Chapter Eight

Environmental Taxation and its Possible Application in Australia

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8.0 Introduction

This chapter explores the potential use of environmental taxes in Australia in addition to the broad-based and larger revenue-raising taxes on income, consumption and assets. Environmental taxes are one of the available policy intervention instruments for correcting market failures that involve the allocation of resources to, and investment decisions for, the environment. Effective environmental taxes provide national efficiency gains, with the revenue primarily a welcome by-product.

Section 8.1 discusses the conceptual basis for environmental taxes. Likely market failures associated with the external costs of pollution, public goods, and common pool resources are considered. Building on the description of each market failure, the tax base and tax rate of an environmental tax to achieve a more efficient allocation of resources is determined. An assessment is provided of the pros and cons of the environmental tax option, relative to other market failure correction instruments, including tradable permits, regulations and subsidies, in terms of the criteria of efficiency, redistribution relative to the status quo, simplicity and compliance and administrative costs. The section includes a discussion of some wider implications of environmental taxes for other taxes and for government expenditure.

Section 8.2 provides a review of current taxes levied by the Commonwealth, state (and territory) and local governments as they affect incentives for decisions on the use of the environment. In several cases, current taxes distort decisions on the production, consumption of and investment in the environment, and so warrant reform. Areas identified for reform include a number of tax expenditures in the income tax system, the ad hoc tax base and tax rates in the petroleum excise and motor vehicle taxes, stamp duties, and the royalties levied on the extraction of minerals.

Section 8.3 draws on the background provided in sections 8.1 and 8.2 to generate a list of potential environmental taxes and reforms to current taxes which would produce a better set of incentives and outcomes for decisions on the environment. Particular areas canvassed are specific taxes for pollution external costs, subsidies for activities providing external benefits, taxes and other measures to reduce urban congestion, reform of taxes to capture resource rents, and the possibility of taxes on private good uses of environmental resources which have alternative public good or common pool properties.

A final section 8.4 offers a tentative road map of reform options.

8.1 General Framework

Specific or *ad valorem* taxes on the production and consumption of environmental resources originally canvassed by Pigou (1920) may be an option to concurrently correct market failures and advance economic efficiency as well as to generate general revenue for government. There are a number of examples in practice; mostly taxes on transport and energy, with some on water and the disposal of wastes (e.g. see OECD 1990). The market failures[1] include:

- situations where there are external costs not incorporated in current market transactions (e.g. pollution associated with the combustion of fossil fuels);
- common pool resource situations where there is rival consumption but high costs of exclusion (e.g. fisheries and traffic congestion); and
- situations where some uses of the environment have public good properties of non-rival consumption and high costs of exclusion (e.g. natural biodiversity and species preservation).

From a social economic efficiency criterion, these market failures can result in: too much pollution of the atmosphere, waterways and land; over-exploitation of fisheries and highways; and too little investment in natural habitat and biodiversity.

Special environmental taxes, in addition to the set of broader based income, consumption and wealth base taxes, offer one form of government intervention to correct the market failures. The tax option needs to be compared with other market correction policy interventions, including regulations, tradable quotas, subsidies and the creation of missing property rights, on such criteria as efficiency, distributional equity, and administrative ease and cost. In general, the tax option is not always an unambiguously preferable option.

This section provides a background story drawn from the public finance and environmental economics literature (e.g. see Stiglitz 2000, on the former; Hanley 1997, on the latter), and the review papers by Bovenberg and Goulder (2002), and by Fullerton, Leicester and Smith (2008). It uses partial equilibrium models[2] to describe the underlying

* I gratefully acknowledge productive discussions with officers of the Australian Treasury, and with Harry Clarke and David Prentice, but take full responsibility for all the views expressed in this chapter.

1 Other categories of market failure not explicitly considered are: market power which results in too little production and consumption; and, information asymmetry which is better addressed directly than via a tax.

2 As Bovenberg and Goulder (2002) persuasively argue, at least for environmental taxes collecting a significant amount of revenue relative to existing taxes, second-round effects on the rest of the economy can mean that the partial equilibrium model misses some important effects and these situations warrant the use of a general equilibrium model. Section 8.1.6 includes a discussion of some of these second-round effects in the wider fiscal policy context, and the possibility of a second dividend.

market failure to be corrected, the design of a market failure corrective tax in terms of the base or taxable sum and tax rate, and it compares the tax with alternative government intervention policy instruments.

8.1.1 Market Failure or Not?

A large proportion of the market sector making decisions on the allocation of scarce environmental resources to different production and consumption uses, investment in their development, and the choice of production method, provides results where the private market decisions closely correspond with those that are efficient from a social perspective. Markets work in the interests of society where the products have private good properties of rival consumption and low costs of exclusion, and where there is a good property rights system in terms of well-defined benefits and costs embracing all the costs and benefits to society, freedom to transfer ownership, and low costs for monitoring and enforcing compliance. In these cases, market decisions equate: marginal social benefits (MSB) across different uses; marginal social costs (MSC) across different options; and, MSB with MSC. Market decisions work well on the production, consumption and investment of most minerals and energy, on the allocation of land between different businesses and households, on the allocation of water among different consumptive users, and in some instances of least-cost ways to protect nature and biodiversity. In these situations, there is no opportunity for market failure correction environmental taxes. Inevitably, there are differences of opinion and legitimate arguments of both logic and of fact as to the precise boundaries of market decisions which approximately achieve social efficiency.

A necessary condition for an environmental tax is the establishment of a clear market failure under current institutional and legal arrangements. A market failure could arise in any of the following circumstances where there is:

- an external cost or incomplete property rights. As a result, too much of the polluting product is produced and consumed, too much of the pollution-intensive production process technology is chosen, and pollution costs on third parties are too high.
- a common pool resource which is characterised by high costs of exclusion. A result is that the common pool resource is over-exploited for both production and consumption.
- a public good which is characterised by both non-rival consumption and high costs of exclusion. The result is free riding and too little supply and consumption of the public good.

The nature of the market failure, and specifically a comparison of the market decisions with socially optimal solutions to the allocation of environmental resources, guides the choice of the tax base and the tax rate for the environmental tax. The following sub-sections explore these issues for each of the three generic market failure cases.

However, before introducing an environmental tax, two further conditions need to apply, namely that:

- government failure associated with limited and costly information, the costs and decision distortions associated with rent seeking and lobbying by special interest groups, and costs of tax administration and compliance, together involve smaller society costs than the market failure; and
- the tax is a better policy intervention instrument than the alternative market failure correction instruments available to government.

8.1.2 Pollution Externalities

Perhaps the greatest scope for environmental taxes is as a mechanism to internalise the external costs of pollution associated with many production and consumption activities which provide private goods valued by households and businesses. Examples include: the combustion of fossil fuels, providing valuable energy but polluting the atmosphere via greenhouse gases (and likely future climate change), sulphur dioxide leading to acid rain and the costs resulting, and particulates and gases contributing to smog that has adverse health effects and is a visual pollutant; disposal of waste water products into rivers, lakes, bays and the ocean resulting in down-graded recreational services and environmental amenity, loss of biodiversity, and adverse effects on human health; contamination of land and underground water through legal and illegal disposal of wastes resulting in losses of usable resources and adverse effects on the health of humans and animals. In many cases, there are no effective property rights for the spill-over or pollution products, although the creation of property rights for the missing market often will be one of the possible policy intervention options.

In practice, there are a number of characteristics which distinguish different types of pollution and these can have an important bearing on the feasibility of and the benefit-to-cost ratio of government intervention, and then on the relative pros and cons of different intervention instruments, including a pollution tax. These characteristics include:

- the geographic stretch of the pollution costs. Some have a global effect, some a national reach, and some are more local. For example, the combustion of fossil fuels has global pollution effects in the case of greenhouse gas emissions, a much more local effect in terms of smog, and a wider but less than global domain for acid rain.
- whether the pollution costs on third parties are associated with the stock of pollution or the flow of pollution. For example, the combustion of fossil fuels and greenhouse gas emissions involve long-lived processes with the stock driving climate change, whereas smog pollution is of shorter duration and can be described as a flow pollutant. In turn, in the case of a stock pollutant, the rate of build-up of the pollution stock depends on the natural decay rate of the pollutant, with some quickly assimilated by nature and others with a close to infinite life.
- the geographical and temporal uniformity, or diversity, of the external costs per unit of pollution.
- so-called point pollution which can be readily measured, versus non-point or diverse pollution involving many small and difficult to measure sources of an external cost.

These and other considerations are important to the details of the design of a pollution tax in terms of the tax base and tax rate, and on the ease and costs of administration and compliance.

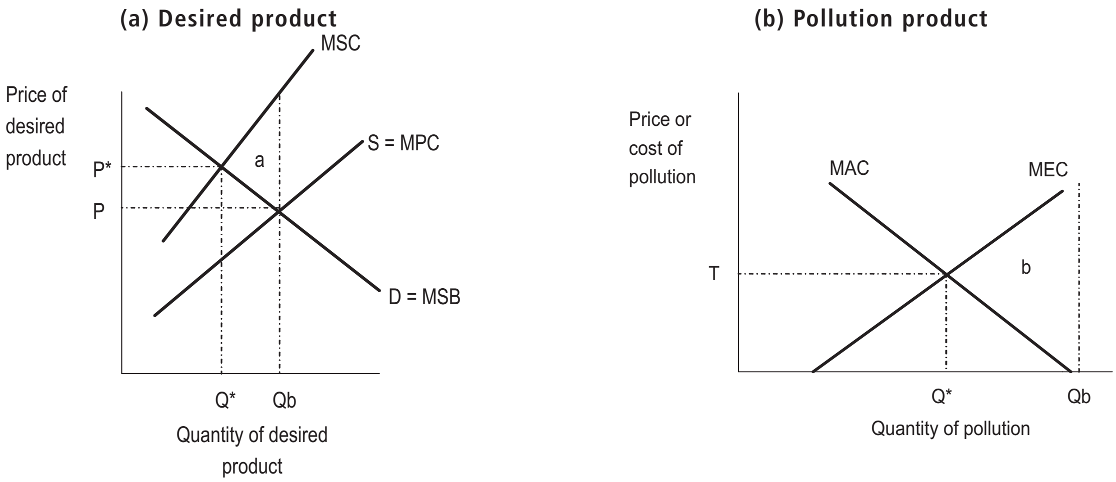
Figure 8.1 provides a framework for comparing the market outcome and the socially desirable outcome for economic activity which involves a pollution externality. Figure 8.1(a) shows the market for a desired product, such as electricity from fossil fuel combustion or industry use of water, but one where the production and/or consumption of the product also produces pollution as a by-product which under current institutions is dumped for free into the atmosphere or in a downstream river/bay, respectively. Under a market solution for the quantity of production and consumption of the desired product, given by equating supply and demand, the business-as-usual quantity Qb where MSB = MPC (with the simplifying assumption that MSB = MPB) is the outcome. If the external cost of pollution was to be included for the socially optimal quantity, this would equate MSC = MPC + MEC, where MEC is the marginal external cost of the pollution, with MSB at a smaller quantity Q* and a higher desired product price. The efficiency gain from reducing production and pollution is given by area a.

Figure 8.1(b) shows the general story for a pollution by-product. It measures the quantity of pollution on the horizontal axis. Figure 8.1(b) is general in the sense that it aggregates across different desired products that generate the pollution in their production or consumption, and it allows for more flexibility in the options to reduce pollution. In a market context where pollution is a free good, pollution quantity is the business-as-usual quantity Qb, and this is analogous to Qb on Figure 8.1(a). The MAC or marginal abatement cost curve shows the rising cost per unit of pollution reduction relative to Qb.[3] Smaller quantities of pollution involve a combination of the cost of reduced consumption of the desired product and the cost of replacing the product with more costly and less suitable substitute products, the use of more costly production processes which involve less pollution per unit of desired product, and of research and development (R&D) to find better substitute products and production processes. The MAC can be considered the demand curve for pollution. The MEC curve shows the marginal external cost of the pollution, or the supply cost of pollution. The social optimum equates the MAC with the MEC to give a social optimum pollution level of Q* pollution. At the Q* quantity, MSB equates with MSC for the desired products. The smaller and socially efficient quantity Q* relative to the market quantity Qb generates an efficiency gain of area b.

Figure 8.1 can be used to evaluate different policy interventions, including a pollution tax, to correct the pollution externality market failure. In particular, Figure 8.1(b) is appropriate for describing and comparing different interventions, and Figure 8.1(a) can be used to assess some of the wider economic effects and implications of the market failure correction intervention. Policy options for government intervention to correct for the pollution external cost include:

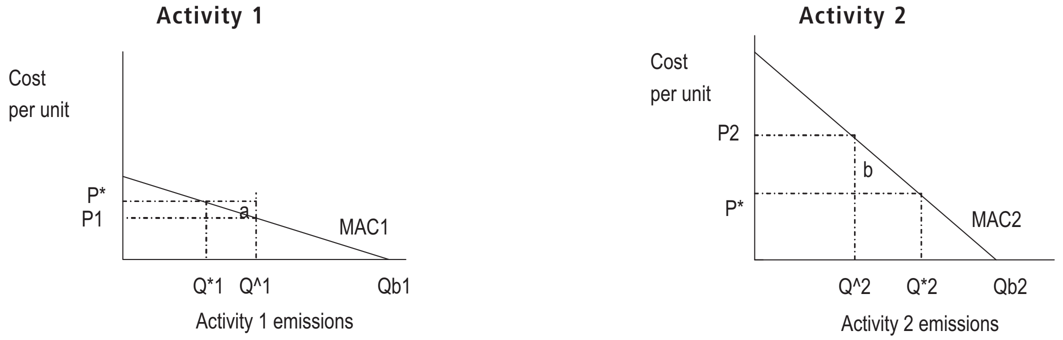
» a pollution tax per unit of pollution emission of T. The most direct tax base is the external cost-causing pollutant (with a discussion in section 8.1.5 below of alternative bases for the tax as well as for the quota and regulatory intervention options), and with a rate equal to the MEC at the socially optimum level of pollution.
» a quota, and better still a tradable quota, set at the socially efficient pollution quantity Q*. Then, there are further options as to whether the permits are grandfather-gifted to current polluters, or gifted to another group, as a windfall property right gift, or whether the permits are auctioned. The scarcity value of limited rights to pollute of Q* will have an opportunity cost value of T, which would be generated by a competitive market for the limited rights to pollute.
» regulations to restrict pollution emissions via controls on the emissions themselves, on production processes,

Figure 8.1 Market and Social Solutions for Pollution



3 For the special case where the pollution is produced as a fixed proportion of the desired product, the MAC of Figure 8.1(b) equals MSB – MPC of Figure 8.1(a). Also, areas a and b would be equal in size.

Figure 8.2 Cost Effectiveness of Market Instruments



or on production quantities of the desired products, all with the general objective of restricting pollution to the Q* level.

- creation of a property right to pollute. Here, there are options on the initial allocation of the property rights, including to the polluter or to the affected party. For most cases of interest for an environmental tax, the large numbers of players involved means very high transactions costs which rule out the property right option.
- an up-front bond payment which is refunded if pollution comes under a stated target level.
- subsidies for substitute products and production processes which are less pollution intensive than those chosen by a market. In effect, these subsidies shift the MAC curve, and the associated quantity Qb where MAC = 0, closer to the pollution emissions origin.

In effect, the pollution tax, tradable quota and regulatory options increase the cost of producing the desired products and the choice of pollution-intensive production methods. In turn, this pushes upwards the market supply curve for the desired product in Figure 8.1(a) towards the MSC curve. As a result, production, both of the desired products and of pollution declines from the market outcome Qb to the social optimum quantity Q*.

In terms of who bears the final economic incidence of the interventions to reduce production, a portion of all the extra private production costs are passed on to consumers as higher market prices of P* as illustrated in Figure 8.1(a). The more elastic the supply of the desired product relative to demand, the greater the share of the extra costs associated with the tax, quota, newly created property rights and regulatory interventions that is passed forward to buyers as higher prices. At the extreme, 100 per cent of the cost is passed forward to buyers if supply is perfectly elastic, as is the case with a constant returns production technology.[4] Many analyses of indirect taxes, and a pollution tax is in effect a selective indirect tax, assume 100 per cent pass through of the tax to consumers as higher prices (e.g. Australian Bureau of Statistics 2007; Warren, Harding & Lloyd 2005), and this assumption is supported by the empirical outcome of the 2000 GST reform package (Australian Treasury 2003). Governments gain revenue from the environmental tax and auctioned tradable permits; and businesses receiving tradable permits as gifts and those employing regulations gain economic surplus.

A number of other comparisons can be drawn between the different policy interventions to reduce the market failure of pollution. Given that individual businesses and households know far more about their different and individual options and their costs to reduce pollution, the market policy interventions of taxes and tradable permits are likely to reduce pollution at a lower cost than a command and control policy intervention. Further, both businesses and individuals are unlikely to provide such data to authorities, and even if they did, the authorities do not have the capacity to collect and collate such information. Figure 8.2 illustrates the proposition that market-based interventions are more cost effective than regulations.

Consider in Figure 8.2 the case where there are two activities or firms which generate pollution. In the market outcome with free disposal of the pollution, and no recognition of the external costs, the two operate at Qb1 and Qb2, respectively, with MAC = 0. The firms have different marginal abatement cost functions MAC1 and MAC2 in terms of different slopes or elasticities, which is private information reasonably known to the firms, but not to the government. Suppose government has sufficient information on the aggregate MAC and MEC, or otherwise aims to reduce pollution by, say, a half. A sensible command and control intervention in the context of no firm-specific information would be to impose a common quota on both firms of Q^, either absolutely or relative to Qb output. Note that at the Q^ levels the two firms face quite different marginal abatement costs with P2 > P1.

If the policy intervention to reduce pollution were to take the form of a market intervention, the quotas could be made tradable property rights or a pollution tax could be used. In either case, the two firms in Figure 8.2 would face a common price per unit of pollution of P* which equates the MAC across the different firms/activities, the government target level of aggregate pollution reduction is achieved, and at least cost with efficiency gains of areas a + b. Newell and Stavins (2003) report a number of studies in which market-based instruments reduced pollution abatement costs to a fraction of the costs with command and control methods.

4 Strictly, Figure 8.1(a) is based on a model of perfect competition where the market supply curve is given by firm marginal cost curves. Freebairn (2008) shows that this perfect competition cost shifting outcome applies also for many models of monopolistic competition and of oligopoly, which likely better capture the real business economy.

More generally, different firms and households in their own self-interest use information not available to governments to find the least-cost way from society's perspective to reduce pollution. With a tradable permit scheme, such as the proposed Carbon Pollution Reduction Scheme, the targeted aggregate quantity of pollution reduction will be achieved at least cost. With a pollution tax, for a given cost per unit of pollution, the private sector finds ways to maximise the pollution quantity reduced at the tax rate cost per unit pollution.

There are two sets of arguments about the relative merits of regulations versus the market-based instruments of pollution taxes and tradable permits to speed up new investment and technological change to reduce pollution. One important criticism of regulation is that once a regulated reduction in pollution is reached, the reward and incentive for further reductions is zero. By comparison, the tax rate, or the market price of a tradable permit, provides a continuing incentive and reward to find ways to reduce pollution per unit output and to find better substitute or replacement products with lower pollution outputs. In part, this argument assumes regulations will not be tightened over time. But, as illustrated by the ever tightening regulations on motor vehicle fuel efficiency and lower pollution with technological change, the assumption of a constant regulation target (and likewise for the tax rate and aggregate tradable permit quota) will not be valid in many cases.

A second line of argument in favour of regulation contends that regulations speed up the adoption of new technology, particularly on processes, because of compulsion. By contrast, market-based instruments allow firms and households to make voluntary choices on technology adoption. However, competitive pressures, including by shareholders and the threat of take-over or bankruptcy, allow very few firms the luxury and complacency to ignore responding to changes in profit opportunities caused by changes in the price of pollution. Implicit assumptions which favour process regulation include that a single technology to reduce pollution will best fit all firms, and that the authorities 'know' the best technology. Both assumptions are implausible. When either assumption is incorrect, the cost to economic efficiency and society of the incorrect choice is similar to the story told in Figure 8.2 for the regulated firm quantity reductions.

In reality, governments will have imperfect knowledge of the MAC and MEC functions necessary for setting the aggregate quota for a tradable permit scheme or the tax rate. Allowing for imperfect knowledge provides some comparisons and contrasts between the tax and tradable permit options for reducing pollution. Imperfect information means that both will not be chosen at the MAC = MEC socially efficient level, except by luck. In extreme cases, the chosen cure can be worse than the pollution externality to be corrected. More generally, the efficiency gains of intervention described in Figure 8.1, the areas a and b, will be smaller than under perfect information.

In the event of uncertainty about the MAC function, Weitzman (1974) provides insights about the conditions favouring a tax over a tradable permit, and vice versa. For similar percentage errors relative to the perfect knowledge social optimum, the efficiency loss with the tax option, relative to the tradable permit option, will be less when (the absolute value of) the slope of the MAC is greater or steeper than for the MEC. Where the MAC is flatter than the MEC, as when there is a threshold pollution level at which external costs increase very sharply and this threshold point is well defined (and that often is not the case), a tradable quota system with a quota at or just below the threshold involves lower costs. The relative slopes of the MAC and MEC will vary from problem to problem, with the answer very much an empirical issue particular to each pollution problem.

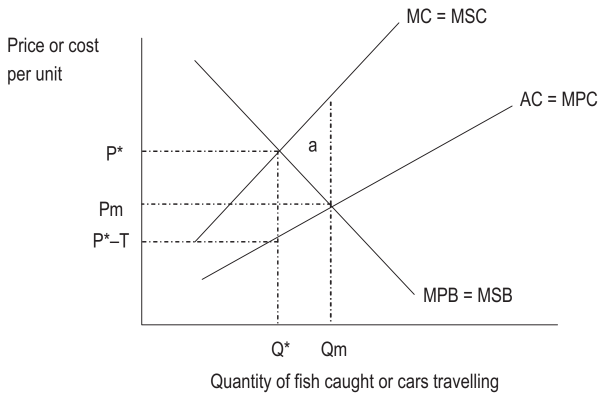
Inevitably, shorter run seasonal and cyclical factors and longer run trend factors will shift the MAC function and also change its slope. Shifts will be a consequence of, for example, seasonal conditions, the state of the general economy, consumer relative prices and tastes, and relative input costs and technology. These shifts of the MAC have different implications for the stability or otherwise of the internalised cost of pollution, or the price of pollution, and the quantity of pollution for the tax versus the tradable permit intervention options to reduce pollution. While the tax option results in stable prices, the pollution quantity will vary as the MAC shifts. By contrast, the tradable permit option provides a stable pollution quantity, but with variation of the market price of the permits. Then arises the question of the relative cost, incurred by businesses and households in their decision-making, and perhaps to the ease and effectiveness of macroeconomic management by government, in responding to the variation of prices and costs relative to the variation of quantities. The answer to this question depends on empirical facts for each situation, and ultimately the solution will vary with the pollution externality being corrected.

8.1.3 Common Pool Resources

Another category of market failure in the use of the environment for which an environmental tax is one of the corrective policy options is the so-called common pool resource problem. The problem lies in resource allocation decisions where the resources have the characteristics of rival consumption and the lack of property rights or high costs of exclusion. Market forces result in over-exploitation relative to the social optimum. Examples include the use of fishery and forest resources, underground water, congested roads, transport infrastructure and, potentially, popular beaches, national parks and icon sights where usage rates involve congestion. While individuals may recognise the cost to themselves of using the common pool resource, at the same time their use involves a type of external cost in that their use concurrently reduces the value of the fishery, roadway, and so on, to other users.

Figure 8.3 depicts a common pool resource such as a fishery or a congested road, and illustrates the market solution, the market failure to be corrected, and the environmental tax and other policy intervention market failure correction options. Users of the resource have a demand curve for fish or travel given by their MPB which for simplicity we assume also equals MSB. The cost faced by each individual is the average cost, AC = TC / Q where TC

Figure 8.3 Common Pool Resource



is the total cost to society of using the resource. In a market setting AC = MPC represents the supply curve facing the individual. A market would choose a quantity to equate private demand and supply at Qm.

However, the marginal cost to society of each additional unit of Q is the MC = dTC / dQ curve. This MSC recognises that additional fishing (or car on the roadway) reduces the available fish stock (or adds to congestion) not only for the new entrant, but also for all the existing fishers (and road users). Then, the social optimum is at a lower level of resource usage where MSC = MSB at Q*. The potential efficiency gain of correcting for the market failure and reducing resource exploitation is area a.[5]

A number of policy interventions can be considered as options to reduce the excess consumption of a common pool resource. These include:

- » providing a monopoly ownership of the common pool resource. Effectively, sole ownership internalises the external cost and provides a property right with a low cost exclusion characteristic. Here, there are sub-options on the allocation of the monopoly property right, including a gift, or auctioning to the highest bidder.
- » establishing a tradable quota system with a quota of Q*. The quotas can be gifted, including a grandfathered share to incumbent market users, or auctioned.
- » regulation to restrict usage to Q*.
- » an environmental tax of T which represents the difference between MSC = MC, and MPC = AC at the social optimum quantity Q*.

Although theoretically an environmental tax can solve the market failure associated with a common pool resource, there are few examples in practice. Reasons for choosing other interventions rather than an environmental tax include: practical feasibility of determining the appropriate tax rate relative to a quantity (but then, often the chosen quantity is based on a biologically sustainable yield rather than an economically efficient quantity); costs of administration and compliance; and, the comparative distribution effects of the different policy intervention options. The tax option, relative to gifting of a monopoly or a system of tradable quotas, or even the regulatory option, redistributes from the incumbent market participants to the government. Although this is a one-off transfer, in a political context, the incumbents largely succeed in arguing prior ownership and entitlement to the resource. For this distributional reason alone, market-based policy interventions to reduce over-exploitation of fisheries, forests and other common pool resources for the main part have used the grandfather-gifted tradable quota intervention rather than a tax (Tietenberg 2009).

In the case of imposing a user charge to internalise the congestion costs associated with transport, the big challenge is the availability of low cost measurement technology. This cost issue may be resolved in the future. Until the technology becomes available, a number of second-best zoning and other regulations have been proposed, along the lines of the applications in Singapore and London (Clarke & Hawkins 2006). But even with tollways where measurement cost is not a valid constraint, in practice the tollway pricing strategy is directed more at cost recovery and financial viability of the investment rather than at the external costs of congestion to others.[6] Recent changes to tollway charges on the Sydney Harbour Bridge are a notable and desirable exception.

8.1.4 Public Goods

Environmental amenity benefits, particularly the non-use benefits associated with option and existence values, have the public good characteristics of non-rival consumption and high costs of exclusion. Some examples we can cite include the natural environments of rivers, mountains, geographic icons, and local parks. Given the public good properties, in a competitive market individuals have an incentive to free ride on others, with a collective outcome of too little produced and consumed. In effect, as illustrated in Figure 8.4, the society demand or MSB function[7], which we call Ds, is much, much higher per unit public good than the revealed market demand function, which we call Dm.

Figure 8.4 provides an illustration of the market failure associated with public goods, and it provides a framework for evaluating different government intervention options, including an environmental tax. Suppose it was possible to allocate a fixed supply of an environmental resource (e.g. land or water)[8] between a private good use where individual marginal private benefits (MPB) and marginal social benefits (MSB) correspond (e.g. land for private housing, or agriculture and water for use by households or for irrigation) and a public good use (e.g. land for a park/reserve to preserve flora and fauna, or water for wetlands to preserve

5 Clarke and Hawkins (2006) estimate the efficiency cost of traffic congestion in the city of Melbourne, analogous to area a, at around $900 million a year. BITRE (2008) estimate the deadweight cost of road congestion for Australia at $3 billion a year.

6 However, it should be noted that financial viability and economic efficiency are not necessarily inconsistent. Depending on such circumstances as the mix of fixed and variable costs and of demand relative to capacity, a congestion charge set at MEC may generate revenues less than, greater than or equal to that required to fund the project.

7 Ds is the vertical sum of the individual MPB functions, and Dm represents the highest MPB at each public good quantity.

8 And we could readily generalise the example for an aggregate supply with a non-zero elasticity.

flora and fauna) for which MPB < MSB, or where society demand, Ds, is greater than market demand, Dm.

In Figure 8.4, to achieve a social optimum that equates the MSB of the natural resource allocated between the private good and the public good, the allocation would be Qp to the private good and Qu to the public good with MSB = P, and equal across the two alternative uses. But, if the allocation is left to market forces (for the public good, Dm is relevant rather than the social demand Ds), a larger share of Q would go to the private good, namely Q'p, with a MSB value of P', and a smaller quantity would go to the public good, namely Q'u with a much higher MSB value of P". The possibility of correcting the market allocation of too much to the private good and too little to the public good, and to collect an efficiency dividend represented by the areas a plus b, provides the necessary condition for government intervention.

In reality, we can anticipate the optimal allocation to a public good will change over time. Changing circumstances will shift one or more of the following functions: private good demand (Dp), public good demand (Ds), and resource supply (S). Changes in incomes, private good product prices, input costs, technology and tastes shift one or more of these curves in Figure 8.4.

Government intervention to correct the market failure associated with a public good might employ a number of different instruments. In the context of Figure 8.4, these include:

- regulation that a minimum of Qu be allocated to the public good, or a maximum of Qp to the private good;
- making the Qp a tradable quota, and retaining the options initially of gifting the quota to incumbents (a grandfather model) or to others, or auctioning the permits;
- government purchase of the social optimum quantity Qu and dedication of its use in providing the public good (e.g. national parks and water buy-back);
- granting explicit property rights of Qu to an environmental manager with the responsibility of providing the public good. The environmental manager could be a government department or agency or chosen via an open tender arrangement;
- provision of a subsidy to the private sector using the resource for public good use; or
- a tax on the private good users.

Figure 8.5 is based on Figure 8.4 but provides more detail on the environmental tax option. A tax at rate T would be levied on the private use of the good in order to drive down the private good market demand to Dp – T, and the aggregate market demand to D* = (Dp – T) + Dm. As a result, the market price of the natural resource falls to P*. But, private good users pay the social optimum price P = P* + T = MSB for the resource, and the efficient allocation of Qp goes to the private good and Qu to the public good. Note that the tax rate T = P – P* is set with reference to the social optimum allocation of the scarce environmental resource to the private good use.

Several observations can be made about the tax option relative to the other instruments for correction of a public good market failure. In principle, the same efficient allocation of scarce environmental resources can be achieved under different government interventions.[9] However, markedly different redistributional effects may occur. In general, the starting position is the market solution

Figure 8.4 Allocation to a Public Good

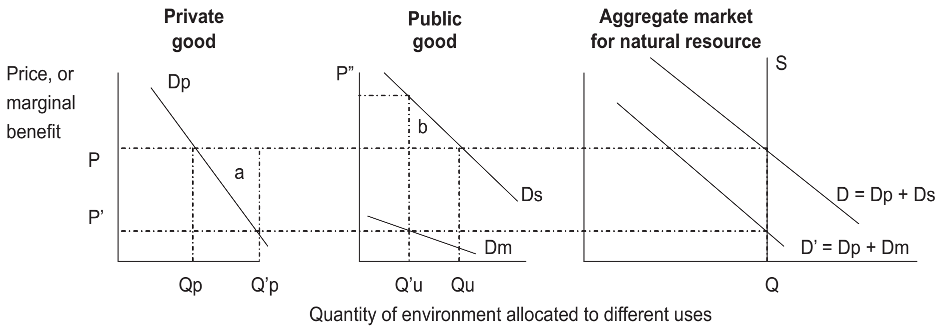
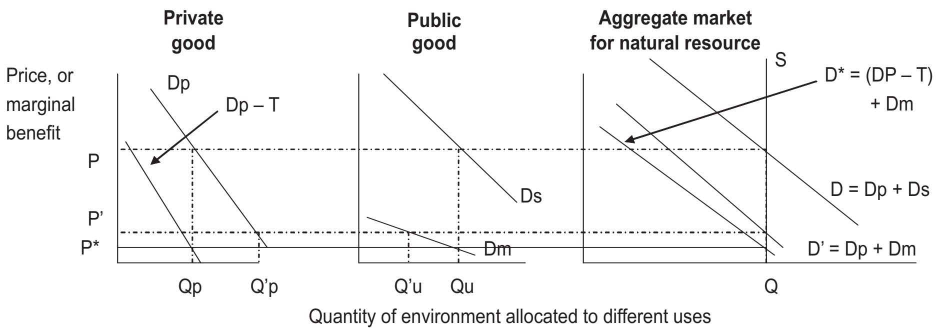


Figure 8.5 Allocation to a Public Good: Tax



9 This statement assumes perfect knowledge. In the reality of imperfect knowledge, all instrument choices will achieve less than the social optimum (except by chance), and with different comparative properties much as discussed in section 8.1.2 for pollution external cost market failures.

with a market price of P’ shown in Figure 8.5. Then, with a tax of T on private good users, the private good users lose considerable economic surplus, and government is a big revenue beneficiary. This redistribution would also happen if tradable permits were to be auctioned. Note that current market holders of the resource for public good uses share some of the tax burden as a lower market price of P* < P’. The alternative instruments of grandfather gifting of tradable permits, government purchase of the resource for public good uses, or regulations, transfer most of the economic surplus arising from the higher market price for the resource to those receiving the permits or the rights to use the now smaller quantity but also more valuable resources for private good use.

8.1.5 Choice of Tax Base

Often the choice of a tax base for a pollution tax necessitates making tradeoffs between simplicity, low costs of administration and compliance on the one hand and providing direct and explicit incentives to change behaviour to reduce pollution on the other hand. While market transactions already have an established invoice system for use as a tax base, this is not the case for those market failures which by definition have no market transaction currently. Typically, the supply chain involves multiple production stages with, at each stage, different: input mixes and substitution opportunities; levels of industry concentration; and linkages between inputs, outputs and the pollution externality. The ease and cost of measurement also varies. As argued by Schmutzler and Goulder (1997), the choice of the tax base either as a direct measure of the pollution or an associated input or output along the supply chain will depend on relative administration and compliance costs of the input, pollution and output, the extent of input substitution, and the output demand elasticity. The use of petroleum products for the provision of transport services with two types of pollution in the form of smog and greenhouse gas emissions illustrates some of the issues.

All else constant, a direct measure of the pollution externality, and preferred tax base, is the pollutant itself. It provides the most explicit and direct incentive for reduction of pollution at minimum cost; in terms that follow a correlation coefficient of unity. In the case of the operation of motor vehicles, which provide transport services but also produce smog and greenhouse gas emissions, a measure of pollution by vehicle would provide the most explicit measure of pollution. But, to make such a direct measure of pollution would be very costly with current technology.

Other proxy measures of the pollution product include key inputs such as the type of vehicle, fuel, or engine. Often these proxy measures are more easily measured, but they may be only weakly correlated with the pollution. Where the correlation is low, taxation of the proxy measure provides poor incentives to change decisions to reduce pollution and/or to reduce pollution at minimum cost. In the case of greenhouse gas emissions, the correlation between the carbon content of the fuel and the pollution externality is very high, and it is much higher than correlations with such alternative measures as the vehicle type or kilometres travelled. Using the existing petroleum products excise system (with its highly concentrated refinery and import industry) as the pollution tax base sharply reduces operating costs for a tradable permit scheme or a carbon tax to internalise the costs of greenhouse gas emissions.

But, a fuel input tax base is not a good proxy for smog pollution. In the case of smog, regulations on the type of engine, or a tax calibrated by engine type (and perhaps also by location), may offer a better compromise between operating costs and a proxy measure of the external cost-causing activity.

For cases where (a) direct measures of the pollution are administratively challenging or costly and (b) low cost measureable proxy variables upstream or downstream in the production chain have a low correlation with the pollution, Fullerton, Leicester and Smith (2008) argue that it may be desirable to use a number of complementary instruments to correct the market failure. For example, smog pollution might be addressed by a combination of a tax on fuel, regulations on engine design, and subsidies for R&D to reduce emissions.

8.1.6 Complementary Taxation and Fiscal Policy Issues

In addition to the direct effects of environmental taxes in correcting market failures already discussed, there are also implications for other parts of the fiscal regime. These include the conduct of other forms of taxation, the overall level and structure of taxation, and possible hypothecation of the revenue gain for environmental expenditure.

The efficiency rationale for environmental taxation is to internalise to private sector decision-makers the full social costs and, in particular, the social opportunity costs, of their use of the environment. That is, an environmental tax can be regarded as an element of the social cost of production, the same as expenditure on labour and materials.

- For income taxation, environmental taxes should be regarded as a deductible expense incurred in producing goods and services.
- For the GST, the environmental tax-inclusive price of goods and services is the social cost. Efficiency among consumption choices requires the social cost as the tax base. Inclusion of the environmental tax in the GST tax base does not represent a tax-on-tax or double taxation issue of legitimate concern.

Environmental taxes represent both an increase in aggregate tax revenue and an increase in the share of that revenue collected via indirect taxes (relative to income and asset taxes). As has been the case for other indirect taxes, most of this higher indirect tax burden will be passed forward to households as higher consumer prices (for the

10 For that part of the environmental tax not passed on to the consumer, but rather to the capital and resource owners, there will be distortions in the resource and capital markets akin to the labour market distortions discussed here and in Bovenberg and Goulder (2002) and Fullerton, Leicester and Smith (2008).

taxed products).[10] The associated higher cost of living, all else constant, reduces effective spending power per hour worked. In turn, the loss of spending power per hour worked increases the distortions to work versus leisure decisions caused by existing taxes and an increase in the efficiency costs of taxation.[11] Using the revenue gain from environmental taxes to fund reductions in income taxes can largely offset this efficiency loss effect. Recognition of the distortions to labour supply and other decisions from increased indirect taxation, which is an integral characteristic of environmental taxation, means that in general there is no double dividend as sometimes claimed for environmental taxes, and in some cases the second-round effects add to the deadweight costs of other taxes (Bovenberg & Mooij 1994; Bovenberg & Goulder 2002; Fullerton, Leicester & Smith 2008).

More positively, a strong case can be made for a package that (a) collects additional government revenue as it corrects an environmental market failure which has raised prices and (b) uses the revenue gains to fund the reduction of income taxes in what effectively is an approximately aggregate revenue neutral and distributional equity neutral tax mix change. Government revenue collection options utilising interventions to correct environment resource allocation market failures include taxes and the auctioning of permits. By contrast, interventions which involve gifting permits, or the application of regulations, transfer a government created scarcity rent to the recipients, usually incumbent businesses. While correcting the market failure provides one efficiency dividend, the associated increase in prices and the cost of living further aggravates existing tax distortions to labour and capital market decisions.[12]

Of course, employees could seek to recapture the lost effective purchasing power by seeking compensating wage increases (as would happen under indexation, for example), with the risk of initiating an inflationary wage-price spiral and the costs of a decline in macroeconomic outcomes. Use of the revenue gains from the environmental tax or auctioned permits to fund lower income tax rates would largely offset the increased effective indirect tax burden distortions to decisions, and/or provide a compelling argument against the need for compensating wage increases. Lower income tax rates would more directly offset the distortions than spending the funds on government programs, although some expenditure programs reduce prices elsewhere in the system. Returning the extra indirect tax revenues as a lump sum transfer would have offsetting income but not substitution effects. Such a package is not unlike the 2000 *A New Tax System* (ANTS) tax reforms which included a net increase in indirect taxes (of about two of the ten percentage points of the GST) with compensating reductions in income tax and increases in social security payment rates. Such a package would: reduce one set of distortions over the use of the environment by more closely aligning MSB and MSC without aggravating other tax distortions; ensure maintenance of the current distribution of the overall tax burden (of direct plus indirect taxes); and, support arguments for macroeconomic stability in the sense of treating the CPI price increase effects of the environmental taxes as a one-off increment which should be discounted in wage negotiations (on the argument that the income tax cuts offset the CPI blip) and in nominal interest rates.

The foregoing arguments for the efficiency effects of environmental taxes, with further support of the package of a tax mix change, do not imply nor require hypothecation of the environmental tax revenue to be spent on 'environmental programs' (also see Ergas 2009). The taxes themselves correct the market failure in full, and achieve the efficiency gains. The flow-on labour market distortion effects and redistributive effects of the increased aggregate indirect tax burden are more explicitly, directly and transparently countered via funding lower income taxation (and higher social security payments) than expenditures on the environment.

Worthwhile expenditures on the environment should be justified with an explicit and transparent social benefit cost assessment, and this assessment should be independent of the revenue source. Also, public good expenditures on more public good environment amenity would compete via the normal government processes with other government expenditure claims for education, defence, and so forth.

8.2 Assessment of Current Taxation and the Environment

This section assesses current taxes levied by the Commonwealth, states (and territories) and local governments as they directly and indirectly affect the use of the environment. Some of these taxes affect the environment in a positive way and sometimes negatively. In most cases, the effects on environment allocation and investment decisions are unintended second-round effects rather than explicit design effects. Necessarily, there has to be some ambiguity and legitimate debate about the chosen list of taxes affecting environment production, consumption and investment decisions. Within this list the information about the initial or current rationale for the particular tax base and rate is often imperfect. This section works through the different broad categories of tax collected by each level of government, and focuses on particular components which have explicit or unintended effects on the incentives and rewards from private sector environment resource use decisions.

8.2.1 Commonwealth Taxes

Commonwealth taxes can generally be categorised as income tax, broad-based expenditure tax, and product specific indirect taxes, including excises and tariffs.

In principle, broad-based income taxation of individuals and businesses and broad-based expenditure taxes, including the GST, have a neutral effect on decisions to allocate the environment among different uses and to invest

11 In the absence of money illusion, the effective spending power of a wage W per hour of work is W (1 – Ty) /(1 + Ti), where Ty is the income tax rate and Ti is the indirect tax rate, including higher costs to correct for environmental market failures.

12 Then, as Bovenberg and Goulder (2002) note, there can be no guarantee of a net efficiency gain.

in the environment. In practice, neither the income tax nor the consumption tax bases are comprehensive because of a number of special exemptions and deductions. While the exemptions of the GST for basic food, education and health services represent a reduction from a comprehensive consumption base by about a third, neither in intention nor in effect do the exemptions significantly create or correct market failures in the use of the environment. However, in the case of the income tax system, a number of special exemptions and deductions referred to as tax expenditures induce changes in consumption, production and investment decisions affecting the environment.

Table 8.1 lists a number of income tax concessions which have adverse effects on environmental outcomes. Almost certainly the adverse effects are unintended effects. If the objective of the tax concession is to correct other market failures, and of course such a claim would need to be substantiated, it may (or may not) be the case that the efficiency loss to use of the environment decisions is less than the efficiency gains from correcting the market failure which was the primary reason for the tax concession. But, then we should ask: is there a more direct form of market failure correction without the adverse side effect for the environment decision?

In the context of labour costs and employee remuneration, relative to wages and salaries, a number of fringe benefits and the associated tagged expenditure on transport are taxed at a lower rate. This has a second-round effect of subsidising the allocation of incomes and expenditure to private transport with associated external costs of pollution and, in cities, the cost of congestion. An accelerated depreciation allowance for some transport equipment has a similar effect of subsidising private transport and associated external costs.

The subsidy component of accelerated depreciation for the on-farm storage of water, initially to encourage drought preparedness by primary producers, results in some diversion of water from the environment, although the quantitative effect of reallocation of water from the environment to agriculture would be small.

A number of tax expenditures which favour agriculture, forestry and fishing at the same time increase the competitive position of these uses of scarce natural resources relative to a smaller allocation for the environment, and they support higher private utilisation rates and possible additional environmental external costs such as excessive stocking rates and pushing primary production into sub-marginal areas.[13] Examples of these tax expenditures include: undervaluation of natural livestock inventory increases; farm management deposit bonds; accelerated depreciation provisions for horticultural crops which effectively subsidise agriculture; and, accelerated depreciation for plantation forestry. Accelerated depreciation allowances for some construction capital works favour the allocation of the environment for private use purposes rather than for environmental amenity.

On the other side of the ledger, there is a relatively smaller set of tax expenditures in terms of revenue cost which may encourage businesses and households to move environmental decisions closer to the optimum. Even then, it is arguable that the direction of effect is in favour of more socially efficient outcomes and it is unlikely that the implicit subsidies equate MSB and MSC. Table 8.2 lists some examples of desirable environmental consequences. To the extent that private sector outlays on environment protection activities, environment impact studies[14], and donations to environmental organisations provide external benefits beyond the private benefits, the tax expenditures encourage further production with MSB > MSC. It would be surprising if the subsidy rate implicit in the tax expenditure approaches the required subsidy for social efficiency.

Table 8.1 Income Tax Concessions with Adverse Environmental Consequences

Name of concession	Adverse effects on the environment	Tax Expenditure Statement Code: 2008–09 revenue cost ($million)
Fringe benefit tax treatment of cars	Subsidy to car use relative to alternative transport, or to reduced travel	D24: 1830
Fringe benefits to non-profits, including for cars	A component is a subsidy to car use relative to alternative transport, or to reduced travel	D6, D8, D28, D30, D48: 1130
Fringe benefits for car parking	Subsidy to car use relative to alternative transport, or to reduced travel	D26, D33, D39: 16
Commuter travel concessions for employees	Subsidy for travel	D16, D17, D18: 37
Accelerated depreciation for some transport equipment	Subsidy for private transport	B81: 385
Accelerated depreciation for farm water investments	Subsidy for farm use vs other uses of water	B27, B72, B73: 25
Tax expenditures for primary production	Subsidies for agriculture and forestry relative to allocation of land to environment	B40, B44, B71, B101: 300
Accelerated depreciation for selected capital works	Subsidy for investments which include use of environment resources	B83: 520

Sources: Author in consultation with Commonwealth and State Treasuries. Data for third column from the Australian Treasury, *Tax Expenditures Statement 2008, 2009*.

13 These effects are similar to those described in detail by the Productivity Commission (2009) in its criticisms of concessional interest, freight and other subsidies to primary producers in the event of drought conditions and other ‘exceptional’ circumstances.

14 While environmental impact studies may be a regulatory requirement, and the subsidy lowers the development cost of projects requiring them, and so subsidises such projects, it might be argued that better environmental outcomes are reached.

The net resource reallocation effect of the subsidy provided to plantation forestry via accelerated depreciation provisions is uncertain. The claim that it encourages the use of forests for carbon sequestration to reduce climate change should be considered against levels of sequestration with alternative agriculture and natural forest uses of the land. The plantation forests may involve higher external costs relative to these other uses, such as the use of water priced below MSC and the loss of biodiversity.

Next, consider the excise tax system on petroleum products and, in particular, the various tax concessions. Originally, the rationale for excises on petroleum, alcohol and tobacco products was heavily tilted to them being revenue raisers on products with few points of supply and hence low collection costs, with a low elasticity of demand, and the consumption of which carried a sense of sin. Potentially, there are good market failure reasons for such special taxation in addition to a general consumption tax.

Market failure arguments for additional taxation of petroleum products, such as the excise tax, include: a crude form of user pays charge for government-funded road infrastructure; a tax on pollution associated with the combustion of fossil fuels; and, a crude form of congestion tax. State-imposed motor vehicle taxes, and perhaps a portion of municipal rates, should be included in a complete assessment of the special taxation of motor transport as a user fee and to correct for market failures. In general, unless the taxes on petroleum products and motor vehicles are to correct a market failure, as a general revenue raiser their high initial incidence on business inputs, rather than on final consumption, results in distortions to the choice of input mix and production methods. As noted by Cronin (1997) and others, the excise tax on petroleum products in its present form has many deficiencies in terms of the tax base and exemptions from the base, and the excise rate.

As a user charge for government-provided road services, excise on petroleum products has a relatively low correlation with services used, and relative to a charging system based on kilometres travelled per weight per axle. The user fee argument does justify exemptions from the present excise tax for off-road use of vehicles and for uses of petroleum products for heating as noted in Table 8.3. However, it does not support current exemptions for LPG, CNG and biofuels used in road transport also noted in Table 8.3.

A pollution charge on greenhouse gas emissions would require the taxation of the combustion of all fossil fuels. The current exemptions from fuel excise for off-road use and for LPG and CNG, the low rate on aviation fuel (especially if the current rate is taken as a user charge for government-provided infrastructure), and arguably the complete exemption of excise on biofuels, are inconsistent with a tax to internalise the pollution costs associated with greenhouse gas emissions. Further, the combustion of fossil fuels for stationary energy production, including coal and gas for electricity, would be included in meeting a greenhouse gas emissions target. The proposed Carbon Pollution Reduction Scheme (CPRS) quota with its associated

Table 8.2 Income Tax Concessions which Claim Desirable Environmental Consequences

Name of concession	Nature of support for the environment	Tax Expenditure Statement Code: 2008–09 revenue cost ($million)
Accelerated deductions for environmental expenditures	Subsidy relative to other business costs	B77, B78: 15
Tax deductions for gifts to registered environmental organisations	Government co-funding	
Tax incentives for landcare	Subsidy for programs which may have external benefits	B70: up to 25
Accelerated depreciation for forestry investments	Subsidy for forest over agriculture and environment	B87, B101: 135

Sources: Author in consultation with Commonwealth and State Treasuries. Data for third column from the Australian Treasury, *Tax Expenditures Statement 2008, 2009*.

Table 8.3 Departures from a Comprehensive Excise Tax on Petroleum Products[a]

Exemption from general excise tax	Possible justification for exemption	Tax Expenditure Statement Code: 2008–09 revenue cost ($million)
Fuel tax credit for off-road fuel use	Justified as exemption from a road user charge and congestion fee, but not as a pollution charge	F4, F5, and other
Fuel tax credits for some on-road use	Perhaps justified as a exemption from a congestion fee, but not as a pollution charge	
Aviation fuel concession	Implies a zero pollution charge	F3: 710
LPG and CNG concession	Subsidy for road use, congestion and pollution	F6: 830
Biofuels exemption	Subsidy for road use, congestion, and arguably for pollution	

Note: (a) Assessed against a base petroleum products fuel excise rate of 38.14 cents per litre.
Sources: Author in consultation with Commonwealth and State Treasuries. Data for third column from the Australian Treasury, *Tax Expenditures Statement 2008, 2009*.

market price per unit of quota is to include all carbon-based energy (Department of Climate Change 2008).

Where the pollution associated with petroleum products and other energy production is localised (e.g. smog) the fuel excise tax ideally would have a more local tax base than the present national tax base. Of course, if alternative instruments such as regulations were to be used, a first-best regulation would have a local application base also. That is, similar issues of geographic area or product coverage apply across the alternative policy instruments.

It is likely that the largest market failure associated with motor transport is congestion, and particularly at peak hours in the large cities (Parry & Small 2005; BITRE 2008). Given that the external costs of congestion vary with the road and by time of day, a flat fee per litre of petroleum product will be poorly correlated with external costs of congestion. More generally, it would be a surprising coincidence if the current 38.14 cents per litre excise rate approximated the appropriate market failure correction tax. Failure to adjust the excise rate with inflation, and with likely changes in other circumstances, seems inconsistent with a logical special tax on petroleum products and fossil fuels.[15]

The luxury car tax with an exemption for 'fuel efficient luxury vehicles' involves a political compromise which potentially gives rise to a favourable environmental effect. More fundamentally, the equity and efficiency arguments for a luxury tax on motor vehicles, but not on other luxury goods and services, and the magnitude of the concession for 'fuel efficient' vehicles require assessment.

8.2.2 State Taxes

Broadly, state taxes can be categorised as: payroll tax, land tax, a number of particular product taxes, including stamp duties, motor vehicle and gambling taxes, and royalty charges on mining activities. As with the discussion of Commonwealth taxes, the objective here is to assess whether state taxes have the direct or unintended effect of encouraging or discouraging production, consumption and investment decisions for the environment towards a social optimum.

Though the tax base of state payroll tax is much narrower than it could be, nonetheless it has a relatively neutral effect on decisions affecting the environment. Exemptions from the land tax base for primary production and for owner-occupied housing support some reallocation of land into these uses and away from land allocated to commercial use which is subject to land tax. The reallocation effects are generally not considered to be large, and the environmental distortion effects are probably even smaller.

Stamp duties or conveyance duty on the transfer of property, both housing and business property, distort the transfer of property from lower value to higher value uses because the tax can be avoided if no transfer of ownership is the decision (NSW IPART 2008; Freebairn 2009). A portion of the efficiency costs of these distortions is the adverse environmental effects. For example, in the case of households, people who change their place of employment may substitute extra commuting time, and the associated external costs of transport, rather than change their place of residence and pay conveyance duty. Others may experience a reduction in household size and yet continue to live in a 'too large' house with spill-over costs of heating and so forth to avoid conveyance duty instead of transferring to a smaller house with fewer environmental external costs. Some of the distortions to the pattern of ownership and use of business property associated with the conveyance duty tax wedge include transfers of property that would have a smaller environmental footprint.[16] For both households and businesses, an annual property tax replacing stamp duties, and generating similar revenue over time, would remove distortions to the transfer of property ownership to more valued uses, and have small redistributive effects (Freebairn 2009).

In addition to the excise on petroleum products levied by the Commonwealth and discussed in section 8.2.1 above, the states levy a number of taxes on the use of motor vehicles, including an annual fee and stamp duty on changes of ownership, and in a few of the capital cities additional parking fees are payable in the CBD as a proxy congestion charge. The transfer of ownership stamp duty distorts vehicle turnover choices, including the purchase of newer models. In general, newer models are more fuel efficient and safer and so incur less external costs. It would be better to augment the annual registration fee and replace the distorting stamp duty in an approximate aggregate revenue neutral package, which also has close to neutral distribution effects (Freebairn 2009). While the annual registration fee pays some homage as a road user charge, as it takes into consideration vehicle weight or size and potential road damage, there is no consideration for kilometres travelled. The fees per CBD parking space in Sydney, Melbourne and Perth are designed to reduce private traffic and congestion in the CBD, although the correlation between city parking and congestion is far from unity. The recently introduced congestion premium on the Sydney Harbour Bridge toll represents a more direct congestion charge. On the other hand, where fees for the use of tollways have been implemented, the tolls have been set largely with a criterion of cost recovery rather than according to the marginal congestion externality cost (Clarke & Hawkins 2006).

Overall, in combination, the Commonwealth excise on petroleum products and state motor vehicle taxes are

15 Further consideration of an appropriate index factor would be required. The ideal index tied to the MEC of fuel use is unlikely to be just the CPI or some other readily available general inflation index.

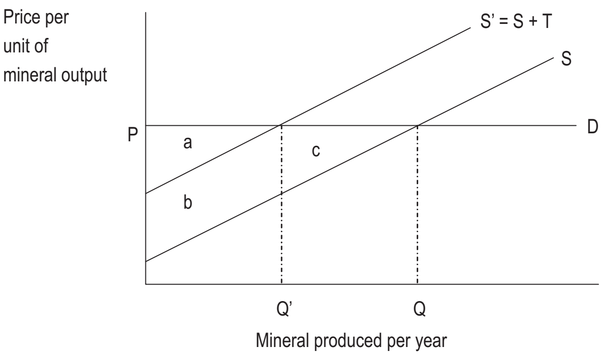
16 These effects are in addition to, or an aggravation of, other distortions in the income transfer system which effectively subsidise both owner-occupied and residential housing relative to other forms of consumption and of saving. These subsidies for owner-occupied housing include no taxation of the imputed rent and capital gains, no land tax and the exemption of own home from the pension assets test. For rental housing, the tax concessions and implicit subsidies include the 50 per cent rate reduction and the deferment to realisation for capital gains tax and unlimited negative gearing, and a number of subsidies for renters.

poorly designed in terms of both the base and the rates as a user pay fee for road infrastructure, pollution and congestion taxes.

The states impose a range of royalties, both *ad valorem* and specific, on the extraction of minerals and energy (Hogan 2007; Australian Treasury 2008). The rationale primarily is one of revenue collection rather than as a market failure correction tax. Because the quality and unit costs of exploitation of deposits vary, the supply curve for mineral and energy products as illustrated by S in Figure 8.6 (and of most other natural resources) is a rising function, and rents are earned on the higher quality deposits. Royalties as an additional cost per unit output shift the supply curve upwards from S to S' = S + T, where T is the royalty. As a consequence, production falls from Q to Q', and in the absence of market failures an efficiency loss of area c is incurred. Since regulations, performance bonds and so forth are used to reduce pollution externalities and damage to biodiversity associated with the mining activities, the presumption of no other market failures seems a reasonable one.

There is an extensive literature evaluating the different ways of taxing rents earned on minerals and energy that favours a resource rent tax over royalties (see Garnaut & Clunies Ross 1979; Heaps & Helliwell 1985; Hogan 2007). A less distorting and roughly revenue neutral replacement profit-based resource rent tax (namely a share of area a + b + c with revenue approximating area b now collected), such as the Commonwealth petroleum resource rent tax, would largely eliminate the efficiency loss on production decisions. It would have a similar disincentive effect on decisions on exploration in the sense of involving a similar reduction of the expected private return. Arguably, the resource rent tax reduces the sovereign risk of future changes in the royalty rate if market conditions boom beyond current expectations. Under a resource rent tax, production would stay at Q and the efficiency cost of area c under the present royalty system would not occur.

Figure 8.6 Taxation of Mining Rents



8.2.3 Local Government Taxes

To fund their outlays, local governments use rates, generally on a tax base of the unimproved land value, and a range of user pays fees for some of their services with private good properties. Transfers from the Commonwealth and the states are important revenue sources. Clearly, local government regulations significantly influence the allocation of land and sites for different uses that have a variety of environmental outcomes. But, the effect of rates per se on environmental outcomes seems likely to be small.

8.2.4 Hypothecated Taxes and Charges

Over the years, the Commonwealth and the states have introduced a number of specific taxes for which the revenue has been hypothecated for expenditure on programs with environmental objectives. The various taxes on fuel and motor vehicles discussed above exemplify the story. Table 8.4 provides a partial and illustrative list of other hypothecated taxes and charges.

In the context of the discussion in section 8.1 on market failures in decisions on the production, consumption of and investment in the environment, it is possible to categorise and assess the taxes in Table 8.4 as a user fee, a tax on an externality, or a tax on a private good use of a resource which has an alternative public good use. The charge on visits to the Great Barrier Reef and the landfill levy would be better recognised as a user pay charge for the cost of services provided rather than as a tax on an external cost. The taxes on aircraft noise, ozone and on landfill (to the limited extent that tonnage into landfill is correlated with landfill waste pollution external costs) in principle seeks to internalise external pollution costs. If the tax rate was set at the marginal

Table 8.4 Taxes Designed to Raise Revenue Hypothecated to be Spent on Programs with Environmental Objectives

Name of tax or charge	Comments
Product stewardship oil levy	Funds used to subsidise used-oil recycling
Aircraft noise levy	An externality tax to fund noise attenuation investments in affected buildings
Charge on visits to Great Barrier Reef	Provides 17% of Statutory Authority funding (a part user fee)
Ozone protection and Synthetic Greenhouse Gas (SGG) levy	An externality tax to fund administration of the Act
Save the River Murray levy (SA)	Charge on private good water use to partially fund public good use of river
Environmental levies on statutory water corporations (Vic)	Charge on private good water use to partially fund public good use of river
Metropolitan improvement levy/parks charge (Vic)	Charge on private property to partly fund public parks
Landfill levy/waste and environmental levy (most states)	A user charge, and possibly a crude externality tax

Source: Author in consultation with Commonwealth and State Treasuries.

external cost, the tax alone would correct the market failure, with no need for a hypothecated expenditure, and the revenue could flow to consolidated revenue rather than to a hypothecated expenditure. However, granted the less than perfect correlation between the external cost and the tax base, as argued by Fullerton, Leicester and Smith (2008), the combination of a fee and an expenditure may move closer to a social optimum than one instrument alone.

Finally, consider in Table 8.4 the tax and hypothecated expenditure measures affecting the allocation of water for private good household uses versus public good environmental amenity flow measures, and the allocation of urban land between private good housing versus public good parklands. An efficient allocation of scarce land between the private and public good uses requires equating marginal social benefits across the different uses (section 8.1.4 above). Relative to the market outcome, a more efficient allocation can be achieved in part by a package involving taxing the private good use (the stick) and subsidising the public good use (the carrot). In principle, the combination of hypothecated taxes and subsidies of the form noted in Table 8.4 may, arguably, recognise the complementary effects of the different stick and carrot instruments to reach a socially efficient allocation. However, it seems unlikely that the current arrangements achieve the required balance, and certainly there is no transparent supporting formal analysis. More importantly, in terms of the efficiency criteria, there is no requirement to either hypothecate the revenue or to restrict the market correction expenditure program to the revenue collected by the market correction tax.

8.3 Some Reform Options for Environmental Taxation

This section seeks to bring together the material of the preceding two sections to provide more specific options for environmental taxation in Australia. In drawing up the options, consideration is given to:

» correction of a market failure to deliver an efficiency gain. The nature and magnitude of the market failure indicates the first-best choice of tax base and tax rate. However, administrative and compliance costs may force the choice of a second-best tax base imperfectly correlated with the market failure. In this second-best world, more than one policy intervention with complementary properties may be better than a single instrument, and in some cases no intervention may be the better decision. In all cases, the revenue gain is a consequence rather than an objective per se.

» changing parts of the current taxation and income transfer systems that have adverse efficiency effects on the environment, often unintended. Sometimes these reforms will have positive revenue effects and in other cases negative revenue effects.

» comparison of the tax reform option relative to other government policy intervention options to correct market failures associated with market decisions affecting the production, consumption of and investment in the environment, such as tradable permits, regulations and subsidies. Criteria for comparison include efficiency, redistribution based on economic incidence, and in general with reference to the current pattern of distribution, feasibility and costs of government administration and private sector compliance, and inertia as represented by past policy decisions.

Specific reform options are considered under the sub-headings of: pollution externalities; environmental external benefits; traffic congestion; other common pool resources; competing public good uses; and, taxation of natural resources rents.

8.3.1 Pollution Externalities

Under the polluter pays principle, a pollution tax equal to the marginal external cost on the most direct measure of the pollutant causing spill-over costs on third parties will internalise all social costs and provide incentives and rewards for more efficient production, consumption and investment decisions. Pollution of air, water and land is prevalent in many parts of the Australian economy, and there are a number of features of the present taxation system which aggravate pollution.

Consider first pollution of the atmosphere. Here, the topical example is greenhouse gas emissions, a form of global pollution. At the same time, the combustion of fossil fuels and some mining and industrial processes also generate local pollution in the form of smog and emissions with adverse effects on the health of humans and animals. Governments have a number of different instruments in place to counter, in varying degrees, pollution of the atmosphere. The proposed Carbon Pollution Reduction Scheme (CPRS) scheduled for implementation in July 2011 as a tax for the first year and then as a system of tradable permits on fossil fuel energy, with agriculture and other sources of emissions to follow (as initially proposed in the Department of Climate Change White Paper 2008, which was subsequently modified in May 2009). With most of the quota permits to be auctioned, the scheme will have similar market-based effects to an emissions tax, but with more certainty on the quantum reduction in pollution and greater uncertainty and volatility in the price or cost per unit of pollution. Both the tax and tradable permits options will have common challenges on, for example: choice of the quota level and tax base; administration and compliance; treatment of trade exposed, energy-intensive industries should Australia proceed before other countries; and, reaching a cooperative international agreement.

Either the CPRS or an emissions tax scheme would generate significant additional government revenue, much as any other increase in indirect taxation, and most of the extra internalised production costs will be passed forward to households as higher prices.[17] To avoid the efficiency losses of aggravated distortions to labour market decisions

17 The extent of pass through of prices will depend primarily on the extent of global participation in schemes to place an explicit cost on greenhouse gas emissions. For non-traded goods and services, the pass through will be close to 100 per cent. But, for the traded sector, if Australia and a few other

and/or to avoid the risk of a wage-price inflation spiral (as discussed in section 8.1.6 above), and to maintain the current redistribution pattern of the income transfer system, most of the revenue gains will need to be returned to households as income tax cuts and increases in transfer payments.[18] Such a package would still change relative prices to encourage and reward switches away from carbon-intensive products and production processes to achieve lower greenhouse gas emissions.

Atmospheric pollution taxes, or tradable permits, have comparable and, in some senses, more efficient properties relative to current regulation policy interventions. Consider, for example, greenhouse gas emissions and electricity. Given the availability of direct, low cost measures of greenhouse gases emitted by the generators, a carbon tax or tradable permit raises the cost of all electricity-related greenhouse gas emissions. It then provides incentives for a plethora of ways to reduce emissions which are much better known to firms and households than even the best intended and informed politicians and bureaucracies. Regulations by contrast, such as those that may apply to renewable energy targets, or types of light bulbs, have a 'picking winners' property which tends to place less emphasis on other pollution reducing options, such as introducing technology to reduce emissions per kwh of fossil fuel fired electricity, or more energy efficient white appliances, that may form part of a package of lower cost ways of meeting an emissions target.[19]

Regulations already play a large role in restricting many forms of pollution. There are a number of other forms of atmospheric pollution, other than greenhouse gases, produced by electricity generators as well as smoke and particulate emissions from motor vehicles. Given that most of these regulations have a national focus, or are state-based, national or state-based pollution taxes could be considered a viable alternative market failure correction option. There are two other opportunities to replace regulations with pollution taxes, or to include pollution taxes as a part of a package of intervention instruments to reduce pollution. These are: waste water pollution, both in urban and rural uses of water, and the external costs of hard waste disposal.

A number of current taxes either aggravate pollution of the atmosphere or are poorly designed as an instrument to correct the market failure. The fringe benefits concessions for motor vehicles in the Commonwealth income tax, and conveyance duties on property and motor vehicle transfers levied by the states, induce higher levels of vehicle use and also more energy-intensive housing, with associated atmospheric external pollution costs. While a part of the rationale for the Commonwealth excise on petroleum products might include a correction for the associated external pollution costs, the many exemptions for coal, gas, LPG, CNG, off-road use and business use mean it is an ineffective pollution tax. Motor vehicle taxes levied by the states might be in part motivated by a correction for pollution external costs. However, neither the bases nor the rates are closely, if at all, correlated with the pollution. For these and other reasons, these Commonwealth and state taxes as currently operated are candidates for major reform.

Pollution of water and land are the by-products of many household and business activities. Examples include: sewage and garbage from households, agricultural run-off of fertilisers, pesticides and herbicides, building and industrial wastes, and land and water salination as a consequence of irrigation and the clearing of forests and other vegetation. Currently, there are many regulations to reduce water and land pollution. In most cases, the regulations target associated inputs, outputs or production methods rather than the direct pollution external cost component. Often these regulatory instruments target stages in the supply chain that are not well correlated with the pollutant. The incentives often do not provide for a cost minimising reduction in pollution, and there is little assessment that the reduced pollution approximates a level equating MSB with MSC. In principle, taxes per unit of pollution set at the marginal external cost could be more effective instruments to reduce water and land pollution. Overdue reform of the regulations to reduce the current deficiencies could include environmental taxation as an option.

8.3.2 Environmental External Benefits

Several of the income tax expenditures noted in Table 8.2 provide a form of subsidy to private sector outlays which might provide external benefits in the form of better environmental outcomes to third parties. Presumably the tax expenditure subsidies have a similar rationale, and with similar limitations, as the tax concessions for expenditures on R&D and government co-payments via tax exemptions for a broad set of benevolent gifts. The limitations include that the

countries lead, given that Australia for most products is a world price taker, most of the additional costs for pollution will not be passed forward to consumers of export and import competing products; and this would also be the case under current proposals for compensation of the so-called trade exposed, energy-intensive industries. Expected exchange rate adjustments would partly cushion these results. If, or when, most countries participate in a global pollution reduction scheme, then the extra pollution costs will be passed forward to consumers in both the traded and non-traded sectors.

18 While the White Paper (Department of Climate Change 2008) indicates all the revenue gains will be spent and it proposes income compensation for those on low incomes (and in fact over-compensation is promised), it tends to ignore the arguments made here for income tax cuts for those on middle and high incomes, and it proposes allocating some of the revenue gains to R&D and to compensate some industries for falls in the values of some sunk assets. There will not be enough revenue from the auctioned permits to meet all these demands.

19 The argument can be developed further using Figure 8.2. Suppose the regulated activities are Activity 2 of Figure 8.2 with a MAC of P2, while the non-regulated activities are Activity 1 with a MAC of P1. A market-based intervention that sets a common price of P* across the regulated and non-regulated activities achieves the same aggregate pollution reduction, but with efficiency gains of areas a plus b. Alternatively, if the regulations apply to Activity 1, they are non-binding with no effect on behaviour. That is, a pollution tax is at least as effective (and at no higher cost, and usually at a lower cost) as a set of regulations imposing specific reductions on different activities.

20 For individuals and unincorporated businesses, the personal tax rate is the relevant rate, and with a progressive rate schedule the implied subsidy for the external benefit varies with the level of taxable income. For corporations, the imputation system means that some to all of any tax preferences at the corporate level can be washed out by a higher compensating personal income tax contribution on unfranked dividends.

subsidy rate is set by the relevant marginal tax rate.[20] The value of the marginal tax rate varies with the business circumstances, and often its magnitude is uncertain. In any event, it would be an extraordinary coincidence if the tax rate approximated the marginal external benefit (MEB) required for efficiency. Removing the tax expenditure (and as part of a general package of broadening the income tax base to fund lower rates) together with an explicit subsidy set at the MEB would be a more efficient market failure correction intervention.

8.3.3 Urban Congestion

The external costs associated with urban congestion during peak hours are large and growing. They have adverse effects on businesses with significant transport costs, and on households as commuters. Expected advances in technology are likely to provide low cost measures of the time and geographic use of road infrastructure in the future. Such data will provide a direct tax base for the congestion externality rather than the relatively poorly correlated measures of fuel use and vehicle registration addresses now available, or even the CBD cordon models of Singapore and London. Low cost GPS information and estimates of the MEC of use of the road infrastructure by location and time would come close to a first-best congestion tax system in the future, but not immediately.

In the intervening period, the main issue is whether more cost effective but lower correlated measures of congestion external costs, such as city cordons, parking levies, and tollways set with tolls determined with some consideration of congestion costs (and recognising the second-best issue of free substitute roads) will improve efficiency relative to the present very crude measures based on a component of the fuel excise and motor vehicle taxes. One way to approach the decision is to employ an investment options model. Here, comparative strategies include: maintain current arrangements and inefficiency costs of excessive congestion for some years with the future option of a one-off investment to introduce a first-best new technology (based on GPS) system; or, invest now in a feasible and better system such as city cordons and CBD parking levies for a few of the large cities and reduce some of the congestion external costs. Then, and perhaps even later than for the first strategy, replace these interim measures by investing in a first-best new technology (based on GPS) system. The preferred strategy will depend on the relative costs of the different investments and the savings in congestion inefficiency costs, and on the expected time lag before availability of the GPS, or similar technology, as a workable low cost technology.

A number of current taxes subsidise motor vehicle use and other taxes aggravate congestion costs or they are poorly designed as an instrument to correct for a market failure associated with road traffic congestion. The fringe benefits concessions for motor vehicles, and accelerated depreciation for some transport equipment in the Commonwealth income tax, subsidise private motor vehicles. In the absence of arguments for correcting other market failures, and with regard to the adverse environmental effects, there seems to be a compelling case for the removal of these concessions as part of a revenue neutral, income tax base broadening reform package, incorporating a lower tax rate.

One aspect of a logical re-evaluation of the Commonwealth excise on petroleum products and the state taxes on motor vehicles is to assess the role, if any, of these taxes as part of a congestion tax, along with consideration of their roles and reform options as measures of a user fee for government provided and maintained road infrastructure, and as a pollution tax. For these and other reasons, these taxes as currently operated are candidates for major reform.

8.3.4 Other Common Pool Resources

Competitive markets result in over-exploitation of common pool resources such as fisheries, forests, underground water and perhaps some minerals and energy. To reduce the rate of resource use towards a social optimum, governments in Australia and elsewhere have used quotas, and then increasingly tradable quotas, and in both cases have allocated the quotas for free on a grandfather basis (rather than auctioning them). They have also used regulations, and in some cases monopoly property rights. An important characteristic of these forms of government intervention is that most of any scarcity rent created by the intervention is distributed to the incumbent producers, and this has often been seen as important to gain political acceptance.

By contrast, an environmental tax would, if it is set at the gap between MSC and MPC, achieve the desired reduction in resource exploitation, but at the same time it redistributes any scarcity rent to the government. This redistributive difference makes the tax option a political challenge. Perhaps a more palatable option is to extend the idea of resource rent taxation, discussed in section 8.3.6 below, to apply to increases in profit above a base period situation (e.g. recent years) to common pool resources.

At the same time, reform for greater efficiency and simplicity would seek to phase out any subsidies for natural resources, including the income tax concessions listed in Table 8.2.

8.3.5 Public Goods

In many cases of market failure in the allocation of too few limited environmental resources for uses with public good properties, some of the alternative uses have private good properties. For example, forests can be used for private good timber and pulp products or for biodiversity with mostly public good option and existence uses; or water can be allocated to households and irrigation with private good uses or for environmental flows providing mostly public goods. Restriction of supply to the private good uses and reallocation to the public good uses by any of the government intervention measures inevitably means that the smaller quantity of aggregate private good use in a market will have a higher opportunity cost and be reflected in a higher market price. This higher price outcome for the private good use will occur whether government corrects the market failure via regulation, a tradable quota, direct government supply of the public good, or if a tax is imposed on the private good use so that the quantity allocated to the private good uses falls to the social optimum. However, while the tax option often can achieve as efficient an allocation (or more) as the alternative policy interventions, it has an explicit and transparent redistributive effect from the private good users to the government which either does not happen or is less transparent with the other instruments that are more commonly applied.

8.3.6 Taxing Resource Rents

Most collections of different natural resources, including minerals, energy, water, land and icon sites, have production units with differences in quality and variable cost attributes. This means that the elasticity of supply is less than infinite and that scarcity rents are earned on the natural resource units with more favourable attributes. By contrast, for much of the manufacturing and services sector industries the elasticity of product supply is highly elastic with constant returns to scale technology and high elasticities of factor supply to individual industries. The scarcity rents, together with general perceptions within society (including the possibility of legal ownership) of natural resources have often provided a redistribution and equity justification for society via government taking a larger share of the scarcity rents earned on natural resources than collected through the broader income tax and general consumption tax systems. Appropriate design of the taxation of rents on natural resources can have minimal effects on decisions and so very low efficiency costs. Root and branch tax reform provides an opportunity to implement less distorting and larger revenue collecting taxes of the scarcity rents earned on natural resources via a profit-based resource rent tax, such as the Commonwealth petroleum resource rent tax, as a replacement for the present inefficient system of royalties.

Another alternative is to broaden the system of land taxation. One option would be to include land held by owner-occupied housing and primary production as well as commercial property in a comprehensive land tax base. As part of a reform package, some to all of the revenue gain from a more comprehensive land tax base could be used to replace the far more distorting system of conveyance duties on property transfers. On average and over time both land tax and conveyance duty have a similar economic incidence, that is, a transfer of scarcity rent income on land from the landlord to government with little effect on the rental rate paid by the user of the property input. Removing or reducing the current zero land tax threshold, and moving to a flat rate, would further advance efficiency, but at the cost of drawing a larger number of landowners into the tax net (though the landowners would at the same time gain from the withdrawal of conveyance duty).

In principle, the arguments for taxing scarcity rents earned on minerals and energy are also applicable to taxing scarcity rents on water, fishing, forests and other natural resources. In the context of rising community incomes and the associated increase in demand for environmental amenity services provided by these natural resources, the market prices and scarcity rents earned on these natural resources almost inevitably will rise in value. Options for governments to share the rents include: auctioning the limited quotas for private use; environmental taxes; or a resource rent tax system. Concerns for distributional equity, political acceptance, and reduction of sovereign risk, might be addressed by setting the profit-based resource rent tax as profit in excess of current rent returns.

8.4 Conclusion

The arguments for environmental taxes should be driven primarily by the efficiency criterion. Gross revenue gains are likely to be no more than a few per cent of current aggregate tax revenue. At least as important, to avoid second-round effects of environmental taxes aggravating other tax distortions associated with the higher consumer prices, is the requirement that most additional revenues be returned as income tax reductions (and increases in social security payments). A large part of a more efficient set of environmental taxes is the need to replace existing indirect taxes, including the petroleum excise and motor vehicle taxes, with better targeted market failure correction taxes. The income tax and social security systems are more direct and effective ways of meeting equity objectives than environmental taxes. Considerations of simplicity and cost effectiveness are important in the choice of the environmental tax base (and also the point of application of regulations or a tradable quota) as a related input or output along the supply chain as an alternative for the often hard-to-measure environmental externality or public good.

Reform of the current taxation system to deliver more efficient decisions on the environment can be directed ideally at correcting market failures and removing distortions to decisions affecting the environment caused by the present taxes levied by the Commonwealth and the states. Taxing the polluter of the atmosphere, water and land with a rate at the marginal external cost offers a cost effective way to correct a market failure, and in most cases at a lower cost than regulation. In the most important example of greenhouse gas emissions, current government policy is premised on a tradable permit scheme rather than an emissions tax. Introducing an appropriate tax to reduce the large efficiency costs of traffic congestion may need to be delayed until the anticipated relatively low cost technology to measure congestion by time of day and location becomes available. In principle, taxation of the private good use of common pool resources, such as fisheries, and of private good uses of resources with alternative public good uses, such as water and natural habitat, can be used to achieve a more efficient allocation. However, the redistributional effect from private resource owners to government, relative to alternative intervention options of grandfather tradable quotas, regulations or government purchases, means the tax option is problematic in terms of political acceptability.

A number of changes to current taxes to remove distortions to decisions affecting the allocation of and investment in the environment have been suggested. The income tax system includes a number of tax concessions, or tax expenditures, which result in subsidies to over-exploitation of the environment, including fringe benefit and accelerated depreciation allowances for private transport, concessions for primary production, and accelerated depreciation for some capital works. The excise tax on petroleum products and the state taxes on motor vehicles should be reviewed and replaced with a comprehensive set of user pay fees for government-provided road infrastructure services, pollution taxes, and congestion taxes. One of several efficiency costs of state stamp duties on the transfer of property and vehicles includes adverse effects on the environment. Replacement of the array of state-based royalties on energy and minerals with a profit-based resource rent tax would provide efficiency gains and, if required, additional revenue. Consideration might be given to extending the resource rent tax idea to other natural resources, including water, forests and fisheries.

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