging in the future, adding a potentially significant source of revenue to the array of user charges available. The weight-distance charge could be applied most effectively on a national and/or a provincial level.

Newbery (1988: 130) contends that the approach adopted in New Zealand, which involves heavy goods vehicles paying for licences to carry a given load over a given distance, can be simplified for groups of road types and strengths, as well as for categories of weights, if the legal weight limits for heavy vehicles are adequately enforced. Newbery (1988: 122-126) goes on to discuss in some detail how road user charges based on damage inflicted upon roads may be calculated. On the strength of empirical evidence he suggests that this type of road user charge could recover between one-half and three-quarters of road maintenance costs from heavy road vehicles.

For a detailed comparison of four variations of the weight-distance charge, i.e. the vehicle kilometre, ton-kilometre, imputed gross revenue and inverse elasticity charge, see McGillivray and Neels (1978).

4.9 CONCLUDING REMARKS

General taxes are a sound means of financing rural and interurban roads which are not well-utilised as these exhibit characteristics of pure public goods. Well-utilised interurban and urban roads have been shown to possess elements of privateness and so can be financed as nonpure public goods. The market for roads, however, is characterised by elements of natural monopoly as has been described in this chapter and the employment of user charges rather than general taxes is considered appropriate to finance those roads which display privateness as nonpure public goods.

Concerning the list of user charging instruments presented in this chapter, the following points can be made:

- Licence fees and fuel levies have much to recommend them due to their ease of collection, administration, allocative efficiency, potential to enhance equity and significance as sources of revenue and will remain the principal components of any user charging programme, although there are questions around the long term viability of fuel levies;
- Tolls, electronic charging, parking charges and ALS schemes have potential in the urban context, but inadequacy as a source of revenue and public acceptability respectively remain problems; and
- Weight-distance charges are a feasible means of addressing the problem of charging heavy vehicles for the use of road infrastructure in an equitable manner and show much promise in this regard.

The important issue which now arises is the means by which the funds obtained through the levying of the various road user charges described in this chapter may be secured so as to flow back into the maintenance and construction of roads.

CHAPTER 5**THE ALLOCATION OF REVENUE TO THE FINANCING
OF ROAD INFRASTRUCTURE****5.1 INTRODUCTION**

The issue that will be dealt with in this chapter is that of how the revenue obtained from taxes or from road user charges can be channelled back into the funding of road infrastructure, whether it be for the purposes of maintenance of existing or construction of new infrastructure. Accordingly, the discussion in this chapter will encompass the range of methods by which funds may be allocated to roads:

- general fund financing;
- earmarking of taxes;
- direct user charges.

The discussion in this chapter has been divided into two parts. Firstly, the notion of general fund financing will be compared and contrasted with that of tax earmarking. Secondly, tax earmarking and direct user charging will be discussed. It must be emphasised at the outset that the general fund financing approach differs sharply from either tax earmarking and direct user charging, the differences between the latter two concepts being rather more subtle.

5.2 GENERAL FUND FINANCING VERSUS TAX EARMARKING**5.2.1 The general fund financing approach**

General fund financing is defined as the:

"...financing of services in a way that does not allocate taxes to particular goods and

services but finances them by revenues collected for all purposes" (Hyman, 1987: 614).

Therefore, this approach involves the allocation by central Treasury of funds for the maintenance and construction of road infrastructure financed from general taxation revenues. This means that revenues accruing from general taxes, including revenues from possible taxes on road users such as a fuel tax, are added together and placed in the general account at the disposal of central Treasury for allocation to the various functions, such as defence, education, health and so on. Naturally, this is a heavily centralised system as the subsequent expenditure allocations to both executive departments and lower levels of government are determined entirely by the priorities of the central authority after an assessment of the needs of the different sectors.

5.2.1.1 The case for the general fund financing approach

The advantage of the central allocation of expenditures in this manner from general taxation revenues is that it makes for good budgeting practice as it allows for a certain amount of flexibility in the allocation of expenditures to the competing needs which confront central government (Musgrave & Musgrave, 1989: 222). This is because revenues from all sources which are obtained in the form of general taxes are allocated to the expenditures which the central authority deems important on an annual basis. This approach has been adopted in South Africa in the recent past for this very reason. Indeed, the case for the general fund financing approach to the allocation of expenditure was set out in Croeser (1990), where the aforementioned author also sought, in effect, to make a case against the use of earmarking and dedicated funding in the case of roads:

"(W)e may maintain that all levies on road users are simply taxes of one kind or another and as such should end up in the central Treasury and form part of the general pool of revenue. Roads are just another good to be paid for by the taxpayer...

...above all, it would not be in accordance with sound public finance to attempt to match specific taxes and specific public benefits. That way lies fiscal anarchy." (p.16)

Croeser (1990) concludes by dealing more directly with the issue of competing claims on tax revenues:

"In short: there can be no justification for the diversion of scarce resources (for which read tax revenue) to specific functions outside the government's prioritisation process, where the spending decision is uninhibited by the competing claims to those resources: this is subversive of all sound principles of public finance, and moreover it can simply not be tolerated in a situation where the politico-economic demands on the Treasury are being upped remorselessly." (p.20)

The general fund financing approach is therefore aimed at ensuring that the budgeting authority has maximum flexibility and can allocate funds in accordance with changing priorities.

5.2.1.2 The case against the general fund financing approach

An important point that should be noted in arguing for a general fund financing approach through the budget allocation is that it assumes that the budgetary process works properly and is undertaken with a fair measure of transparency (Musgrave & Musgrave, 1989: 222). This would certainly be the situation in a perfect world. However, the disadvantage of the general fund financing approach is that it can lead to uncertainty in the allocation of expenditure amongst functions, with allocations in danger of becoming *ad hoc* and dependent upon the bargaining power of the different functions. This can lead to fluctuations in the amounts of funding allocated to various sectors. There is also the danger that the basis for decisions that are taken will be political expediency and not economic criteria.

Further advantages and disadvantages of the general fund financing approach are set out in the course of the discussions on the other approaches in the sections which follow.

5.2.2 Allocation of funding through earmarking of taxes

This option for the allocation of funds to the roads sector involves the employment of

specified taxes (e.g. the revenue accruing from a tax on any specified good or service, including a fuel tax for example) the revenues of which would then be earmarked at a central level to be allocated to the roads sector via a dedicated road fund.

The practice of earmarking has been defined as "the practice of designating or dedicating specific revenues to the financing of specific public services. It is discussed under such headings as 'special funds,' 'segregated budgets,' 'dedicated revenues.' Normally, earmarking as a term is used with reference to the dedication of a single tax source to a single public service within a multitax, multiservice fiscal unit, but the identical effects are produced by the creation of special-purpose fiscal units, such as school districts, fire districts, and sanitation districts, each of which is granted independent, but restricted, taxing powers." (Buchanan, 1963: 457-458).

Thus, in essence, earmarking involves the assignment of revenues obtained from specific sources to specific end uses or purposes. This must be distinguished from the notion of general fund financing, which involves the allocation of expenditure to various functions from the general pool of revenues resulting from the deliberate consolidation of tax receipts (Anderson, 1991: 16).

It is important to bear in mind, as Bird (1992: 174) argues, that the earmarking of revenues does not comprise a "homogeneous set of practices", but can indeed assume many variations. For example, whilst the more defensible approach to earmarking would ensure that the revenues and expenditure are use/benefit related (e.g. fuel tax and road infrastructure), it is not uncommon for tax revenues to be earmarked for uses with no direct relation whatsoever between the two.

Earmarking can therefore vary in its implementation. Revenues from identified taxes (e.g. fuel tax or licence fee) can be channelled into a special fund (e.g. road fund) from which specific payments will be allotted. This fund can be administered directly by government (e.g. Department of Finance and Department of Transport), or revenues obtained can be directed to the institutions involved in actual implementation without passing through a Treasury account at all. At the same time, expenditure allocations to the functional areas identified for

funding may be supplemented by revenue from other sources such as general taxes. Also, not all revenues received from earmarked taxes may be directed solely to the activities identified, a portion thereof being directed to other purposes. Other variables which can be applied include the period of time for which the revenues are assigned to funding the stated purposes, as well as the rate and base of the taxes or levies utilised (Bird, 1992: 171-172).

The concept of earmarking has additional characteristics. These include what Bird (*ibid*: 172) refers to as "strong" and "weak" variations of earmarking of revenues. The "strong" version of earmarking involves the allocation of all revenues (and only those revenues) accruing from the earmarked taxes to the specified activities, with a specified base and rate applied on an indefinite time period. This means that the level of funding allocated to the areas identified will vary only with the yield of the earmarked taxes and charges. The "weaker" concept of earmarking implies that the allocation of expenditure to the recipient functional areas will not necessarily be reduced if the revenue yield from the sources of funds falls; similarly, expenditure allocations will not automatically rise should revenue yields increase.

The "strong" and "weak" forms of earmarking are the two extreme versions of the concept, with several different types of earmarking lying in between. One such example is that of the "rational" strong form of earmarking. This notion is employed where the objective of the tax is to approximate a price or direct user charge for the good provided, and the amount of revenue obtained is used to signal whether the level of activity should be expanded or reduced. The need for taxes and levies to be used as proxies for pricing would arise when correct pricing, signalled by the intended recipients through their willingness to pay for such services, is not technically possible.

Other variations of the concept of earmarking include: the expenditure form of earmarking, whereby a fixed percentage of expenditures are earmarked for a particular function; the general revenue sharing form of earmarking where a fixed share of revenues collected by central government must be transferred to other levels of government.

5.2.2.1 The case for the earmarking of taxes

There is a strong case to be made for the use of earmarking in the determination of funding levels. If certain taxes are linked to certain expenditures, this can approximate, to some extent, the charges on the consumer of the good - this would be the case with the fuel tax. Musgrave and Musgrave (1989: 222) suggest that this linkage is efficient in that the tax will charge according to variable cost, and equitable as costs will be apportioned according to benefits derived (i.e. by the road user in this case). The method is, therefore, in line with the benefit principle (McCleary, 1991: 85), and has much to recommend it on both equity and efficiency grounds due to its capacity to link revenues and expenditures through the notion that the impact of taxes should be borne by those who benefit from the associated expenditure (Bird, 1992: 176; Teja & Bracewell-Milnes, 1991: 19). In so doing, the benefit approach should imply that the tax contributions of the individuals will be linked to the marginal benefits derived from the goods consumed (use of the road). Hyman (1987: 328) makes the point that because the production costs of public goods need to be shared to ensure efficient allocation and reflect the marginal benefits of public goods, the benefit approach can be a useful means of ensuring efficiency, and earmarking has merit (i.e. where the taxation system is sufficiently well-designed so as to facilitate the linkage of tax payments with benefits accruing to the taxpayer).

Musgrave and Musgrave (1989: 222) also argue that, by linking specific taxes and expenditures, voting on these issues (i.e. when budgets are allocated and approved) will be enhanced as preferences are more easily revealed and expenditure decisions can be taken with that much more certainty. Teja (1988: 523-526) suggests in this regard that earmarking will assist in the reconciliation of the various preference schedules which exist in the economy thereby, it is believed, serving to assist in the efficient allocation of resources to the provision of public and quasi-public goods in a democratic market economy. By linking particular revenues and expenditures, it is believed, fiscal decisions can be compartmentalised and a high level of rationality be brought into the decision (Bird, 1992: 177). This, Buchanan (1963: 458-459) argues, is because each individual in his capacity as a voter, taxpayer or beneficiary of public goods is able to participate in several of the public expenditure decisions separately. This implies that the individual can "vote" on the allocation of funds to various functions,

whether it be road infrastructure, education, health or whatever. Earmarking will, then, enable the individual to make something of a private choice as to the provision of a particular public or quasi-public good, which would not occur under the regime of general fund financing, where the individual only receives the opportunity to "vote" on a broad allocation of expenditure to all such goods on a collective basis, as it is presented to him by the authorities.

An added advantage of earmarking *viz-à-viz* general fund financing is that the latter is non-Pareto efficient in terms of Lindahl's theory (see Section 2.6.1.1). Using a model consisting of two individuals and the consumption of two pure public goods and a private good, it is suggested that a move from earmarking to general fund financing will leave both individuals worse off (Teja, 1988: 524-525).

In terms of preference revelation, earmarking has an advantage over general fund financing. Teja (1988: 526), and Teja and Bracewell-Milnes (1991: 16) utilise a practical example to illustrate the distinction between the two methods in this regard. Within an earmarking scenario, the argument goes, the equilibrium quantity of an individual public good is set by a specific vote on expenditure combined with a specific set of taxes to fund that expenditure. The opportunity cost to voters of, for example, an additional battleship for the navy (or, for that matter, additions to the road network) is in the form of higher taxation and not reduced expenditure on other goods. In juxtaposition, general fund financing moves away from this compartmentalised approach because it involves the separation of voting for, on the one hand, the magnitude of the budget and, on the other, the composition of expenditures. Owing to this separation of revenue and expenditure, the opportunity cost of an additional battleship (or extra road project) is not higher taxation but reduced expenditure on other public goods.

The significance of the above for the current debate is that voters, who may have approved an increase in taxes if the revenue so obtained was earmarked for the financing of road infrastructure, may feel disinclined to vote for increased taxes in the context of general fund financing if the revenue so obtained will be directed towards other objectives such as defence. Earmarking is then the better method of the two in addressing voter preferences. This is because the general fund financing approach assumes that there is a single preference function

for public (i.e. pure public goods) and quasi-public goods (i.e. nonpure public goods), whereas proponents of the earmarking option argue that individuals and groups hold varying preferences for public and quasi-public goods (Bird, 1992: 177).

If it is accepted that earmarking is more able to reflect varied preferences for public goods and quasi-public goods than the general funding approach, then earmarking should be able to encourage taxpayer support (and lessen associated taxpayer resistance) for particular funding channels for specific areas of expenditure (Buchanan, 1963: 457); this will also be accomplished if revenues and expenditures are seen to be directly linked. It also has the potential to appeal to groups with a direct interest in the activity in question, e.g. road users, if the level of taxation is such that is limited to what is required to fund that activity and nothing more. In this way, consensus as to the allocation of expenditure can be achieved on issues where consensus would have otherwise been unattainable. This process has the added advantage of generating new sources of revenue (McCleary, 1991: 85).

Moreover, it can be argued that taxpayers will be more favourably inclined towards the payment of taxes and levies if they can easily discern the subsequent allocation of expenditures. In the case of road users, resistance to the payment of fuel taxes, for example, could be lessened if the revenues thus generated are seen to be channelled into the construction and maintenance of road infrastructure. This rationale would also apply to other potential instances of earmarking.

General fund financing differs substantially from earmarking as each involves different processes of budgetary choice and, therefore, different results in terms of budget allocations (Lee & Wagner, 1991: 114-115). In the process of earmarking, levels of taxation and expenditure are determined at the same time for each item of expenditure, e.g. roads, etc. If such a process represents the choice of the median voter, then the overall budget in the context of rigorously applied earmarking would be the sum of the decisions of the median voters for the individual goods the allocations for which make up the budget.

However, this is not the case with general fund financing. The choice of taxation and charging is separated from the choice of expenditure allocation, in that taxation levels are first decided

by government, and the decision as to expenditure allocation taken thereafter in the context of total revenues received. Lee and Wagner (1991: 114-115) argue that shifts in budgetary allocations which occur in general fund financing serve to destroy the uniqueness of allocations which result from the median voter model. This means that the general fund approach can lead to either increased or decreased levels of aggregate spending as well as to variations in the composition of the budget, which can result in uncertainty over the budget allocation process.

The contribution that earmarking can make to solving the budgetary problems, particularly those of developing countries, go some way towards offsetting any disadvantages which can be cited against it (Bird, 1992: 176). This is because the budgetary process under the general funding approach is not only fraught with uncertainty as mentioned previously, but can also be extremely inefficient as it requires a great many controls throughout to counter the arbitrariness which can result - these checks can be complex and therefore time consuming. In contrast, earmarking entails more direct accounting control as receipt and disbursement of revenue is compartmentalised and not of a broad, complex nature.

Earmarking can also be credited with the provision of a minimum level of funding for the activity in question, thereby avoiding the haggling and "horsetrading" which would occur within the bureaucracy and between the bureaucracy and the legislature over levels of funding under the general taxation scenario (McCleary, 1991: 85). In so doing, earmarking provides a measure of consistency and continuity of funding which can facilitate long term planning in the sectors concerned (Julius & Alicbusan, 1989: 31). This is especially important if rational budget allocations are impossible, so that an adequate level of funding can be set aside for high priority areas. Earmarking will then ensure that funding is available for capital/development expenditure on infrastructure projects which could otherwise be underfunded (Teja, 1988: 531). This stability in the amount of funding guarantees a level of activity in the area concerned, ensuring that an optimal utilisation of funds occurs so that an overcapacity of equipment in the sector does not result for example (ibid, 1988: 531). The costs involved in these sorts of infrastructure projects will also be that much lower due to the timeous completion of the projects.

Earmarking of revenues, because they are intended as a long term feature of budget allocation, have the potential to facilitate deals between participants in the legislative process and through this can enhance welfare and contribute to the continuity of funding to activities such as road infrastructure development (Teja, 1988: 529).

With respect to the issue of earmarking introducing the constraint of rigidity into the budget allocation process it can be argued, firstly, that (Teja, 1988: 532; Bird, 1992: 175):

- the assumption that under general fund financing, budget allocations will be regularly reviewed and adjusted accordingly simply does not stand up to empirical scrutiny. Much budgeting occurs incrementally rather than through a rigorous evaluation of revenue and expenditure each year;
- it is assumed that there is a clearly discernible social preference function for public and quasi public goods which can be met by periodic revision of expenditure allocations - this is also not so. Preferences and allocations do not always coincide;
- although earmarking may indeed introduce rigidities into the budget process, their effect can be reduced by adjusting the tax base or rate applied; and
- an activity can be financed jointly by both earmarked revenues and funds obtained from general taxes.

In making a case for general fund financing in the previous section, Croeser (1990) makes a fundamental error. This is to view roads as "just another public good to be paid for by the taxpayer" (Croeser, 1990: 16). As has been shown in Chapter 2 of this dissertation, roads display significant elements of privateness to the extent that it is possible for government to make a deliberate choice as to whether they should be provided by the "tax route" or the "price route". Quite clearly, Croeser's choice is the "tax route".

There are good reasons for disagreeing with this choice. In the case of true public goods, nonexcludability and nonrivalness render rationing by way of market-type processes

impracticable. Thus, government is obliged to intervene to do the job instead. Having done so, it is correct for rationing to take place through the prioritised apportionment of funds to alternative uses. However, this is a second-best alternative to market allocation, required explicitly and exclusively in instances where the market fails to ration resources appropriately. Such second-best solutions must be kept to a minimum if the difficulties encountered by centrally-planned economic systems are to be avoided. It is extremely undesirable for activities which could be funded by way of market-type activities to be lumped together with true public goods and financed out of general revenues.

This reasoning enables a proper distinction between public and private sector activities to be drawn. Proponents of general fund financing, such as Croeser, draw this line inappropriately, suggesting that the provision of all goods with elements of publicness should be placed under the control of the Treasury. It is suggested that this view is only correct for those goods classified as pure public goods which display overwhelming elements of publicness. However, with goods which possess elements of privateness, the proper criterion relates to the possibilities of rationing and follows the user pays principle of efficiency: is it possible to use market-type mechanisms to generate price signals or is it not?

In the case of roads which display elements of privateness, rationing is clearly possible through pricing. In direct user charges in the form of fuel levies, for example do not achieve the direct correspondence between expenditure of revenue and receipt of service as that attained through the use of free market prices. However, they do manage to provide a reasonable correspondence between expenditure on fuel by the road user and the quantity of road service received in return. Also, the most important feature of rationing is that it must be possible for users to indicate their preferences for the quantity of the good they consume. It is possible to offer road users higher or lower levels of road services and to gauge their willingness to pay for these by linking them with higher or lower tariffs. However, it will be impossible to do this in the absence of dedicated funding and earmarking, and this is a major blow to the objective of economic efficiency.

Thus, it is inefficient to allocate a fixed percentage of revenue from one or other tax to a specific function because the most appropriate allocation may be greater or smaller than this

amount. However, Musgrave and Musgrave (1989: 222) argue that "...other uses of earmarking may be appropriate...First, particular taxes may be linked to particular expenditures because tax payments are equivalent to (or are held to approximate) charges imposed on the consumer...(T)his holds to some extent for gasoline taxes."

5.2.2.2 The case against the earmarking of taxes

Earmarking has had something of a chequered history in that it has been applied haphazardly and halfheartedly in many situations. It is also burdened by the fact that it has come to be perceived by some economists as being associated with old-fashioned fiscal systems, particularly when juxtaposed with the notion of "modern budgeting" where the emphasis is on a unitary budget designed to facilitate the allocation of expenditure (Bird, 1992: 174).

According to McCleary (1991: 81), most economists are sceptical about earmarking. McCleary argues that it is difficult in practice to arrive at pricing and taxation arrangements that will result in an appropriate allocation of resources for the sector in question and still require minimal administrative involvement. Efficient pricing and charging can lead to unbalanced budgets for the earmarked fund, and in turn, to renewed dependence on the central budget.

One of the principal arguments against earmarking is that it is not in accordance with the precepts of good budgeting procedure due to the fact that in linking certain revenues with expenditures, in this case the fuel tax and roads, it makes for an element of rigidity in the process. This is because, it could be argued, the appropriate allocation of funding to the roads sector may be higher or lower than that dictated by the earmarking approach (Musgrave & Musgrave, 1989: 222). The general fund financing approach, on the other hand, could possibly allow for more timely adjustments in the allocation of funding to be executed.

Indeed, strong criticism can be made against the earmarking of revenues. The practice has been cited as "probably the worst danger to good budget practice" (Julius & Alicbusan, 1989: 30) because, it is argued, it inhibits effective fiscal management and budgetary control by removing some activities from periodic review and control (Bird, 1992: 174). The latter point

does depend, however, on whether earmarking is provided for in terms of statute law or guaranteed constitutionally (McCleary, 1991: 84). Also, the revenue structure can be rendered inflexible and unresponsive in the face of changing conditions and requirements (Bird, 1992: 174), thereby constraining the ability of the budgetary authorities to transfer resources in accordance with sometimes rapidly changing priorities (Julius & Alicbusan, 1989: 30). As a result of this, earmarking can lead to an overall misallocation of resources in the budget, as some areas will tend to be over-supported and others under-supported financially (Teja & Bracewell-Milnes, 1991: 27). Given these problems, a case can therefore be made that the practice of earmarking impinges on the independence of the budgetary authorities (Buchanan, 1963: 458). The redirection of resources in response to changing situations and the implementation of policy are thereby effectively neutralised. Of course, these arguments can be diluted to an extent if the earmarking arrangements are periodically reviewed in line with circumstances. Lee and Wagner (1991: 112), however, sum up the issue as follows:

"It is more likely, however, that earmarking would be regarded as inferior, because, to the extent it could actually modify budgetary outcomes, it would do so by injecting obstacles and rigidities into the budgetary process, thereby impeding the activities of the budgetary authorities in their efforts to promote social welfare." (p.112).

Whilst it may be said that earmarking offers a short run advantage due to the fact that it avoids the inefficiencies of the general fund financing system and that it affords interest groups and politicians some protection of their pet projects, it lessens the pressure to improve the budgetary system and, therefore, impacts upon the long term efficiency of the budget allocation system. Although earmarking should not be rejected out of hand as an option, Bird (1992: 177) argues, "on the whole this argument seems strong enough to constitute a conclusive point against earmarking in all but a few instances." (p. 177).

Over time, earmarking arrangements can become embedded in the financial structure to the extent that they are seldom, if ever, reviewed. Even in cases where the need for earmarking (or for that level of earmarking) has long since passed, it is not unusual to find these arrangements still in place, adding further to the distortions described previously (Teja & Bracewell-Milnes, 1991: 27). Often earmarked funds expand beyond what is required and end

up providing extravagant support for the function concerned, in the process weakening incentives to control costs (Julius & Alicbusan, 1989: 31). One of the main reasons for the failure of earmarked revenues and dedicated funds has been in their application, where the fund is simply allowed to grow out of proportion to the requirements of the sector, an example of this being that of Colombia where the fuel tax generated excessive revenue and thus became an attractive target for a government seeking additional funds (Bird, 1992: 175).

The administration costs associated with several smaller funds are suggested to be probably greater than those of administering one general fund (Julius & Alicbusan, 1989: 31). Although this may be true at face value, the costs involved with the determination of the myriad budget requirements and allocation of expenditure to meet those requirements should not be underestimated.

The aforementioned adherence to the benefit principle does have the disadvantage that it can be difficult to assess the benefit derived by the individual user and revealed preferences may not be entirely adequate. However, this argument does not apply that strongly in the case of roads and road usage as use can be measured by fuel use, for example.

5.2.2.3 Practical applications of tax earmarking

Both Japan and the United States have developed sophisticated systems of earmarking specific taxes to a special road fund dedicated for the purpose (Heggie, 1995: 26). In Japan, the system involves the earmarking of revenues from the fuel tax and part of a tax on liquid petroleum gas for allocation to roads at national level. A portion of revenue from the taxes is paid directly into the Road Improvement Special Account, whilst the remainder is channelled to the General Account and then into the Special Account. Funding for local roads is obtained from tax revenues collected by national government and passed on to local authorities (e.g. a motor vehicle tonnage tax and local petrol tax), as well as from tax revenues collected at a local level (such as local diesel tax). Where appropriate, general tax revenues are used to supplement the Road Improvement Special Account and local authority funds. The actual tax rates applied are proposed by the Ministry of Construction in consultation with local authorities, with final approval being the prerogative of the Ministry

of Finance; tax rates are revised every five years. Responsibility for the subsequent administration of the expenditures lies with the Ministry of Construction.

In the United States where earmarking has been extensively applied for some time (Buchanan, 1963: 458), earmarked taxes are directed to the Federal Highway Trust Fund, essentially an accounting mechanism, and are then used to finance the federal highway program of the Federal Highway Administration. Anderson (1991: 20) makes the point that the United States federal government does not formally use the term "earmarking", but does, in effect, practice earmarking by directing certain revenues into various trust funds which are utilised to finance specified programmes, of which the federal gasoline tax and the aforementioned Highway Trust Fund would be a prime example. Revenues collected for the Trust Fund are fuel taxes, a tax on tyres for heavy vehicles, a retail tax on certain heavy vehicles and a use tax on heavy vehicles. Tax rates are periodically adjusted. Most states in the United States have their own highway or transportation accounts which are funded by taxes collected at a state level. Local authorities also have the responsibility for financing local road infrastructure from local and state sources of revenue (Heggie, 1995: 26).

On a practical level, it would appear that earmarking has not enjoyed much success, indeed World Bank experience bears this out (McCleary, 1991: 81). The lack of success of earmarking as it has been applied can be attributed at least in part to the commitment to the concept of the governments which have sought to employ the technique. In some cases, governments have arbitrarily withheld allotted funds or suspended the arrangements in place in order to channel revenue from the funds back into the general fund (ibid, 1991: 81).

The problem of government raids on the road fund has been a characteristic of the implementation of the concept, as has been mentioned earlier. In Britain, a Road Fund was established in terms of the Roads Act of 1920. The Act provided for the transfer to the Road Fund of all revenues from the Road Improvement Fund account which had been set up in 1909, these revenues consisting of proceeds of motor spirit duties and carriage licences. From 1921, the Road Fund was also financed by licence duties on mechanically propelled vehicles and, to a lesser extent, fees from drivers' licences and goods vehicle licences. Raids on both the Road Improvement Fund (in 1915) and the Road Fund (in 1929, 1935 and again in 1936)

occurred before the Road Fund was relegated to simply being a mechanism for administering a Parliamentary Grant in Aid from 1937 to 1955. The Fund was used to finance road construction and maintenance and was finally abolished in 1955 in terms of the Miscellaneous Financial Provisions Act. From 1955 to the present, road funding has continued in Britain without a Road Fund.

As can be seen from the British experience, tremendous discipline is required on the part of government to keep from raiding the dedicated road fund when it becomes temptingly healthy.

5.2.2.4 Concluding remarks on tax earmarking

In addition to everything else, economists continue to disagree on the merits and worth of earmarking (Buchanan, 1963: 457). Bird (1992: 179) sets out the relative merits of the various methods in the following way:

"While direct prices or user charges are better on efficiency grounds than earmarking, the latter, when correctly designed, is often better than general-fund financing, contrary to what too many public finance textbooks still say." (p.179).

Even so, it is imperative for the success of earmarking that it not be applied arbitrarily with revenues from various sources funding expenditures in another sector. Preferably, revenues and expenditures must be related, which is an argument that makes the roads sector a particularly likely area, where a dedicated road fund could be financed by instruments such as a fuel tax and licence fees. Other factors which must be considered in deciding on the appropriate structure of an earmarking system are the cost structure of the sector in question, as well as the distribution and characteristics of the intended beneficiaries (Bird, 1992: 179).

An important component of road funding is the establishment of a road fund. Heggie (ibid: 77-78) suggests that this can be achieved either: through existing legislation in terms of which the Minister of Finance would be able to open a special account via parliament or a ministerial/cabinet decree; or under totally new legislation. The latter Heggie sees as a much

firmer option but does acknowledge that there are disadvantages in that the legislation would set out rules before the ministry concerned had experience in what these rules ought to be, and passing new legislation may be a difficult task in itself.

The utilisation of a road fund can have numerous disadvantages, which Heggie (1995: 79-81) puts forward based upon his experience in Sub-Saharan Africa:

- Funding problems - begin when the ministry of finance interferes with the road fund, possibly by diverting funds from the road fund, withholding funds from the road fund and so on.
- Insufficient road fund coverage - occurs when the road fund is used to finance a part of the expenditures, with the balance coming from the government general budget. Once roads receive revenue from the road fund, it becomes difficult to obtain funds from the general budget.
- Excessive road fund revenues - has been dealt with earlier in this section, occurs when the road tariff is set too high, and the road fund becomes a tempting target for government, as happened in South Africa in 1988.
- Legal problems - can occur if legislation for the road fund is drawn up too hastily, and is consequently vague or ambiguous leading to problems later.
- Ineffective and inconsistent management - occurs in the absence of a road fund board, or when the road fund board membership is affected by interest groups, as in South Africa where members held provincial not national agendas.
- Inconsistent road tariff - the tariff is unable to convey a clear signal to road users because the charges are not linked strongly enough to road usage (e.g. Ghana where revenues from vehicle inspection fees and kerosene taxes are paid into the road fund - it is preferable to employ direct and strong indirect user charges such as those set out in Section 4.8 of this dissertation).

- Inability to adjust the road tariff - occurs where there is no mechanism to adjust the road tariff outside normal taxation procedures, which renders any timeous adjustment for inflation or for requirements of the road network extremely difficult.
- Poor mechanisms for objectively allocating funds - allocation of funds can be left to political whim and a result is that allocations become inconsistent in terms of needs and subject to political horsetrading between interest groups.

While the practice of general fund financing has strong arguments to recommend it, and is vigorously proposed by governments around the world, it has become apparent from the sources examined and the arguments put forward thus far in this chapter that earmarking of taxes is more theoretically defensible. However, the latter concept should be carefully applied and continually monitored in terms of the amount of revenue collected, the requirements of the specific sector - roads in this case, and the base and rates of charges to be used. If extremely carefully applied, tax earmarking stands a better chance of avoiding the major problem it has encountered, that is where the revenue collected and channelled into a dedicated road fund is permitted to grow excessively to the point where it becomes a temptation to governments requiring revenue. The remaining option, that of direct user charges, therefore arises as the first-best solution and it is to this option that the discussion now turns.

5.3 TAX EARMARKING AND USER CHARGING

The groundwork for this discussion has been laid in Chapters 2, 3 and 4 of this dissertation, where the point was made that certain roads do possess the characteristics of privateness, in terms of the criteria of excludability and consumption, and therefore can be funded by properly constructed user charges in the context of a natural monopoly.

In the preceding section, the relative merits of general fund financing and tax earmarking as veritable polar opposites were analysed. The discussion now moves to examine the related notions of tax earmarking and user charges, and the similarities and somewhat subtle differences between the two will be outlined.

5.3.1 Tax earmarking and direct user charging compared

User charging has become increasingly popular internationally because it is perceived as a convenient way in which revenue can be raised by government without increases in taxation which are largely unpopular. This is because user charges are perceived as voluntary payments and are only incurred if use is made of the facility in question, whilst taxes are compulsory and unavoidable regardless of use of public services.

The difference between the closely related concepts of tax earmarking and direct user charging is generally acknowledged to be extremely subtle and has not yet been determined to any great extent in the public finance literature (Anderson, 1991: 29):

"Despite the growing popularity of user fees as a revenue-raising device across all levels of government in the United States, the precise difference between such charges and *taxes* is left dangling in the realm of public finance theory, and becomes virtually unfathomable in the realm of public policy."

However, some extremely pertinent points can be made on the differences and similarities between tax earmarking and user charging.

Of course, one of the main similarities that these two concepts share is that of conformity to the benefit principle as discussed in Section 4.2.1.1. Stated simply, the benefit principle holds that the cost of public goods should be borne by those who use these goods, and so derive some benefit from them.

In terms of the benefit principle, user charging involves the case of beneficiaries of public goods being charged directly for their use of such goods. Tax earmarking, meanwhile, can be likened to an indirect form of user charging and involves the taxation of a commodity or service closely related to the public good being supplied, and earmarking the revenues so collected for specified public activities.

Indeed, this is an important point which enables a distinction to be made between the two

concepts. User charging implies that a direct relationship exists between the receipt of a service from government and the rendering of a payment for that service. An example of a road user charge would be a toll levied on road users appropriate to their direct use of a road, and can be levied at the time when they actually make use of the facility in question and is for their direct use of the road. In the case of an earmarked tax, the link between use and payment is still there, but less direct. An example of an earmarked tax would be a fuel tax which is included in the price paid by road users for fuel; revenues so collected are then directed to expenditure on roads. Thus, both user charges and earmarked taxes are similar in that in both cases, the individuals paying the charge or the earmarked tax are the same individuals receiving the service that the revenues collected are used to supply (Wagner, 1991: 8). However in the case of direct user charges, payment is made for the direct benefits enjoyed from the use of the road facility. Revenues collected would be in proportion to the positive correlation between fuel consumption and road use and so not for the direct use of the road network as such.

This can be contrasted with the much greater difference that exists between user charges and earmarked taxes on the one hand, and general fund financing on the other. With tax earmarking and user charging, the link between use and payments exists and is strong, and it is this link that enables these concepts to "...enhance the efficiency and fairness of public sector resource allocation." (Katz Commission, 1995: 17). In the case of general fund financing, there is no link whatsoever between the use made of a public good and the payment for the use of that good. In terms of general fund financing, tax revenues are simply collected together and used for the purposes deemed critical by government, thereby being unable to assist in the promotion of allocative efficiency in the use of resources. The importance of the efficiency argument is stressed by the aforementioned report on the inquiry into the tax structure of South Africa (Katz Commission, 1995: 17). Thus, user charging and tax earmarking are in line with the benefit principle of taxation because of the aforementioned linkages between use and payment, whilst general fund financing would be more compatible with the ability to pay approach to taxation. This is reinforced by Wagner (1991: 8) where he brings together his argument of the benefit principle being in accordance with a democratic order due to its contractual footing, as set out in Section 4.2.1.1, and the whole notion of user charging:

"User charges might thus seem to represent an effort to place government more directly and immediately on a contractual footing than might characterise general-fund financing. In this way charges could represent a programme to implement more fully the benefit principle of public finance, through getting people to pay for the services they receive from government. After all, if the state is viewed, normatively, as simply a nexus of contractual relationships among inhabitants, people should pay for government only to the extent to which it is agreeable to them, which, in turn, produces some direct link between people's tax payments and their evaluations of the services government provides."

Another way of explaining the similarities between user charging and tax earmarking is to view tax earmarking as a quasi-charge or quasi-price for public goods. Methods of direct user charging do exist, such as tolls which can be levied electronically (using technology which works around recognition equipment at toll plazas and transponders fitted into vehicles - see Section 4.8.2) and weight-distance charging, which enable road users to be directly charged according to their use of the road system. However, earmarked fuel taxes are a form of quasi-charge due to the relationship between road use and fuel consumption and operates differently to direct user charging. This is because a fuel tax cannot account for the actual time that use of the road takes place but direct user charging methods are able to do so (peak load pricing), and such charging can be employed to alleviate congestion and so ration scarce road space amongst competing users. Also, a fuel tax is not able to vary according to the differences which can arise in the cost of various roads. A fuel tax with revenues earmarked for roads, then, can be described as an indirect user charge, unlike a tax levied simply to provide revenues for a general fund which is to be allocated subsequently (Wagner, 1991: 9). For example, if the revenues from a fuel tax are diverted to subsidise public transport, this amounts to a tax on the consumers of fuel to subsidise commuters. As such, it conforms more to the distribution function of government and the ability to pay principle of taxation than the benefit principle and the allocation function (see Sections 4.2 and 2.3 respectively).

5.3.2 Conclusions on direct user charging and tax earmarking

Thus, the case for direct user charging is acknowledged in the literature to be stronger than

that of conventional tax earmarking, but the latter can, however, be used as an alternative given certain conditions:

"Direct user charging is clearly superior to the indirect, quasi-charging that tax earmarking represents. But there can be many cases where direct charging is prohibitively expensive to implement." (Lee & Wagner, 1991: 112).

Whilst it can be argued that earmarking does have some merit, user charges are generally considered to be the first-best option in terms of conformity to the benefit principle, criteria of excludability and consumption and also possess efficiency and equity advantages. It is only when user charges are judged to be administratively impractical or not cost-effective to implement, that an earmarked tax can be used as a second-best instrument of finance (Teja, 1988: 527).

5.4 CONCLUSIONS ON THE USE OF THE VARIOUS METHODS

General fund financing allows government a great deal of flexibility in the allocation of tax revenues to expenditures in line with the government's priorities and policies and is currently the most popular methods of allocating revenues to expenditures in government. However, general fund financing can be criticised for resulting in bargaining between functions for allocations leading to inadequate funding for certain functions, uncertainty in allocations to functions, inhibiting continuous planning, and can erode taxpayer morale if taxes are perceived to finance areas which are not sufficiently close to taxpayers' areas of interest.

Earmarking, it is argued, is a feasible allocation tool because it can link revenues with expenditures, makes for a certain and an adequate source of funds for the function in question. On the other hand, it has led to an overrecovery of funds where it has been applied, as in the case of road funds which government has then coveted as an attractive target as sources of much-needed finance for other important activities, thereby necessitating continuous monitoring and appropriate adjustment.

The utilisation of comprehensive user charges also has much to recommend it in that it

rigorously links road use with payment therefor and is thus extremely theoretically defensible in terms of what has been outlined earlier in this dissertation, in terms of the criterion of allocative efficiency. Indeed, the similarities and overlaps between tax earmarking and user charging have also been discussed in this chapter. User charging is very much the first-best option which links use of facilities with the payment, in other words ensuring that road users pay for what they get and get what they pay for, which would be extremely difficult to achieve under the general fund financing approach. Thus, the element of taxpayer or road user support for user charging, as well as the potential user charging holds for alleviating the funding crisis for roads, would have to be set against the flexibility which would be afforded to government by the general fund financing approach in addressing a myriad other competing demands on the fiscus.

Having applied the theory of public goods to roads and found that certain road types possess the characteristics of pure public goods (i.e. uncongested rural, interurban and urban roads) and that others display elements of privateness which makes them nonpure public goods (well-utilised interurban and urban roads). The financing of roads as pure public goods has been shown to be best undertaken by general taxes, whilst those roads which are nonpure public goods ought to be financed by user charges, also because the market for roads is characterised by elements of natural monopoly. Appropriate user charges have been described and evaluated. The relative merits of the general fund financing, earmarking and user charging approaches have been examined in this chapter and found to have their respective applications. Thus, what remains now is to apply these findings to the problem of financing roads in South Africa.

CHAPTER 6**THE FINANCING OF ROADS IN SOUTH AFRICA****6.1 INTRODUCTION**

The purpose of this chapter is to analyse the financing of roads in South Africa using the theoretical underpinnings of Chapters 2 to 5. The chapter will therefore consist of three components:

- a description of road financing in South Africa up to the present;
- an examination of which road financing instruments evaluated earlier in Chapter 4 are most applicable to a road financing system;
- a proposed road financing system for South Africa.

6.2 DESCRIPTION OF ROAD FINANCING IN SOUTH AFRICA TO THE PRESENT

There are a number of phases which can be identified in this regard and each of these will be dealt with briefly.

6.2.1 Prior to 1910

Roads were built in South Africa since the earliest period of colonisation of the country and accounts of road construction have been traced as far back as 1653 (Mitchell, 1989: 26). Road construction was accelerated under the various British administrations which ran the Cape as it was realised as early as 1828 by the then Governor, Sir Lowry Cole, that road infrastructure would play an important role in the facilitation of economic activity in the country. Further development of roads in the Cape, Natal Orange Free State and Transvaal proceeded, albeit rather slowly, during the latter half of the nineteenth century, with rail as the prime mode of

long distance travel (Mitchell, 1989: 27).

During this period, funding for roads came from general taxes. However, with the formation of a Central Road Board in the Cape during the 1840s, road funds comprised a property rate supplemented by tolls obtained from toll gates, bridges and ferries. Similar systems of tolls as a supplement to general taxes for the purposes of road funding were also utilised for the remainder of the nineteenth century in the other colonies of what was to become the Union of South Africa in 1910.

6.2.2 The period 1910 to 1935

The political arrangements introduced by the inception of the Union of South Africa in 1910 also heralded a number of changes in the administration and financing of roads in South Africa. Responsibility for rail infrastructure was assigned to central government, whilst roads were retained at a provincial level. This was due to the view held at the time that rail was a strategic asset and a critical component of the national transport infrastructure and was, in any event, by far the most feasible means of transporting freight and passengers over the long distances characteristic of transport in South Africa. Road transport technology and vehicle ownership had not progressed to the point where it could be regarded as anything more than a feeder mode for rail.

From 1925, road construction took on a new urgency in the Union as it had become apparent that an established road network was to be found in any industrialising economy (Floor, 1985: 1). Finance for roads came from allocations from the Union government, and motor vehicle taxes and loans taken by the various provinces for the funding of expenditures on their networks (Floor, 1985: 27-28). Local authorities financed their own networks of urban roads from general rates. During the inter-war period, the Le Roux Commission of Inquiry into Road Competition made some recommendations in 1929 which were to have far-reaching implications for the administration and financing of roads in South Africa (see Floor, 1985: 2-3).

These recommendations included the construction of what would be termed National Roads

and Provincial Roads, aside from urban roads which would reside under local authorities. National Roads would cover those roads deemed to be of national importance and would be administered as a network in itself and connecting major urban centres, whilst Provincial Roads would be those of importance to provinces specifically, connecting smaller towns with the major centres and performing a largely feeder role for the national routes. A National Roads Board (NRB) was proposed, independent of political interference, with responsibility not only for National Roads, but also for classification and applicable standards of Provincial Roads. The National Roads Board would also be responsible for the creation of a Road Fund and would oversee disbursements from the said fund for expenditure on National and Provincial Roads. Aside from supervising the construction of new road and rail projects with the Railways Board, the NRB would also make recommendations on the taxation of motor vehicles. Municipal or urban road infrastructure was to be left in the hands of local authorities (Mitchell, 1989: 28-29). These recommendations were subsequently adopted by the government in 1935.

6.2.3 The period 1935 to 1971

The recommendations of the Le Roux Commission referred to in the preceding section were eventually accepted by government and were made the subject of legislation in the form of the National Roads Act of 1935 (see Floor, 1985: 4-6). The Act provided for a National Roads Board (NRB) as well as a National Road Fund (NRF). The NRB then embarked upon a programme of road construction and sources of funds for this programme to be paid into the NRF were provided by a fuel levy in the form of a customs duty on imported fuel, and allocations from Treasury (Floor, 1985: 28; see also Mitchell, 1989: 30). However, the amount channelled to the NRF from the fuel duty varied according to government requirements, and the NRF was also burdened by the substantial interest commitments which the NRB had taken over from the provinces' pre-1935 loan obligations.

The NRB was duly replaced by the National Transport Commission (NTC) which was established in terms of the Transport (Co-ordination) Act of 1948, with the NTC receiving powers similar in scope to the NRB (see Floor, 1985: 17-37 for an account of the activities of the Board, including the years of the 1939-45 War); in addition, however, the NTC was

to be responsible for the co-ordination of transport activities in the country aimed at maximising the contribution of the sector to the economic progress of the Union. The NTC was besieged by requests from the provinces for funds for additional road construction projects, but adhered to the plans of the NRB limiting itself to the construction of new National and Provincial Roads identified originally.

The announcement in 1961 of major additions to the construction programme, including a "freeway" component which would enhance the National Road programme then in existence, heralded a more expansive phase in the construction of road infrastructure in South Africa. In terms of the Transport Co-ordination Act of 1948, the NRF was relieved of the obligation to repay the loans of the provinces prior to 1935, but was still forced to pay the interest on these loans. However, the NTC's obligations in terms of maintenance of existing infrastructure were mounting, and more funding would have to be made available if road infrastructure was to be expanded by the NTC. Accordingly, government increased the fuel tax, with special emphasis on some of the funding to be utilised for expenditure on new construction. The increased income of the NRF was rapid - for example, the revenue collected from the fuel levy rose in the 1961/62 year by 21%. However, this resultant increased income level of the NRF placed pressure on the NTC to utilise the funds available. With the NRF flush with a seemingly limitless source of funds, road construction took an ever ambitious and expansive tilt.

However, this euphoria did not last long, as the implications of having to maintain an extensive "freeway" network once it was constructed, whilst at the same time maintaining an existing network of lesser National routes, became apparent. This problem was of a particularly vexing nature to the authorities, both at central and provincial level. The revenue being collected by the NRF was simply not sufficient to maintain the entire network of declared National Roads in existence at the time, and finance a comprehensive programme of construction aimed at the creation of a new network of roads built to "freeway" standard. The NTC then attempted, in vain, to persuade the provinces of the need to redeclare certain National routes to Provincial status, thereby passing responsibility for the funding of the maintenance of a substantial part of the existing National Road network to the provinces so as to free up funds from the NRF for the construction of a network of improved National

Roads (Floor, 1985: 62).

In order to address this problem, the Marais Commission of Inquiry into the Co-ordination of Transport in South Africa (1969) recommended that: the NRF be used to finance a national freeway system for the country; with the exception of those parts of the existing National Road network which could be improved and included in the national freeway programme, all existing National Roads would be downgraded to provincial status with financial assistance rendered to the provinces by the NTC where possible; the national freeway system be incorporated into a revised National Road network administered by a central body (Mitchell, 1989: 32). These recommendations were the basis of legislation set out in 1971.

6.2.4 The period 1971 to 1988

In terms of the National Road Act of 1971, the NTC became responsible for the administration, planning and maintenance of National Roads, and the NTC was then empowered to oversee the management of the national freeway development programme, involving both construction and upgrading of roads built to freeway standard. The programme, ambitious as it was, was subsequently revised, not least because of the funding problems exacerbated by the fuel crisis of 1973 which had made stringent fuel restrictions necessary, and which had drastically reduced the income accruing to the fund (Floor, 1985: 70). The NRF enjoyed a positive balance all this time, but this was simply inadequate and was dwarfed by the sheer scale of the eventual requirements of the expansive "freeway" programme. The entire national freeway scheme was effectively abandoned by the late 1970s, and a rethink on the provision of roads in the country was required.

A revised plan for the envisaged National Road network was put forward in the 1980s, taking into account the severe funding restrictions which had confronted the government during its earlier and more ambitious phase of freeway construction (Mitchell, 1989: 33). A transport policy study (South Africa. Department of Transport, 1984: 241) concluded in 1984 also advised that the responsibilities vested in the NTC be spread across three agencies, to be called the Transport Tribunal, a Transport Advisory Council and a newly constituted National Roads Board, the latter to oversee both National and Provincial Roads. These

recommendations were accepted and embodied in a White Paper on National Transport Policy (South Africa, Department of Transport, 1986). The White Paper also set out policy with an emphasis on deregulation and privatisation, as well as policy relating to the encouragement of toll roads with the private sector playing a more active role in the form of concessionaires who would then assist in the construction and financing of new infrastructure (ibid: 42-43).

These events must be seen in their proper context. During the 1980s, receipts from the fuel levy directed into the NRF grew steadily and would have provided a sound financial basis for the maintenance of existing and possible gradual expansion of road infrastructure for both National and Provincial requirements. However, the pressures on the fiscus generally were mounting with the deteriorating political situation in the country, and the government required additional sources of funds for its increased social and security commitments. These developments provided the impetus for a switch from the practice hitherto which had permitted the earmarking of the fuel levy for the NRF and a subsequently healthy road fund, to one of general fund financing with rigid central (Treasury) control of expenditure (see Croeser, 1990: 16-20). This situation led to significant changes in the financing of roads from 1988.

6.2.5 The final phase: 1988 to the present

The revisions advocated in the 1984 policy study were adopted, with a Transport Tribunal and Transport Advisory Council being set up. A new National Roads Board was also established, called the South African Roads Board (SARB)(through the South African Roads Board Act of 1988). The responsibilities of the former two bodies related to the resolution of disputes and advice to the Minister, whilst the role of the SARB became more important. That is, the role of the SARB was now the administration of both National and Provincial Roads in South Africa, and the allocation of funds to these networks. The critical point in this regard was that there was now a road fund from which the SARB could deal out funds to the National and Provincial Road networks. The SARB, unlike its predecessors, would have to apportion funds to National and Provincial Roads from whatever amounts the Treasury was prepared to allow to go to the NRF for the financing of National roads, and to the provinces. This was because the Cabinet had decided to abolish the dedicated road fund (which was on a positive balance

at the time) in keeping with its focus on centralised management of national priorities, so the amount of funds to be channelled to the financing of roads would be determined at a Treasury and not a Departmental level. The Annual Report of the Department of Transport (South Africa. Department of Transport, 1987/88: 73-74) has an account of these events:

"During his speech at the opening of Parliament on 5 February 1988 the State President announced that the income derived from the fuel levy would be paid direct to the Treasury and no longer into dedicated funds such as the NRF. The allocation of income derived in this manner will in future form part of the process of priority determination together with all other projects".

Thus, the fuel levy continued to be used, featuring as a component within the fuel price, but revenue collected from this item by the oil companies was no longer paid directly into the NRF, but to the Directorate of Customs and Excise of the Department of Finance (South Africa. Department of Transport, Annual Report 1987/88: 73). The other, less significant, dedicated items within the fuel price, i.e. the Motor Vehicle Accident Fund levy, the Equalisation Fund levy for the subsidisation of Sasol and Mossgas, and the National Road Safety Council levy have continued up to the present (Katz Commission, 1995: 16; South Africa. Department of Mineral and Energy Affairs, Private Communication). This meant that the fuel levy was no longer a fuel tax earmarked for the road fund, but simply a tax on fuel in accordance with the concept of general fund financing. Amounts channelled to roads from the fuel levy would then vary according to the priorities of government which managed general disbursement of the funds; this consisted of allocations from the Department of State Expenditure to the NRF.

The state of health of the NRF obviously had much to do with this decision on the part of government. The total income of the NRF from the fuel levy, toll tariffs and other less important sources amounted to R838 million in the year 1987/88 - at the same time, expenditure from the fund amounted to R578 million (South Africa. Department of Transport, 1987/88: 74), indicating a substantial positive balance of the NRF (this amount was then split between construction and maintenance of unlimited access and tolled facilities).

Since 1987/88, the income level of the NRF has fallen sharply when compared to previous years, whilst road needs have increased (i.e. maintenance and rehabilitation). As can be seen from Table 6.1 below, the NRF has been allocated a decreasing amount of income by the Department of Finance since the earmarking mechanism was abolished in 1987/88 (R840 million in 1987/88 to R570 million in 1993/94). This situation is made even worse if the figures are expressed in real terms, as the above figures are actual amounts.

Table 6.1: Income of the National Road Fund, 1985/86-1993/94

YEAR	INCOME TO NRF (R)
1985/86	404 782 830
1986/87	619 685 328
1987/88	838 187 440
1988/89	601 923 266
1989/90	586 188 000
1990/91	565 710 000
1991/92	547 507 284
1992/93	569 306 000
1993/94	569 646 000

Source: South Africa. Department of Transport (Annual Reports).

The implication of these events was that from 1987/88, the Department of Transport would then supervise the disbursement (South Africa. Department of Transport, 1991/92: 94) of a vastly smaller amount of funds (see Table 6.2 below on expenditure of which NRF would form a part), allocated by Treasury, amongst the National Roads (including toll roads) and the provinces. Naturally, the amount of lobbying for funds on the part of the provinces continued as before but became far more intense given the reduced sums of money available. This is borne out by the fact that the total budget allocation of state road authorities fell from R4000 million in 1988/89 to R2458 million in 1993/94 (South Africa. Department of Transport, 1993/94: 93). The task of apportioning funds to roads between the various

authorities was performed by the Function Committee: Roads of the Department of State Expenditure from 1992/93, which, while chaired by the Department of Transport, included representatives of all major road authorities. Provinces were still entitled, however, to the funds they managed to obtain from government, as well as those it managed to raise through instruments like the licence fees which accrued to the province in question, and these supplemented whatever funds the province managed to get from the SARB.

The restriction on funding has inevitably led to reductions in expenditure on roads. Table 6.2 sets out the data relating to expenditure on National and Provincial roads combined versus total government expenditure for the years 1986/87 through estimates for 1995/96, as well as expenditure on roads as a percentage of total government expenditure.

Table 6.2: Total nominal expenditure on National and Provincial Roads as a percentage of total government expenditure (excluding selfgoverning territories and TBVC states), 1986/87 to 1992/93

YEAR	ROAD EXP. (R'000s)	% CHANGE in RD Exp.	TOTAL GOVT EXP. (R'000s)	% CHANGE IN GOVT EXP.	RD EXP. AS % OF GOVT EXP.
1986/87	1 420 186	-	41 570 400	-	3,4
1987/88	1 621 944	14,2	49 422 600	18,9	3,3
1988/89	2 187 808	34,9	59 723 200	20,8	3,7
1989/90	2 035 648	(7,0)	74 665 300	25,0	2,7
1990/91	2 083 372	2,3	79 095 300	5,9	2,6
1991/92	2 311 849	11,0	91 450 700	15,6	2,5
1992/93	2 110 755	(8,7)	112 906 400	23,5	1,9

Sources: South Africa. Department of Transport (1995: 13) and South Africa. Department of Finance (1996: B55-B56)

Regarding Table 6.2 above, it must be noted that the former self-governing territories (SGTs - e.g. KwaZulu) and TBVC states (Transkei, Bophutatswana, Venda and Ciskei) have been excluded. The period under consideration has also been restricted to 1992/93 due to the fact that the data for road expenditure from 1992/93 to 1994/95 is incomplete and simply not available in a coherent form due to the political and institutional changes which have occurred since 1994. When changes in total nominal expenditure on roads are considered, a clear pattern cannot be distinguished. In some years, expenditure increased significantly (34,9% in 1988/89) and in other years negative growth rates were recorded (minus 7% in 1989/90 and 8,7% in 1992/93). Government expenditure, meanwhile, increased fairly steadily. However,

as a percentage of government expenditure, road expenditure has decreased from 3,7% in 1988/89, to a mere 1,9% in 1992/93. This figure is influenced both by the reduction in road funds which has led to almost static road expenditure in nominal terms, as well as the increases in government expenditure which have occurred over the last ten years.

At the same time, a programme of construction of National Roads to freeway standard was continued, but in the form of toll roads. This policy involved the tolling of any new National Roads, as well as the tolling of sections of some existing National routes, as this was seen as the only way in which new interurban roads could be built. This was because "(V)irtually no funds are available for the construction of new national roads other than those that can be funded as toll roads by means of capital market loans" (South Africa. Department of Transport, 1989/90: 54). Part of the scheme involved the private sector acting as concessionaires and operating the toll roads after completion. Also, government undertook to provide an alternative route in every case, thus endeavouring to give a choice to the road user. State ownership of the roads themselves continued, although the companies involved as concessionaires were given operation of the roads for an initial 20-25 year period (Mitchell, 1989: 34). The toll road policy encountered much resistance from road users, especially in the case of where existing roads were tolled, and eventually all toll roads were brought back under direct government control with the toll collection aspects an activity for which companies could tender. Income accruing from the various toll projects has been kept in separate accounts for the relevant toll projects and this has served to offset the deficit in funding these roads and servicing the associated loan obligations (South Africa. Department of Transport, 1993/94: 113-116). However, the roads sector continued to receive reduced amounts of funding from government overall, which meant even maintenance of the existing National and Provincial network could not take place.

This situation has continued after the country's first nonracial elections in May 1994, which brought the Government of National Unity (GNU) to power in South Africa. Road funding has come under severe pressure due to the immense social backlog facing the GNU. Roads remain classified into three groups, i.e. National, Provincial and urban. The respective networks remain as they were prior to the elections, with the exception of the provinces where some nine provinces replace the previous four in terms of Section 124 of the Interim

Constitution (see South Africa. 1994), and the urban authorities where previously "black" and "white" local authorities are in the process of merging; the overall networks of roads (i.e. length of roads) will remain the same. General fund financing still prevails, with allocations made from Treasury to the Department of Transport, which then allocates funds to National and Provincial roads, and this has resulted in a reduction in the amounts of funding directed towards roads whilst total government expenditure has grown steadily (see Table 6.2). Provinces are still entitled to licence fees collected on vehicle registered in their provinces as before. The system in use at present is a "bottom-up" approach. Extensive data on the existing road network is provided, from which maintenance requirements are determined. Also, data on proposed new (construction) projects is provided, and this is used to determine priorities in upgrading and construction. Funding for road needs is then allocated by the Department of Transport to National Roads and Provincial Roads. The problems associated with the current system are (Ringwood, et al 1994: 2-3):

- the system is time-consuming and expensive due to its immense requirements in terms of calculation, re-calculation and negotiation between authorities;
- in order for the system to be acceptable to the various road authorities, it permits little deviation from historical funding patterns and for this reason could prove somewhat inflexible in responding to future political demands;
- the system has hitherto primarily been applied to the case of a negotiation process involving four regional road authorities. How this process of allocation would be complicated by the involvement of nine individual provincial authorities is open to question;
- the system has failed to address the essential problem faced by the road authorities, that is the issue of "inadequate overall funding levels".

The authors do make the point, however, that these problems are more a product of the application of the current system than the system itself, although it does highlight possible, nay, typical problems which can arise under such systems of allocation under a régime of

general fund financing. As a means of correcting possible shortcomings of such a system, the authors propose a funding allocation system utilising multiple objective linear programming as an alternative allocation system between the provinces; this is more on the allocation side of road financing and will not be examined further in this dissertation.

The amounts of money directed to roads are such, however, that funding of even routine maintenance has fallen behind increasingly. However, the GNU is attempting to encourage the private sector to become involved in the construction and subsequent operation of new National Roads and it is the view of the GNU that these be toll facilities; private ownership of these roads has also not been ruled out, depending on the level of private sector financial commitment. Examples of where private sector and government have become closely involved in major National road projects are the N3 National Road between Johannesburg and the port of Durban, and the N4 National Road which would form part of the envisaged Maputo Corridor between the province of Gauteng and the Mozambican port of Maputo (see for example the *Sunday Times*, 25 February 1996), as well as the N1 where build, operate and transfer (BOT) arrangements with the private sector are seen as a possibility (see Mitchell & Glass, 1995). In terms of the interim constitution as it stands at the time of writing this dissertation, provinces have been given the power to levy taxes and user charges (Interim Constitution, Section 156) where appropriate and this could form the basis for road user charging at a provincial level.

As far as the current overall size of the road network in South Africa is concerned, the respective overall National, Provincial and urban road networks in kilometres as per 1993 are set out in Table 6.3 below. This will give some idea of the size of the respective road networks in the country.

Table 6.3: National, Provincial and Urban Road networks in South Africa (estimates for SGTs and TBVC states included in estimates for rural developing areas), 1993

NETWORK	LENGTH (KM)
NATIONAL:	
Dual-carriageway freeways	1 319
Single-carriageway paved roads	4 792
TOTAL NATIONAL	6 111
PROVINCIAL:	
Dual-carriageway freeways	634
Conventional dual-carriageway roads	452
Single-carriageway paved roads	49 837
Gravel roads	125 363
TOTAL PROVINCIAL	176 286
URBAN:	
Municipal (estimate)	47 210
Urban developing areas (estimate)	36 908
TOTAL URBAN	84 118
RURAL DEVELOPING AREAS	
Rural roads in developing areas (estimate)	221 092
TOTAL DEVELOPING RURAL	221 092

Source: South Africa. Department of Transport (1995: 19-22).

What Table 6.3 shows is that, owing to the standard of the roads involved, the National network is far smaller than that of the Provincial in terms of kilometre length. However, what must be noted from the table is that a large part of the National network (run by the SARB)

comprises dual-carriageway freeways (major roads with 2 to 3 lanes for traffic in either direction - 1319km) an extremely high standard of road between major urban centres, examples being parts of the N3 route between Johannesburg and Durban, and parts of the N1 between Johannesburg and Cape Town. National roads also include single-carriageway paved roads (roads with a paved surface, one lane for traffic in either direction - 4792km) which are of a lesser standard than freeways, examples being also found on parts of the N3 and N1 routes.

In contrast, Provincial roads consist of various types, standards and carrying capacities. As can be seen from Table 6.3, the overall length in kilometres is far higher than that of National routes, but the standard of roads varies considerably. Some of the provinces do have dual-carriageway freeways under their control (634km), as well as conventional dual-carriageway roads (452km) similar to the National routes (between major provincial and national cities). However, the greater part of the Provincial network comprises single-carriageway paved roads (roads with only one lane in either direction with a simple paved surface - 49837km) which link smaller provincial towns, and gravel roads (125363km) which have no surfacing whatsoever and the standards of which vary considerably and link small rural settlements.

Regarding the urban road network, data is only sufficient for estimates to be provided. From Table 6.3, the data on municipal roads relates to major established municipalities in South Africa (47210), whilst that for urban developing areas (36908km) relates to developing areas in the urban context. In the course of a study sponsored by the South African Bitumen and Tar Association (SABITA)(see South Africa. Department of Transport, 1995: 22), it was discovered that a substantial part of the rural road network in developing areas was not classified as either Provincial and nor did it reside within any other body's jurisdiction and this forms the basis of the figure for rural developing areas (221 092 km), and includes estimates for the former SGTs and TBVC states.

The overall road network of South Africa is, therefore characterised by a substantial "highly developed" sector which is of a high standard, significant carrying capacity, high volumes of traffic, high maintenance costs and examples of these types of roads can be found at National, Provincial and urban levels. At the same time, the South African road network is also

characterised by low volume roads with minimal levels of traffic, provide basic access to both rural and urban developing communities, incur minimal amounts of maintenance costs due to low levels of usage, and are to be found at a Provincial, local or urban, as well as rural and urban developing level.

The current funding crisis in road infrastructure in this country can also be given meaning if the Department of Transport's estimates of the road financing requirements for the proclaimed National and Provincial networks are taken into account. Currently, the Department of Transport has three road funding scenarios and these are set out in Table 6.4 below:

Table 6.4: Annual funding strategies to address the needs of the current proclaimed National and Provincial road network of South Africa

FUNDING STRATEGY	ESTIMATED ANNUAL EXPENDITURE PER STRATEGY (R MILLION P.A.) (1995 RANDES)
Network preservation	4 070
Retain capacity	5 560
Ideal	7 880

Source: South Africa. Department of Transport Private Communication (1995)

Relating to Table 6.4 above, the figures relate to the estimates of the Department of Transport for the proclaimed rural road network. This means those major roads linking towns and cities and falling under either National or Provincial jurisdiction. Thus, the figure excludes those roads which lie in urban centres and in developing areas, for which estimates of length remain indeterminate at this stage. The network preservation strategy involves ensuring that the condition of the existing proclaimed National and Provincial roads does not deteriorate further

- this strategy leaves no funds for the urgent improvement of the road network. The strategy aimed at retention of capacity involves ensuring that the current condition and quality of service of roads is retained. Finally, the Ideal strategy is aimed at, firstly, addressing the current backlog over the next ten years and, secondly, addressing new needs which become necessary due to growth in traffic volumes and deterioration in the roads themselves. Given the 1993/94 allocations to roads (R2 458 million), it seems that even the network preservation strategy seems a far-off goal to achieve.

The road financing crisis can also be said to be a result of the general fund financing approach applied to include the roads sector. This is because while receipts from the fuel levy have increased since the 1987/88 (see Table 6.5 - where the figure for 1987/88 reflects the demise of the dedicated fund and consequently influences the % change accordingly) the amount of funding directed towards the NRF and other financing channels for roads has decreased (see Table 6.1), road needs have increased to substantial levels (see Table 6.4), and total government expenditure has risen rapidly (see Table 6.2) given government's immense social backlog.

Table 6.5: Receipts from the fuel levy, 1987/88 to 1995/96

YEAR	REVENUE COLLECTED (R million)	% CHANGE PER ANNUM
1987/88	693	-
1988/89	2 556	268,8
1989/90	4 081	59,7
1990/91	4 104	0,6
1991/92	5 421	32,1
1992/93	7 083	30,7
1993/94	7 860	11,0
1994/95	8 352	6,3

Source: South Africa. Department of Finance (1996: B1-B4).

Now that the historical development of the road network in South Africa has been outlined, and the financing of that road network described in detail right up to the current situation, the next aspect which must be covered is that of which financing mechanisms should be applied to South Africa, and what would the most appropriate road financing system be for this country.

6.3 EXAMINATION OF ROAD FINANCING INSTRUMENTS AND THEIR ROLE IN A ROAD FINANCING SYSTEM IN SOUTH AFRICA

This section will consist of the drawing together of a number of fundamental concepts and issues and their application in the South African situation: an examination of allocative efficiency and equity and the reconciliation of these two concepts in terms of road financing; the application of road user charging instruments in South Africa; and the application of general fund financing, earmarking and user charging in South Africa. This will then prepare the way for a road financing system for South Africa to be put forward in the final section of this chapter.

6.3.1 Allocative efficiency versus equity in road financing in South Africa

The problem of allocative efficiency versus equity has been discussed before in Section 4.2.3. However, this tradeoff has important implications for the financing of roads in South Africa, given that roads can possess elements of privateness, that is roads are not simply public goods.

The essence of the approach that is advocated in this dissertation is based upon the notion that roads can be viewed as heterogeneous, and that a distinction can be drawn between what may be termed the "highly developed" and "basic access" components of roads. This distinction is important because the road system in South Africa must be able to provide a certain basic minimum level of service that is commensurate, firstly, with the demands of road users which are derived in turn from the level of economic activity prevalent within the economy and, secondly, with the financial resources of the country.

Therefore, it is argued in this dissertation that it is the responsibility of the authorities, i.e. the Department of Transport, to determine the appropriate level of service by setting out a "basic access standard" for roads in general, which accommodates the relevant demand and supply levels. However, it may be that certain groups of road users demand higher standards of roads, and are able to pay for these facilities. In a mixed economy which permits the operation of the market where appropriate, these affordable preferences should be met.

Allowance should therefore be made for the provision of "highly developed" roads alongside "basic access" roads. The latter category will serve to keep road standards in South Africa in line with conditions in other sectors of the economy, while the former will permit market preferences to be exercised. In other words, the latter are pure public goods, whilst the former possess elements of privateness.

It is generally accepted that it is the government's function to provide communities with an acceptable level of basic access. Thus, newly constructed "basic access" roads will be prevalent during the early part of the economic emergence of a country or a geographic region within it. Communities are at that stage both poor and scattered. The results of specialisation in economic activities establish a need for enhanced access to markets and raw materials that only roads can satisfy. However, such roads would initially carry limited traffic that could not bear the burden of high direct costs, so commercial provision of roads is out of the question. Thus, strong grounds exist for supporting road construction out of general tax revenues because the benefits of roads are spread throughout the community. That is, these roads are pure public goods.

In contrast, "highly developed" roads are found in mature communities with a strong economic base. Access to these communities already exists in the form of a well-established road network of reasonably high quality. However, it may well be the case that certain of those roads would exhibit declining serviceability levels to their users, primarily because of congestion. Thus, there is a demand for upgraded facilities, but it is of great importance to recognise that this would emerge from certain road user groups and not from the general public. Consequently, it is reasonable to provide such facilities, but not at the expense of the general public as their level of publicness would be minimal at best, as they would possess strong and varying attributes of privateness in terms of the criteria of rivalness in consumption and excludability.

Therefore, on the grounds of the efficiency arguments discussed previously, "highly developed" roads should be funded by user charges, whether they be of an direct or indirect nature. This is due to the fact that the provision of "highly developed" roads is essentially a commercial type of activity. Such roads are not true public goods (i.e. possess elements of

privateness) because people can be excluded from the receipt of benefits and use of the goods is characterised by rivalness in consumption. In fact, these roads could be provided by the market were it not for the fact that they possess certain features of a natural monopoly which makes public control desirable (see Section 3.4).

Thus, "basic access" roads should not be subject to user charges but rather funded by general revenues. This is because these roads display the elements of nonrivalness and nonexcludability dealt with in Section 2.5 which conform to the requirements of a pure public good. Also, with respect to these roads, it is glaringly apparent that the majority of members of South African society feel the need for government to alter the prevailing distribution of incomes and welfare, as they perceive this distribution to be unjust. They would thus be willing to sacrifice the efficiency of the market determined outcome for one which they would find more equitable. Ideally, the redistribution of income or wealth would occur via direct transfer payments, and not indirectly through the provision of goods and services such as road infrastructure in this case.

However, in a country such as South Africa, this is impractical as it will be necessary to use indirect methods of redistribution for many years to come. This means that, to the extent that certain roads display the characteristics of public goods of nonrivalness in consumption and nonexcludability, there is a case to be made for making them available to users free of direct charges, by financing them out of general tax revenues.

From this it follows that the use of road provision as an instrument of redistribution would require that some users at least should not pay for the benefits they obtain from road use. Specifically, these will be users of roads that provide basic access, rather than those using "highly developed" roads. Adopting this approach, based on the "highly developed/basic access" dichotomy, is equivalent to saying that the time has come in South Africa for those roads possessing elements of privateness to be financed by user charges and allocated through demand management, while those which display the characteristics of pure public goods still warrant a supply-driven philosophy (i.e. are closest to being pure public goods as defined in Section 2.5).

6.3.2 The future role of user charges in road financing in South Africa

The discussion in this section will consist of a brief review of the various road user charging mechanisms that were discussed in Section 4.8, with a view to identifying those that appear to be potentially useful in South Africa.

The overall direction that road user charging may follow in the future will now be dealt with. In this regard, a number of conclusions can be put forward. It is questionable whether the road user charge structure currently utilised most extensively internationally and hitherto in South Africa, i.e. the combination of the fuel tax and registration and licence fees, will continue in the future. It is argued in this dissertation that the current user charge structure is simply not compatible with the efficient use of resources as it does not vary with the type of facility, time, location of use as well as amount of use. Thus, on the basis of the discussion in Section 4.8 and Section 4.9, it is suggested that road user charges be reorientated in the future. In the light of the above, the appropriate road user charges to be levied at various levels should be:

- First tier charges - Registration/titling/licence fees (at state/provincial level)
- Second tier charges - Facility use charges (i.e. tolls, fuel levies, parking charges, area licensing, electronic pricing at federal/national, state/provincial and local levels)
- Third tier charges - Weight-distance charges (at federal/national and state/provincial levels).

Regarding the above types of road user charges, the following points can be made:

- (1) Registration and licence fees should continue to be the first tier charge (i.e. charges based on vehicle ownership - see Section 4.8.1) and essentially represent an entrance fee to the system. The ease of administration and certainty are also major advantages. It is conceivable that such road user variables as the price of the vehicle to be used, age of the vehicle, and type of usage (commercial or otherwise) of the vehicle could

be taken into account.

- (2) Second tier charges (i.e. charges based on vehicle use as in Section 4.8.2) are the next level of charges, and includes tolls levied according to mileage or amount of use, as well approximations of this such as fuel levies. The purpose of these charges is to charge the user for the benefit derived from use of the facility and the cost imposed upon other users so as to permit rationing of the limited road infrastructure facilities. The basis for such a charge ought to be the marginal cost of using a particular facility during a particular time of day. The facility use charge ought to not only vary by facility type, location and time of use but also by vehicle size insofar as this affects road congestion. The amount of charge payable by a user can be determined from mileage data collected by automatic vehicle identification techniques and similar electronic technologies referred to in Section 4.8.2.6.

The fuel tax has been the most stable and the most significant source of road revenues. However, as a road user charge, the fuel tax may not adequately reflect the usage of a facility and the corresponding responsibility in terms of road damage and cost. Also, in recent years increasing environmental and energy conservation concerns have led to extensive research and introduction of alternative fuels for transportation and a tendency towards more fuel efficiency in vehicle design. The viability of charges on fuel could come into question in the sense that an increase in fuel efficiency implies a decrease in revenue from the fuel tax in the long term. Also, it may not be possible to tax alternative energy sources using the traditional approach. Thus, a different user charge structure without a heavy dependence on fuel charges may become more necessary in the future.

Realistically, however, in a developing country such as South Africa, it must be accepted that the greater part of required revenues may have to come from other sources for some time to come for practical reasons. Fuel charges are the best option in this case; they bear some relationship to road use, they have appropriate incentive effects, they are cheap and easy to administer, and they are reasonably equitable - at least insofar as petrol is concerned. Indeed, they appear to perhaps be the best means

of charging petrol-powered vehicles at this time, as discussed in Section 4.8.2. Steenekamp (1994: 385) argues that in the South African context, the fuel levy is a progressive means of taxation, in terms of percentage of income spent on transport for various income groups, which has hitherto not been fully exploited as a source of revenue in this country and whose effect on low-income groups can be lessened by such measures as rebates for public transport operators for example (administration would be critical in this sort of scheme to ensure that savings are passed down to the commuters as such). Fuel charges in the case of diesel-powered vehicles are relatively not as effective due to their possible effects in equity terms (see Section 4.8.2.1).

Tolls are appropriate charging methods for the financing of a road network of a "highly developed" nature, and in South Africa will be applicable to interurban roads but may also be used for well-utilised major urban roads, and practical considerations permitting, automatic vehicle identification systems for electronic toll collection would seem to have a very promising role to play (as was discussed in the HMSO Report: 1993, referred to in Section 4.8.2.3).

Regarding the financing of roads in urban areas, the larger cities in South Africa may be suitable situations for some form of congestion charging. There would certainly seem to be scope for more imaginative, and appreciably higher, structures of parking fees - particularly to fund the maintenance of, and manage the demand for, road infrastructure in areas characterised by an advanced state of development (i.e. previously "white" areas). Barrett (1992: 7-8) has argued that the provision of road infrastructure in areas or communities characterised by an advanced state of development in South Africa is already satisfactory and attention should be aimed at utilising the available infrastructure more efficiently. This would imply that construction of new roads in these areas should not take place and the emphasis should rather be on the increased use of transportation system management techniques such as demand management and provision of improved public transport.

Barrett goes on to make the point that, in the context of South Africa, the creation of new, additional road infrastructure capacity is completely unaffordable. This means

that demand management must assume an important role in the correcting the misallocation of resources which occurs at peak periods. The pricing of the use of roads at peak periods is put forward by Barrett as an efficient method of spreading demand for the facilities in question and also provides additional funds for the financing of roads. Various methods are suggested as means whereby this may be attempted:

- parking charges which penalise vehicle entry to cities at peak periods;
- toll charges at appropriate entry points to congested areas;
- electronic road pricing through the use of on-vehicle meters which measure the amount of time spent in congested areas;
- through licences required in order to gain access to congested areas.

- (3) Weight-distance charges (i.e. third tier charges - which account for the differences in benefits or costs occasioned by vehicle classes - see Section 4.8.3) could be based on the axle weight of the vehicle, the type of facility to be used, the location and time of travel, as well as the actual distance covered. A road user charging system which incorporated these factors would be able to link charges and costs quite effectively.

Therefore, it would be worthwhile to consider the introduction of weight-distance charges for heavy vehicles in South Africa. However, the introduction of weight-distance charges for heavy vehicles "will only be possible in countries with well-developed systems of tax administration, or in countries where the road agency is competent to administer such charges" (Heggie, 1992: 13). These conditions are certainly met in South Africa, and no apparent reason can be discerned for continued exclusion of this charge from the road financing system in this country, especially in view of the recent deregulation of heavy freight vehicles and increase in heavy vehicle traffic.

Charges such as weight-distance charges have hitherto often not been adopted due to a lack of technology to provide relevant and accurate information for the determination of appropriate levels of charges. Recent advances in information and other technologies have largely overcome this problem. Progress in the area of information technology with respect to vehicle identification and the capture of information relating to vehicle characteristics, facility type, location, as well as the time of vehicle travel has occurred to the extent that the implementation of techniques such as electronic toll collection and area licensing is possible.

6.3.3 Conclusions on general fund financing, tax earmarking and user charging in the context of road financing in South Africa

Earmarking, for its qualities, has been shown to have enjoyed little success in implementation thus far, except perhaps for the cases of Japan and the United States. In other cases, it has become apparent that its major defect is its vulnerability to raids by central government. Even if it is accepted that earmarking is superior to general fund financing, it is still prone to interference, particularly where the fund grows out of all proportion to the needs it must service.

The Katz Commission (1995: 18-20) points to the fact that there has been extensive international recognition that tax earmarking or dedicated funding "...distorts public sector resource allocation unduly and tends to undermine fiscal management." Also, the report argues that the existence of a number of dedicated funds will tend to complicate the implementation of fiscal policy. The Commission then goes on to conclude that tax earmarking should be avoided, especially in the context of rapidly changing government expenditure priorities. This is deemed necessary so that the need for integrity and transparency in the budgetary process, by which national and provincial expenditure allocations are made, is not undermined through the so-called "pre-assignment" of tax revenue to various specific functions. The Commission then comes out against tax earmarking in South Africa, until such time as a satisfactory system of intergovernmental financial transfers exists and the provinces have sound revenue bases. As regards the earmarking of a fuel levy to a dedicated road fund, the Commission is not supportive. The Commission (ibid: 21) points to the fact that a fuel

levy was directed to the NRF in the past but this was not a satisfactory arrangement because of the perception that the prioritisation of expenditure through this financing mechanism was poor; the Commission also faults conventional tax earmarking in the roads sector on the grounds that the distributional incidence of road costs are difficult to determine and it is doubly difficult to get these to correspond with the available financing instruments. The Commission also points to the high administration costs which are characteristic of charges such as road tolls. As concerns the other earmarked taxes still in use and levied on the fuel price, such as the Motor Vehicle Accident Fund levy and Equalisation Fund levy, the Commission recommends that these be reviewed.

Thus, the Commission's recommendations regarding general fund financing, earmarked taxes and user charges in road financing in South Africa are set out as follows:

"In South Africa's present circumstances of fiscal restraint, it is important that infrastructural financing should be approached within a *coordinated* budget process, and it is accordingly not deemed advisable to pre-assign dedicated taxes to off-budget roads authorities. There is, nonetheless, a good case to be made for further extension of the principle that road users should pay for road construction and maintenance. A fuel levy, assigned to provinces on an appropriate basis, is an administratively efficient mechanism for this purpose. The Commission recommends that consideration should be given to the assignment of a percentage of the fuel levy to road construction and maintenance *within* the broader budget process." (Katz Commission, 1995: 22).

It is necessary that the view of the Commission be interpreted and discussed at this point, considering the weight that the recommendations of the Commission will carry with government in South Africa at this time. From the above paragraph, it is apparent that the Commission's view is that given the enormous demands on the fiscus in South Africa, the financing of roads should take place within the context of a "*coordinated* budget process". This strongly implies an approach akin to general fund financing, where the advantage that is most frequently touted is that the government is then able to allocate expenditure amongst the various functions according to its overall priorities from general tax revenues. At the same time, the Commission also comes out very much against the "pre-assignment" of taxes to road

authorities, obviously through the process of tax earmarking.

The relative merits of the general fund financing approach versus that of tax earmarking have been examined earlier in this dissertation (see Section 5.2) and it was concluded that, whilst the general fund financing approach has considerable merit in giving government the resources to tackle the needs of the country in a prioritised manner and is extensively employed internationally including South Africa, the concept of tax earmarking is theoretically defensible and is second-best to that of direct user charges in terms of allocative efficiency and the benefit principle of taxation and does away with a level of arbitrariness associated with the former method (see Section 5.2).

Moreover, the point must be restated (as it was made in Section 5.2) that the practical problems with dedicated funds using earmarked taxes have not occurred due to any intrinsic defect as such, but have occurred when governments raid the funds for additional revenue in time of need, and this was most certainly the case in South Africa. There is a strong case for earmarking in the roads sector, and some support for the concept of tax earmarking in South Africa (see Steenekamp, 1994: 385; Heyns, 1995: 33-34; and Grote, 1995: 38-39). However, the point was made earlier in this chapter, on the future financing mechanisms which can be used, that while fuel levies have been the backbone of road user charging systems and probably will continue to be for some time to come, they do not have a secure long term future and should be replaced or complemented by more direct user charges.

The Commission does acknowledge the merits of the user pays principle in financing road infrastructure, and proposes an assignment of a portion of the fuel levy to road construction and maintenance which would then be allocated to the provinces in line with their perceived needs. The emphasis in this regard is that this all takes place "*within* the broader budget process". However, the Commission is not specific enough in regard to the relationship between user charging and the broader budget allocation process. The principal strength of user charging is the direct link between use of service and payment for that use, and ensuring that the user "pays for what he gets and gets what he pays for". The Commission is also vague inasmuch as it fails to spell out how user charges can be employed "*within* the broader budget process" and what the implications of this actually are. Quite clearly, there is no point

to user charges if their allocative efficiency advantages are summarily nullified by absorbing their proceeds into a general fund to be doled out according to government's general expenditure objectives.

However, acceptance of the user pays principle but attempting to apply it firmly within the confines of general fund financing will not solve the problem of inadequate funding for roads. The Commission is similarly vague in this respect, leaving its recommendations to some percentage allocation within the budget process. This means that road infrastructure will continue to be overshadowed by the myriad perceived greater needs facing government at this time and so a more defined position is required on the part of government as far as the determination of road funds is concerned.

Indeed given the importance of road infrastructure in the economy as a derived demand, there are good grounds for roads to be accorded sufficient funding in terms of the user pays principle. Also, the issue of co-ordination in the budgeting process in the context of tax earmarking or direct user charging is an overstated one. The utilisation of a dedicated road fund financed by taxes or user charges of whatever kind does not mean that the budget process is automatically more complicated or less co-ordinated. It is up to government to include this in its overall planning and ensure that such a mechanism is not permitted to grow beyond its optimal level in terms of the requirements of the roads sector; the government is also free to impose general taxes on road users if the need arises. The fact remains that the poor survival rate of dedicated funds and poor implementation of user charging internationally has been because of a lack of clear definition of what dedicated road funding is intended to achieve, as well as a level of arbitrariness on the part of governments faced with increasing funding requirements and ever increasing government general expenditure levels.

Meanwhile, user charging does have the strong element of being set apart from other government revenues, thereby helping to ensure that funding for roads would be both efficient, adequate and largely independent of interference to some extent. There is support for this:

"Among specialists in public finance, it seems fair to say that a consensus supports

user financing and would segregate this financing from other public finances in the absence of overriding social...considerations to the contrary." (National Co-operative Highway Research Program, 1979: 5).

Furthermore, closer examination shows that the economic characteristics of roads do not require them to be provided by the public sector. The private sector - or at least semi-private as in the case of the provision of electricity by various public utilities throughout the world - could deal with them quite adequately. This is because not all roads display the characteristics of publicness to the extent that they must be provided through general taxation. Rather, roads exhibit elements of privateness to the extent that their provision by the private sector is feasible, although natural monopoly conditions would demand regulation of private sector activity. This conclusion is supported by Scheurkogel (1966: 322):

"The private and divisible nature of highway services are not always fully recognised. Highway services are primarily private although provided by government...The public attribute of highway services is historical in character and stems from the regulation of the system and not from the support of the service itself."

Owing to the fact that roads are not overwhelmingly pure public goods, they can be financed by the "price route" and not simply through general taxes. This ensures that the objective of allocative efficiency in road provision can be pursued to its fullest.

Thus, there is no justification for roads to be regarded as only pure public goods. Roads have been viewed as pure public goods and provided solely through general fund financing for historical reasons throughout the world. There is little to be gained from keeping them in the public sector completely. However, if roads continue to be restricted to the public sector exclusively, there is a very real risk that they will be funded through taxation, even if user charges are employed (i.e. although road users may pay use-related levies, there would be no direct relationship between the levies and the quality or quantity of roads they would receive in return). Within such a context, user charges will have little to contribute, because they are not acting as proxies for prices but simply as sources of tax revenue. Thus, user charges will not be able to act as allocatory devices at all, because the road network available to a

particular group of road users will not be related to the amount of revenue that specific group contributes to road funding.

When general fund financing or the "tax route" to road provision is utilised, allocative economic efficiency is sacrificed. Where this occurs and a road funding crisis develops, as has been the case in South Africa, road users become extremely dissatisfied as they believe that although they are certainly paying for what they get, they are not getting what they pay for. One critical result of this is that road users may be opposed to the extension of road user charging in the context of general fund financing as they will perceive it to be in the interests of the government but not necessarily their own. With the foregoing points having been made as a basis, a road financing system for South Africa can now be proposed.

6.4 PROPOSED ROAD FINANCING SYSTEM FOR SOUTH AFRICA

The objective of this section is to outline the components of a road financing system for South Africa at this time, taking cognisance of the discussion in the previous chapters and the preceding sections of this chapter. The different types of roads will be dealt with under the headings below as these provide a good basis for the determination of a road financing system for South Africa based solidly on economic theory:

- National Roads
- Provincial Roads
- Urban/local Roads

6.4.1 Financing National Roads

In Chapter 2 it was stated that pure public goods are characterised by nonrivalness in consumption and nonexcludability. In the same chapter, it was also argued that certain roads do in fact possess elements of privateness, i.e. rivalness in consumption and excludability. This is because they are utilised to the point where each road user's consumption of the good

interferes with the consumption of the good by other users through congestion or damage to the road incurred from road usage. Also, it is both technically feasible and inexpensive to exclude from use of the good those users who are not prepared to pay for the use of the good. These are the "highly developed" roads mentioned previously.

It is submitted in terms of this dissertation that what are termed National Roads in South Africa by and large fall into the category of public goods which possess elements of privateness and ought, therefore, to be funded as nonpure public goods. This implies that they should be priced so as to ensure allocative efficiency. The pricing of these public goods which possess elements of privateness can be undertaken through user charging which would conform to the benefit principle of taxation; it has also been argued that roads also possess natural monopoly characteristics (see Section 3.4).

The user charging instruments which could be utilised have been evaluated earlier in this chapter. It was concluded that direct user charges have most potential for the future. Thus, it is submitted here that direct user charges such as tolls (second tier charges) and weight-distance charges (third tier charges) be utilised at a national level for the financing of National Roads as these roads in South Africa have the requisite traffic volumes to support toll financing and South Africa has the necessary technical expertise to ensure that weight-distance charging can be effective in this country. These two techniques are also attractive on pure allocative efficiency grounds. Also, weight-distance charging has been proved to be particularly efficient as a user charge for heavy vehicles in New Zealand, and South Africa with its increasing number of heavy vehicles on National Roads would do well to examine how this charging method can be employed here. The setting of toll tariffs is a problem as it can result in substantial reductions in traffic volumes, thereby rendering toll projects nonviable (See WorldBank, 1994: 99, for the case of toll roads in Mexico); at the same time, if toll tariffs are set at levels which are appropriate and true even if they are deemed to be exorbitant by road users, this could have a significant effect on the trend in freight transport from rail to road for example.

A fuel levy (second tier charge) at national level should be continue to be employed in South Africa as a quasi-user charge as this was discussed in Section 4.8.2.1, as it is theoretically a

good second-best charge to the first-best of direct user charges. Fuel levies have much to recommend them in terms of ease of collection, administration and application. The long term future of fuel levies has been discussed earlier in this chapter and is rather uncertain given environmental pressures and consumption-technology trends. However, the technique should continue to be a significant component of road user charging in South Africa for some time to come. As with the proceeds of tolls and weight-distance charges, at least some part of the revenue collected from fuel levies by the oil companies should be earmarked for a dedicated road fund (e.g. the NRF). It is important that government come to some decision in this respect as some firm commitment to the financing of road infrastructure is necessary to lend weight to the GNU's avowed intention of developing infrastructure as a critical component of the economic growth process, a view incidentally which is in line with that of the World Bank (1994: 2 and 14-18). Be that as it may this dissertation argues that, in terms of allocative efficiency, the revenue from road user charges and quasi-charges should be directed back to the funding of road infrastructure (Also see World Bank, 1994: 2-6, for the importance of the user-side in funding of infrastructure generally).

Thus, it is submitted that a road fund (e.g. NRF) properly financed by user charges and quasi-charges would provide an adequate, defensible and sustainable source of funds for National Road infrastructure in South Africa. The existing NRF would provide a good basis for this, together with a commitment to the concept on the part of government for road infrastructure as a special case. The GNU's commitment to general fund financing as a means whereby co-ordinated strategies can be developed to tackle the development problems of the country need not be compromised by the existence of a dedicated fund as the level of funding required by the NRF would have to be determined taking cognisance of road infrastructure needs, government policy, overall fiscal requirements and so avoid the problems which have beset dedicated funds in the past. If additional revenue is required by Treasury, a general tax on fuel could be utilised; alternatively, part of the fuel levy could be directed to the Treasury for general funding purposes and a designated part directed to the NRF.

An important issue in the financing of National Roads in South Africa is that of what institutional arrangements should be in place to manage this process as it does have some bearing on road financing. That is, there are two options in this regard given the current

debate on road financing. The first option is that National Roads continue to be managed by a central roads board (i.e. the South African Roads Board of the Department of Transport which also oversees expenditure on Provincial Roads). Thus, this first option for the institutional arrangements would be a roads board functioning within the Department of Transport (i.e. the *status quo*), but with funding drawn from a dedicated NRF as opposed to one receiving allocations from Treasury. In this scenario, the NRF would be financed through user charges (i.e. tolls, weight-distance charges) and quasi-charges (fuel levy) correctly levied.

Alternatively, National Roads could be managed by a public utility of some kind which, it can be argued, could be appropriate in the case of a natural monopoly situation which does exist in the case of roads. Mitchell, et al (1989: 9) argue strongly for a public utility approach to the management of roads. They acknowledge that roads have characteristics which enable them to be treated as private goods in some cases capable of private sector provision. However, direct charging for roads is difficult in a technical sense and, in the case of the roads market with its elements of natural monopoly, a private firm would proceed to glean monopoly profits. Thus, it is argued by Mitchell, et al (*ibid*: 9) that some form of government regulation or co-ordination is required. Options raised as possibilities are either a public utility or public-related utility to manage at least a portion of the road network.

One of the major criticisms which has been raised against the notion of a public utility which is fully autonomous is that government will have no say in the setting of charges, as these will be determined by the requirements of the road network and the financing needs of the utility. A general loss of influence will characterise this option. This does, however, imply that the onus will be on both the utility and government to co-ordinate the planning of the road network to ensure that it is in line with the requirements of the economy, a critical component given that transport is, in the final analysis, a derived demand.

However, the notion of a public utility approach is very close to current World Bank thinking in this regard. Heggie (1995: 78), in dealing with the problem of road financing in Sub-Saharan Africa advocates the use of a commercialised roads board/agency which would then be responsible for the road network and which would be funded by a system of direct and

indirect user charges which:

- Are not set within the government's overall tax framework;
- Reside in the accounts of the public utility which supplies the services;
- Are set so as to achieve certain defined objectives, such as cost recovery, so as not to be excessive;
- By linking revenues and expenditures are used to maintain a hard budget constraint on the utility.

What is proposed by Heggie (ibid: 78) in the form of a commercialised roads board/agency differs from conventional earmarking in a number of respects. Earmarking generally applies to revenues which, firstly, are part of the government's overall system of taxes and, secondly, are directed into the government's general revenue account. Heggie proposes a battery of user charges which, firstly, do not comprise part of the overall taxation system of government and, secondly, remain in the accounts of the agency which supplies road services (e.g. the revenues would be collected by the agency itself, or even by the oil companies in the case of a fuel levy). In doing so, the requirement of efficiency is addressed because, Heggie argues, the charges assist in creating a constituency for the road agency (or create a specific market); the agency becomes more accountable to road users; revenues and expenditures are clearly linked and therefore introduce a budget constraint on the road agency. Thus, it is argued that the rigours of market discipline will be introduced to decision making.

Indeed, the market has become more prominent in World Bank documentation in recent years. The World Development Report (World Bank, 1994: 52-60) envisages market solutions to the problem of infrastructure development. It goes so far as to argue (ibid: 53) for natural monopoly segments of developing economies to be maintained only when the complete "unbundling" (splitting segments of an industry to enhance competitiveness between the providers of the different segments) thereof would be impossible or would result in monopoly provision of the services in question. This would then be linked to encouraging private

enterprise involvement in the ownership and management of roads (World Development Report, 1994: 89-98). However it is submitted that, in the case of South Africa as in all other countries, the market for roads has natural monopoly characteristics and the potential for "unbundling" (or private ownership of individual roads) would be limited to high volume National Roads only (hence the plans for private co-operation in the N3 and N4 National Routes Sunday Times 25/2/96). The success of private sector-public sector joint ventures has hitherto been somewhat mixed where it has been tried, e.g. the United Kingdom (see Section 4.8.2.3). The utilisation of a commercialised roads board would then involve a dedicated road fund; in the case of South Africa this would entail a commercialised SARB with funding drawn from the NRF which, in turn, would be financed from user charges and quasi-charges.

For South Africa at present the first option of a central SARB with a dedicated NRF, it is submitted, is probably the more likely choice of the South African government at this time due to the overwhelming need on the part of government to co-ordinate expenditure at a central level. However, the more appropriate option for management and financing of the National Roads sector (6111km in Table 6.3) would be that of a commercialised roads board (SARB), a dedicated NRF and utilisation of tolls, weight-distance charges and a fuel levy earmarked for the NRF at least in part. It is believed that this combination would be most likely to lead to allocative efficiency in road financing, although the first option is also strong in this respect. However, the use of a commercialised roads board would serve as a more firm commitment on the part of government to ensure adequate levels of funding for road infrastructure, and go some way towards ensuring that the management and financing of National Roads is undertaken with this objective uppermost in mind.

6.4.2 Financing Provincial Roads

The financing of what are termed Provincial Roads in South Africa will be somewhat different. Certain Provincial Roads do have elements of privateness in terms of the criteria laid out previously, as usage of these roads is fairly heavy and exclusion is possible (i.e. "highly developed" roads). However, many Provincial Roads are not heavily utilised at all, especially those in the more remote rural areas between provincial towns and the like, and the case can be made for these roads that they are pure public goods as usage by vehicles is

poor but they provide a measure of basic access to the communities involved (i.e. basic access roads).

The question that needs to be addressed, then, is how these different types of Provincial Roads ought to be financed. In terms of Section 155 of the Interim Constitution (see South Africa, 1994) provinces are entitled to a portion, as fixed by Act of Parliament, of income tax, value added tax or other sales tax which is collected within the province; provinces are also entitled to allocations from national revenue. This implies that provinces are then entitled to a percentage of revenue collected from the fuel levy for example and the possibility then exists for provinces to obtain a portion of this revenue on a more formal basis than is currently the case. Section 156 gives the provinces the powers necessary to levy taxes and user charges provided they are in accordance with an Act of Parliament passed after recommendations of the Financial and Fiscal Commission (in accordance with Section 2.4.4 of this dissertation which deals with the assignment of expenditure and taxation functions). Provinces are, moreover, entitled to allocations from national government as are local authorities (Section 158)(see Section 2.4.5 of this dissertation on intergovernmental transfers). An extremely important provision in the Interim Constitution is that of Section 159, in terms of which provinces may establish Provincial Revenue Funds into which may be deposited all revenue accruing to the provincial government, and the allocation of funds from this quarter may be made provided these are in accordance with laws passed by the particular provincial legislature.

The foregoing provisions in the Interim Constitution, it is submitted, make it possible for provinces to levy their own road user charges and direct them into an appropriate provincial revenue fund, from which allocations to road expenditure within the province may be made via legislation passed by the province. Indeed, Section 2.4 of this dissertation explains the issues around federalism versus a unitary structure, the scope for centralisation versus decentralisation, the assignment of taxation and expenditure functions and intergovernmental transfers; thus, the provisions of the Interim Constitution are in accordance with a federalist structure with some measure of fiscal autonomy for the provinces which could be determined in due course. Thus, it is submitted that provinces could employ road tolls (second tier charges - where appropriate, with revenues going to those specific projects), and licence fees

(first tier charges) and weight-distance charges (third tier charges) with these revenues accruing to the appropriate Provincial Revenue Fund. This is because licence fees enjoy considerable advantages of ease of collection and administration, and Barrett (1992: 7) argues that vehicle licences have hitherto not been exploited to the full in South Africa, whilst tolls and weight-distance charges are particularly strong in terms of allocative efficiency. Thereafter, via the relevant provincial legislation, expenditure allocations to roads can be made through appropriate legislation.

Fuel levies (second tier charges) could be employed at a provincial level and directed to roads via the provincial revenue fund, but it is submitted that this may not be an optimal solution because it could lead to a situation where some provinces institute their own fuel levies but others do not, which could result in road users preferring to purchase fuel primarily in those provinces which do not employ provincial fuel levies (i.e. "just over the provincial border" so to speak - the same sort of problem would not occur in the case of licence fees as all provinces employ these and would have to continue to do so). Far more effective a measure would be a national fuel levy, with allocations being made to the provinces through the SARB (commercialised or not). This solution would relate to the dual-carriageway freeways (634km), conventional dual-carriageway roads (452km) and parts of the network of single-carriageway paved roads (49837km) in Table 6.3 under Provincial Roads. This approach is also consistent with the notion of fiscal federalism discussed in Section 2.4. It is also possible to envisage commercialised roads boards at provincial level, although this may be a rather complex process in terms of the constitution, but it is possible and could be in accordance with a federal structure.

Another matter of extreme importance with respect to the issue of the funding of Provincial Roads is that of funding those roads in the provinces which are overwhelmingly pure public goods (or have strong elements of publicness) as they provide basic access to rural settlements of a developing nature and small towns and do not have sufficient usage levels to warrant a status of nonpure public goods. It is submitted that these roads be funded as pure public goods, i.e. through allocations to the NRF from Treasury from general funds (i.e. from general tax revenues). This would encompass parts of the single-carriageway paved roads (49837km) and gravel roads (125363km) in the provinces, as well as the 221092km of roads in rural

development areas in Table 6.3. Thus, responsibility for funds for these roads would lie with central government as they would be pure public goods. Funds could be made available from Treasury to the NRF and the SARB could then oversee allocations to the provinces for the financing of construction and maintenance of these sorts of roads. In other words, funds would then be made available by Treasury, possibly transferred through the SARB, to the provinces for these public goods-type roads via a process of intergovernmental transfers outlined in Section 2.4.5. This rationale would then solve the problem of intrasectoral allocation of road funds.

6.4.3 Financing of Urban/Local roads

The financing of Urban/Local Roads in South Africa stands apart from that of National and Provincial Roads as the instruments will be somewhat different. Various Urban/Local Roads do in fact possess elements of privateness and publicness.

In the Urban/Local context, the roads which display elements of privateness (i.e. "highly developed" roads) are those which are primarily congested downtown city streets. This is because they display the elements of rivalness in consumption, although excludability, it could be argued, is feasible but could be expensive to implement. Those Urban roads which display stronger elements of publicness are those which give access to communities but are not particularly well utilised, and an example of this type would be those found in informal urban settlements (i.e. basic access roads).

The roads which conform to a level of privateness can be financed through an array of user charges. Earlier, it was argued that electronic pricing technology exists to charge for the use of roads. Thus, it is submitted that appropriate user charges to be used in the urban context would be electronic pricing/charging (second tier charges) which charges road users for access to urban centres (this can be done using a system of transponders on certain routes and fitted to vehicles and owners of those vehicles can be charged for the use of the road by the vehicle), tolls (second tier charges) on certain urban main access routes although this could affect usage of certain routes which could also be levied electronically, and some form of area licensing schemes (second tier charges - as discussed in Section 4.8.2). Also, parking charges

(second tier charges) have much potential as a road user charging instrument and have hitherto not been utilised to their fullest extent in South Africa. This would then relate (see Table 6.3) to the estimated 47210km in municipal areas in South Africa, consistent with the fiscal federalism approach in Section 2.4.

Those Urban Roads which are more akin to pure public goods are those roads which provide basic access to communities and are not well-utilised. As such, these roads should be financed through the revenue collected by general local rates and taxes, or an allocation of funds (revenue from general taxes) from Treasury distributed to the local authorities (via the NRF and the provinces). The estimated 36908km of roads in urban developing areas in Table 6.3 would be funded as pure public goods out of general taxation revenues. Intergovernmental transfers (Section 2.4.5) would then be used to move funds from Treasury to the local authorities, via the provinces.

6.5 CONCLUDING REMARKS

The context of this dissertation has been public finance in a market-orientated mixed economy under a democratic dispensation. It has been shown that a fair amount of decentralisation between levels of government (central, provincial and local) will exist in such a system, although the extent of decentralisation in a federal system can vary from one country to another. Intergovernmental transfers between various levels of government are also possible in such a context.

Given the context of this dissertation, public goods can be defined in terms of the extent to which they display the attributes of nonexcludability and nonrivalness in consumption. Pure public goods will display both of these attributes; pure public goods should then be funded from general taxation revenues. Quasi/nonpure public goods are goods which possess elements of privateness, i.e. there is either rivalness in consumption, or exclusion from the enjoyment of the good is possible and practical; because of these attributes, these goods should be priced so as to ensure allocative efficiency, and would be in accordance with the benefit principle of taxation.

Roads can be classified as pure or nonpure public goods in terms of these attributes of nonexcludability and nonrivalness in consumption. Roads which would qualify as pure public goods would be those which are not heavily trafficked, i.e. those for which consumption is not rival because one individual's use of the road does not interfere with another's use of the same road, and exclusion, while possible, is either not practical or is simply too expensive to implement. Examples of these would be Rural/Urban roads used for basic access to communities who cannot be charged the real cost of using the road. The low traffic volumes would mean that maintenance costs on the road would be minimal, and the revenues obtained from road users so small that the costs of collection could exceed revenues obtained. These roads could be called basic access roads. Roads which display either rivalness in consumption or from which exclusion would be possible and practical are those roads which carry heavy traffic volumes (are sufficiently well utilised), and the use of which can be priced as they contain elements of privateness. This is the case because on such roads, road users do interfere with one another's use of the road through congestion. This would be necessary so as to fund the increased maintenance costs occasioned by the heavier traffic volumes. These roads can be called "highly developed" roads which serve the developed sector of the economy. User charging in this case would be feasible and is justifiable. The market for roads is, however, characterised by elements of natural monopoly and this would have a bearing on the limitation of pricing. That is, roads could have strong elements of privateness, but some form of government regulation would be necessary due to natural monopoly properties of the roads market, thereby making user charges levied by government or public utility appropriate.

Road user charges consist of three types: those which charge for the ownership of the vehicle (first tier charges), those which charge for the use of the vehicle (second tier charges), and those which charge according to the benefits occasioned by vehicle classes (third tier charges). The number of charges which can be employed against the road user are several, but the most important and the most practical are:

- Licence fees - charge relating to vehicle ownership;
- Tolls, fuel levies electronic road charges, ALS schemes and parking charges - charges relating to vehicle usage;

- Weight-distance charges - charge relating to the differential benefits accruing to classes of road users.

There are three methods which can be used to allocate revenues to the roads sector for construction and maintenance purposes:

- General fund financing or the general taxation approach;
- Earmarking of taxes for allocation to the sector;
- Levying of user charges by government or public utility.

Of these options, each has an application to the roads sector but, instead of being mutually exclusive, it is proposed in this dissertation that they be employed to complement one another. In terms of the criterion of efficiency, the option of user charges preferably levied by a commercialised public utility (i.e. SARB) is the first-best choice and is most appropriate in terms of user charging for roads which do not qualify as pure public goods but as nonpure public goods. This is also appropriate given the natural monopoly characteristics of the roads market. The second-best option is that of earmarking of designated tax revenues to a dedicated road fund (i.e. the NRF), although the latter option does suffer from the weakness of being vulnerable to government appropriation; again, earmarking would be most applicable to goods which are quasi/nonpure public goods as these can be priced most efficiently. General fund financing through general tax revenues has its merits and is extremely popular with financial authorities the world over, but in terms of the literature considered, it is most appropriate in the case of pure public goods. This has implications for the financing arrangements for roads in South Africa. The proposed road financing system for South Africa as discussed in Section 6.4 is summarised in Table 6.6 below:

Table 6.6: Proposed road financing system for South Africa

TYPE OF ROAD	FINANCING MECHANISM	INSTITUTIONAL ARRANGEMENT
National roads	Financed as nonpure public goods through user charges: <ul style="list-style-type: none"> • Tolls • Weight-distance charges • Fuel levy * Dedicated NRF	* Commercialised SARB
Provincial roads	Portion financed as nonpure public goods through user charges: <ul style="list-style-type: none"> • Licence fees • Tolls • Weight-distance charges • Fuel levy * Provincial revenue fund Portion financed as pure public goods through general taxes: Revenues collected from general taxes and allocated from Treasury to provinces via intergovernmental transfers possibly through SARB	* Provincial road authorities (Commercialised possibly)
Urban/Local roads	Portion financed as nonpure public goods through user charges: <ul style="list-style-type: none"> • Parking charges • Electronic charging • Area licensing • Tolls Portion financed as pure public goods through general taxes: <ul style="list-style-type: none"> • Local taxes • Revenues collected from general taxes and allocated from Treasury via intergovernmental transfers possibly through provinces or SARB 	* Municipal authorities

(Where: NRF = National Road Fund, and SARB = SA Roads Board)

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