

Economic justifications for government involvement in weed management: a catalogue of market failures

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Abstract

Governments are heavily involved in many aspects of weed management, including regulation, research, inspection, quarantine and physical control. This paper is a discussion of the rationales and potential justifications for this involvement in weed management. One category of justifications is 'market failure', where co-ordinated or regulated action generates greater net benefits than unco-ordinated individual actions. Market failure implies that government involvement may lead to a better outcome than that arising in a free market. Market failure is discussed under the categories of externalities, public goods (non-rival and non-price excludable), natural monopoly and ignorance. Many examples where market failure occurs are described, including spread of weeds from farm to farm, from farm to environment or from environment to farm; chemical residues in food or the environment; contamination of exports; chemical spray drift; cultivation; biological control; herbicide resistance; and research. It is emphasized that the existence of market failure *per se* is not sufficient justification for government involvement since the costs of reducing market failure may exceed the benefits. A second motivation for government involvement is to redistribute wealth. The limited capacity of economists to evaluate the merits of a policy which redistributes wealth are acknowledged and discussed.

Introduction

The literature on the economics of weed control has grown rapidly in recent years. There have been many studies of the costs and benefits of publicly co-ordinated weed control programs. Most are based on the benefits of weed control to farmers (e.g. Marsden *et al.* 1980, Cullen 1984, Pannell 1984, Vere and Campbell 1984, Pannell and Panetta 1986, Auld *et al.* 1987, Denne 1988) but some also consider benefits to consumers of agricultural products (e.g. Vere *et al.* 1980, Edwards and Freebairn 1982). In most of these studies there is little consideration of the circumstances in which government co-ordination of weed control is preferable to leaving control decisions to the private sector. There seems to be limited recognition that just because net benefits of weed

control can be identified, it doesn't necessarily mean that it should be up to government to generate those benefits.

The concept of 'market failure' is central to this issue. Economic theory indicates that in the absence of market failure, intervention by governments in human affairs is likely to reduce economic efficiency. Previous authors to address the issue of market failure in weed management include Menz and Auld (1977), Lumley (1986) and Pannell (1988). The issues are very similar for pest and disease control (e.g. Headley and Lewis 1967, Langham and Edwards 1969, Edwards *et al.* 1970, Southwood and Norton 1973). The objectives of this paper are to increase understanding and awareness of the issue of market failure in weed management and to provide a more detailed discussion of examples of market failure than has previously been available. The paper is not concerned with the methodology of cost-benefit analysis; for that refer to Gittinger (1982), Auld *et al.* (1987) or Mumford and Norton (1987).

The paper includes an outline of the different kinds of market failure and a discussion of their relevance to the issue of government involvement^A in weed management. In the second section many examples of market failure relating to weeds are described. Governments are also concerned with distributional fairness and this will be discussed in relation to possible community attitudes to what is considered fair.

Market failure and the justification for government involvement

Why not leave weed control to the people on whose properties the weeds occur? Most economists consider that there are two potential grounds for government intervention in human affairs: to overcome severe market failure and to redistribute wealth. Broadly, these two justifications relate to efficiency and fairness respectively. An attempt to overcome market failure is aimed at ensuring the efficient operation of the economy (maximizing total economic welfare) whereas redistribution activities are attempts to ensure equitable outcomes for all groups in the economy (achieving a fair distribution of the wealth).

Economic theory has contributed little to society's view of what constitutes

fairness, but a lot to our understanding of efficiency. In particular economists argue that in a competitive market economy, the most efficient outcomes occur when the government sits back and watches. It also says that where there is market failure, this conclusion may break down. The different types of market failure will be outlined below. Before that, consider the qualification in the second last sentence; why only 'may' instead of 'will'?

The mere existence of market failure is not a sufficient justification for government involvement. The failure has to be great enough to offset the direct cost of involvement and the risk of 'government failure'^B. The cost of government involvement includes the administrative cost of collecting, holding, distributing and spending tax payers' money. For Australia this cost has been estimated as being of the order of \$0.40 per dollar of government expenditure on programs (Findlay and Jones 1982). In other words, to spend \$1.00, the government has to collect \$1.40. For this to be efficient, the government's use of the money would have to be substantially more productive than the tax payer's.

As well as the issue of whether any Government involvement is justified, there is also the issue of the optimal level of involvement—the level of Government expenditure which maximizes benefits to society. This depends on the biological, technical and economic characteristics of each case and can be very difficult to determine.

Types of market failure

There are four types of market failure: public goods, externalities, natural monopolies and ignorance or uncertainty. Of these, the first two are of greatest relevance to weeds. The information here is presented in greater detail in most texts on environmental or resource economics (e.g. Randall 1981, Pearce and Turner 1990).

Public goods

There are two broad types of public good: non-rival and non-price excludable (Randall 1981). In each case the economic problem is that in a free market the good is produced at a lower level than would be socially optimal.

Footnotes

^A 'Government involvement' is used throughout the paper in a very general sense to denote any form of government activity related to weeds, including regulation, research, inspection, quarantine and physical control.

^B That is, the risk that even with the best of intentions, government will formulate laws or undertake measures which are not in the best interests of society.

Non-rival goods. For a non-rival good, consumption by one person does not reduce the quantity or quality available to others. An accurate weather forecast is an example. The fact that one farmer benefits from (i.e. 'consumes') the forecast does not reduce the benefit attained by other farmers^c.

The reason a non-rival good results in market failure is that there is no cost of providing the non-rival good to an additional consumer (the marginal cost equals zero), so from a social point of view, the optimal price to charge all consumers is zero^d. At any price above zero there will be consumers who would have consumed the service if it were free but who now choose not to do so. A non-zero price thus excludes some people who could have had a benefit at no cost to society. One possible response is for the government to force private firms to charge a zero price, but if they do this, the private sector will choose not to provide the good at all. Other possible government responses include providing the good themselves as a free public service, or allowing the private sector to charge a non-zero price in order to ensure provision of the good (and tolerating the losses caused by the positive price).

Non-price excludable goods. A non-price excludable good is one which consumers cannot be prevented from consuming, leading to problems of 'free-riders', under-provision or over-exploitation. Because consumers have access to the good without constraint, the provider of the good is unable to charge a fee for access. In the case of a good which must be produced by human activity (e.g. national defence), the result is under-provision or non-provision of the good in a free market. In the case of a good which exists even without human activity (e.g. a natural resource such as a fishery), the result of non-price excludability is over-exploitation of the good.

Non-price excludable goods can often be considered a problem of poorly defined property rights. If a private firm was able to assert and enforce a right to exclude people who did not pay for the good or service, it would be possible for the private sector to charge a price and consequently to efficiently provide the good or service. The assignment and enforcement of property rights also gives the holders of the rights an incentive to preserve the resources on which the rights depend.

Note that a good can be both non-rival and non-price excludable (e.g. free-to-air television). Note also that being non-price excludable is not necessarily an intrinsic characteristic of the good. A good may be non-price excludable in one time or place but price excludable in another, depending on the laws in place. For example,

some fisheries in Australia are open-access while others are subject to quotas. The tuna fishing industry in Australia has recently undergone a phase of quota introduction. Previously it was more or less open-access, leading to over-exploitation of stocks. In this case, the non-price excludable good was a right (to fish) rather than a physical product (the fish), and rights are subject to change if the law is changed. By contrast, non-rival goods cannot be converted into rival goods by a change of law; they are intrinsically non-rival. Note that not all goods which are non-price excludable can be converted to price excludable goods by a change of law, as we shall see when we examine examples related to weeds.

Although the problems of non-rival and non-price excludable goods both relate to zero prices, there is an important difference. For non-price excludable goods, the problem is that it is not possible for a private firm to charge consumers for the good, whereas for non-rival goods, it is not socially desirable for firms to charge a fee, even if they can.

Externalities

An externality occurs when an activity undertaken by an individual has side-effects on others which are not taken into consideration by the first individual. There are two types of externality: negative and positive (also called external costs and external benefits).

For example, suppose pollution is generated as a side effect of an economic activity. In a free market, a negative externality such as this pollution is a problem because the level of the activity chosen by the polluter is too great from a social point of view (in the sense that there exists the potential to improve the welfare of both the polluter and the sufferer). If the external costs could be factored into the polluter's business decision, the polluting activity would not be undertaken or would be undertaken at a lower level. In the absence of regulation or some form of government imposed incentive, polluters generate more pollution than is socially desirable because they do not consider the costs it imposes on others.

A positive externality is also a problem, but this time because the level of the activity is too low. For example, if planting trees on a farm has a side effect of lowering salinity on neighbouring farms, the level of tree planting is likely to be lower than would be socially optimal.

Economists' classic prescription for externalities is to 'internalize' them; that is, to create a market in the externality so that price incentives can operate or to use taxes or incentive payments to cause the instigator of the costs or benefits to factor them into their own decision making. Government responses to externality

problems may also include direct regulation setting maximum or minimum levels of production of the externality, negotiation, and use of peer pressure.

Externalities and public goods are inter-related to some extent. Randall (1981) argues the externalities are not an economic problem unless they also have non-rival or non-price excludable characteristics. For example, an individual who over-exploits a non-price excludable resource causes a negative externality to others through damage to the resource stocks, but it is the non-price excludability which allows the problem to occur.

Natural monopoly

A natural monopoly occurs in an industry with very high fixed costs and/or very low costs of provision at the margin (e.g. railways). Where a monopoly exists, it has an incentive to exploit its exclusive provision of a good by restricting supply and increasing the sale price to the detriment of consumers. Economists often recommend that monopolies be regulated to prevent such practices. However in the case of natural monopolies, such regulations can be counter-productive, resulting in non-provision of the good. In such cases, enforcing low sale prices may mean that the monopoly firm is unable to cover its fixed costs and so will shut down. The most common government responses to this situation are to take on responsibility for provision of the good or to allow the monopolist to charge a price which is higher than their marginal cost.

Ignorance or uncertainty

Individuals sometimes behave in a socially undesirable way simply through ignorance. The ignorance may be over damage that they are unwittingly causing to others (e.g. through spray drift) or over matters which affect them personally. Where governments feel that they have better information than the individuals they may choose to provide that information as a public service (Lichtenberg and Zilberman 1986). Examples include public education programs on health, law, pollution and safety.

Footnotes

^c A possible exception would be where a change in the level of production by one farmer affects the price received by another farmer. However this is not a concern here because it is not 'Pareto relevant' meaning that there is no scope for government involvement to yield benefits in the aggregate (Randall, 1981).

^d In cases where the good is imperfectly non-rival, so that there is a small marginal cost to society from an additional consumer, the optimal price is that marginal cost.

Examples of market failure relevant to weeds

In many cases of government involvement in weed management, it is possible to identify a market failure which has prompted the government to get involved (Table 1). It is notable that in most cases where co-ordinated action would prevent some external costs, the benefits of such action are non-rival and/or non-price excludable. This is a primary reason why solutions to these externality problems do not arise in a free market. The following discussion expands on the issues raised in this table.

1. Spread from farm to farm

Suppose that farmer A has a particular weed on his or her property but farmer B does not. If A controls the weed, A will benefit through higher production, but B will also benefit through a reduced risk of the weed spreading and infested farm B.

Control of the weed generates benefits to B and probably other farmers which are non-rival and non-price excludable. The fact that one farmer benefits from the control by farmer A does not reduce the benefits obtained by another farmer (i.e. non-rivalry). Also it is impossible to exclude one farm from the benefits because to do so puts at risk the benefits of the other farms. This is an example where non-price excludability is an intrinsic characteristic of the good (unlike the earlier example of access to a fishery). With some of the benefits of weed control being both non-rival and non-price excludable, the level of control undertaken without some sort of government involvement may be insufficient from a global point of view.

One potential solution to the problem would be for farmer B to pay A for undertaking a higher level of control than otherwise intended (thus internalizing the problem since all benefits and costs become internal to the control decisions of farmer A). In practice, however, B is unable to identify the (potentially many) sources of the weed. They might pay A to undertake extra controls but then get infested from farm C. Governments, therefore, commonly resort to the strategies listed in Table 1.

The current distribution of a weed is very important in determining whether further spread imposes a substantial external cost. For example, in Australia wild oats is a very serious weed of crops, but because it is already present throughout all agricultural regions, it is not declared as noxious. The control problem is one for individual growers to make, taking into account their own benefits and costs. Any benefits to neighbours are minimal because they and their other neighbours already have the weed. By contrast, aggregate losses from skeleton weed in

Table 1. Summary of market failures relevant to weeds

Description	Types of market failure	Potential government responses
1. Farm-farm weed spread. Control which prevents spread.	External cost to farmers. Benefits non-rival and non-price excludable.	Legislation requiring control. Coordinate control programme. Directly conduct control. Quarantine services.
2. Farm-environment weed spread. Control which prevents spread.	External cost to the public. Benefits non-rival and non-price excludable.	As for 1.
3. Environment-farm weed spread	External cost to farmers.	Directly conduct control.
4. Chemical residues in food. Prevention of chemical residues.	External cost to the public. Benefits non-rival and non-price excludable.	Constraints on herbicide use. Inspections and testing services.
5. Chemical residues in environment. Prevention of chemical residues.	External cost to the public. Benefits non-rival and non-price excludable.	Legal constraints on herbicide use.
6. Contamination of exports. Prevention of contamination.	External cost to farmers. Benefits non-rival and non-price excludable.	Legal constraints on levels of contamination. Inspection and testing services.
7. Chemical spray drift. Prevention of drift.	External cost to farmers or the public. Benefits to the public non-rival and non-price excludable.	Legal constraints on herbicide use.
8. Cultivation. Prevention of erosion.	External cost to farmers or the public. Benefits non-rival and non-price excludable.	Extension to promote low tillage systems. Legal constraints on tillage.
9. Biological control.	Benefits non-rival and non-price excludable.	Public funding of research, testing and release.
10. Herbicide resistance.	Ignorance. External cost to farmers from spread.	Public extension and education. Legal constraints on movement of resistant weed seeds.
11. Research and extension.	Benefits non-rival and non-price excludable. Ignorance. Natural monopoly.	Public funding of R&E. Patents. Plant variety rights.

Western Australia are tiny, but it is subject to an intensive government co-ordinated control programme. The difference is that there are judged to be substantial external costs from failure to control the weed due to its high potential for spread. Quarantine services are favoured by this argument since they apply to weeds for which the potential for spread is at its maximum.

The non-excludable nature of the benefits from prevention of weed spread or re-invasion is a commonly cited justification for government involvement in weed control (e.g. Auld *et al.* 1978, 1982, 1987, Menz and Auld 1977, Menz *et al.* 1980). Externalities from spread of insect pests have been considered in a theoretical model by Regev *et al.* (1976).

2. Spread from farms or towns into native environments

This problem is similar to that of farm-to-farm spread except that there is no private owner of the threatened land. The benefit of weed control which prevents spread to native environments is the value which society places on the lower level of weed infestation in the environment. The beneficiaries are all members of society who care about the state of the relevant environment. The benefit is non-price excludable and non-rival.

3. Spread from environment to farms

If the Government does not control weeds on public lands, the weeds can easily spread onto neighbouring farm land, producing an external cost. The problem is

amplified relative to farm-to-farm spread because on much public land, government agencies have no incentive to control weeds other than for the benefit of their neighbours. This is especially true on land which is not valued for its intrinsic wilderness value.

The benefits of preventing environment-to-farm spread are partly price excludable as some of the beneficiaries are clearly identifiable as the immediate neighbours to the public land. However, there are external costs from risks of further spread in the longer term.

4. Chemical residues in food

In general chemical residues are more of a problem for insecticides which are usually more persistent and more toxic to humans. The issue of negative externalities through effects on human health has been widely discussed for pesticides (e.g. Antle and Capalbo 1986, Langham *et al.* 1972, Lichtenberg and Zilberman 1986, Willey 1986) but hardly mentioned in the weed economics literature. Nevertheless, the potential for a problem with herbicide residues exists. If the risk to health were accurately reflected in the prices consumers pay for food, then the problem would have been internalized and no government action would be necessary. In most cases, however, consumers are unaware of which chemicals have been used, how much residues remain, and what the impact of those residues will be. This is an externality problem because the farmer making a decision to use a chemical based on financial returns is not factoring in the potential health effects to others.

Government responses to this problem include constraints on chemical use such as maximum residue limits, maximum doses, withholding periods (Pannell 1989) and the creation of inspection and testing services. Such services are partly rival. If a particular batch of food is inspected, this uses up some capacity to test another batch. However if inspections are made of random batches of food, the mere existence of an inspection service has some effect on all food production, including those which are not inspected. These benefits are non-price excludable and non-rival.

There have been several studies of the effects of herbicide or pesticide bans (for health reasons) on economic welfare of farmers and/or consumers (e.g. Casey and Laceywell 1973, Pimentel and Shoemaker 1974, Cashman *et al.* 1981, Fox 1987, Lichtenberg *et al.* 1988).

5. Chemical residues in soil or environment

If herbicide residues in the soil reduce agricultural productivity on that same soil in later years, this is not a problem of market failure. For example, if a persistent

herbicide, such as a sulphonyl urea, is applied to a crop, there is likely to be a very low plant density in any self-regenerating pasture the following year. The reason that this is not a case of market failure (and thus is not a potential justification for government involvement) is that all the costs and benefits of applying the herbicide are captured by the same farmer. The farmer can choose a less persistent herbicide or can accept lower weed control in the crop if desired, depending on the trade off between benefits of a higher crop yield and costs of lower pasture production (e.g. Abadi Ghadim and Pannell 1991). In other words, the problem is fully internalized.

However an externality may arise through death of natural flora or fauna if herbicides enter the environment. The external cost would be the value which individuals in society place on the damage caused to the environment. Government responses may include legislative constraints on particular herbicides in or near susceptible environments. On the other hand, the effect of the herbicides on the ecosystem needs to be compared to the effects of the weeds themselves.

6. Contamination of exports

Contamination of exported agricultural products with either weed seeds or chemical residues may damage the reputation of the nation as a whole as an exporter of the product. This would reduce prices received by all producers in this country, resulting in an external cost to all producers who did not sell contaminated produce. The externality arises because no individual producer considers the losses to others that would result from contamination of the individual's produce. Of course there is some incentive for individuals to take care to prevent contamination, because their own sale price would be reduced if contamination is discovered. However if they also considered the losses to others, the incentive to prevent contamination would be much greater.

This externality has been put forward as a justification for export inspection services (e.g. Sieper 1982). In Australia the Government imposes extremely tight control over the quality of exporters' products, especially food products. Laws on the quality of exports are supported and enforced by government institutions which inspect, test and administer the system.

Such services are actually public goods, since the benefits of protecting the reputation of our exports are non-rival and partly non-price excludable. The non-price excludability means that it would be impossible for a private business in a free market to capture the benefits of its services, and the non-rivalry means that it

would not be socially desirable for it to do so even if it could.

7. Chemical spray drift

Chemical drift is another case of externality due to movement. To some extent this is a health issue, especially in rural areas where some people are very concerned about drift from surrounding farms. These concerns have been fuelled by medical evidence of unusually high incidence of otherwise rare diseases in some rural towns. Whether herbicides are implicated in this is not clear. The most common government response to these concerns has been to constrain use of particular chemicals (usually insecticides) or application methods (e.g. aerial spraying).

Another externality resulting from spray drift is damage to nearby crops. This has been addressed, for example, by legislative constraints on use of phenoxy herbicides in the vicinity of highly sensitive species such as tomatoes and grapes. Note that if the damaged crop is owned by the farmer who does the spraying, there is not an externality problem; the farmer can weigh up all of the costs and benefits. However if the spray crosses boundaries and damages the crops of another farmer, an external cost occurs.

8. Cultivation

There are several potential external costs resulting from cultivation undertaken to kill weeds. The resulting change in soil structure results in increased risk of wind erosion with private costs of lower agricultural productivity on the cultivated land and public costs of buried fences, blocked roads, and air contamination in towns or cities. Only the public costs would potentially warrant a government response. Cultivation may also promote water erosion with externalities from silt entering rivers.

On the other hand there may be positive externalities from cultivation since it kills weeds, reducing the risk of weed spread to neighbours or to the environment. To the extent that cultivation substitutes for herbicides, it also reduces any negative externalities from herbicide use.

Governments in Australia appear to put greater emphasis on the negative externalities of cultivation than those of herbicide use as governments actively support use of herbicides in place of tillage (so-called minimum tillage systems) in their extension and research. These are the main types of government involvement in this area. The option of legal constraints on cultivation practices has not been employed directly. There are, however, legal constraints on further clearing of land which may be partly motivated by a wish to reduce erosion when the land is cultivated.

9. Biological control

Notable examples of biological control of weeds in Australia include agents for control of skeleton weed (Marsden *et al.* 1980), prickly pear and Patterson's curse (Tisdell 1987). In each of these cases, the control agent is one which can survive and spread in the environment without needing to be released by individual farmers seeking to control the weeds. In cases such as these, the biological control agents are both non-rival (as the fact that one farmer benefits from weed control does not reduce the benefit to others) and non-price excludable (as it is impossible to prevent the agent from infesting a particular farm). It is thus neither desirable or possible for a private business to develop and release the biological control agents on a commercial basis. Each of the examples given above was tested and released entirely by government sector scientists.

However biological control is sometimes very much a private good. In the United States there are some agents which are effective against particular insect pests but which do not survive in the environment. They have to be released in each year when control is desired, in the same way as a herbicide is applied more-or-less every year. To the extent that these agents do not migrate onto neighbours' farms, they are private goods which are both rival and price excludable. Economists would argue that such organisms should not be provided freely to farmers in the way that spreading biological control agents are.

10. Herbicide resistance

The most dramatic recent development in weed management in Australia has been herbicide resistance in rye-grass and wild oats. There are a number of aspects of the resistance problem which may warrant government involvement. They relate to provision of information and prevention of spread. There would be, however, no valid basis for governments legislating to constrain farmers use of herbicides for the purpose of preventing or delaying resistance on the farmer's own land. From the point of view of economic efficiency, the farmer is in the best position to weigh up the benefits and costs of different types of herbicide use in their own particular circumstances. If they judge that the short-term benefits of high herbicide use outweigh the long-term costs of resistance, governments should not prohibit this behaviour.

The appropriate role for government in this issue is in provision of information on the risks and costs of herbicide resistance, an area where governments throughout Australia have rapidly become very active. The market failure they are overcoming here is in the area of ignorance.

Farmers might eventually obtain the information, but by then they would have suffered substantial costs from resistance. It is economically more efficient to facilitate farmers making informed judgments prior to the development of resistance.

The other valid role for government is in prevention of spread. This can occur via wind-blown pollen or via movement of seeds carrying the genes for resistance. These seeds may be moved intentionally (through sale of rye-grass seeds for sowing as a pasture plant) or unintentionally (e.g. through sale of grain or hay). In either case there is a potential case for government involvement to reduce externalities resulting from the spread.

11. Research and extension

The free provision of information on weeds and weed management can overcome market failure due either to unnecessary ignorance on the part of weed managers or to the public-good nature of information.

Information extended to farmers by government departments is to a large extent non-rival and somewhat non-price excludable. This is very relevant to government funding of research and extension. If a private organization is unable to capture the benefits of its research they will under-invest in research from a social point of view. Patents and plant variety rights are intended to make information price excludable in order to provide the private sector with incentives for investment in research. However these operate imperfectly in their intended role, and also have no impact on the non-rival characteristic of information. There thus remains a potential role for government in overcoming public good problems relating to information.

The example of herbicide resistance described above is a case where governments attempt to overcome ignorance. Reasons why the private sector may fail to adequately provide the necessary information include ignorance on their part and a failure by farmers to recognize that the information would be of value to them and thus worth paying for. Most economists would argue that the public sector should not be involved in extending information which would otherwise be extended by the private sector. This is particularly the case for information which is specific to a particular farm and thus is not subject to public-good problems.

Arguably, research may also be an example of a natural monopoly where a private company could not afford to sell information at a price reflecting its marginal cost of production. The infrastructure required for some types of research is substantial and there may be benefits from maintaining a collection of different types of expertise within a single organization.

This is likely to be beyond the capacity of small research organizations.

Economists have devised a range of techniques for overcoming different types of market failure, based on economic incentives and clear definition of property rights (Randall 1981, Pearce and Turner 1990). It is notable that none of these techniques have been employed in addressing market failure in Australian weed management. There is scope for further investigation of the feasibility of applying these techniques to weeds.

Distributional issues

Suppose that the government is advised that there will be major external costs if a weed is allowed to spread, and so makes a decision that it must be controlled. Who should pay?

- The farmers whose properties are currently infested?
- Their near neighbours?
- All farmers in their region?
- All farmers in environments suitable for the weed?
- All farmers?
- Tax payers?
- Consumers of the relevant farm products?

There is nothing in economic theory which helps us to objectively evaluate the relative merits of different distributions of wealth^E, although in practice redistribution is often one of the goals of government policy and action. In these cases the professional contribution of economists is limited to:

- quantifying the distributional effects of government action,
- quantifying the impacts of government action on efficiency, and
- assessing the performance of the action with regard to several rules of thumb which attempt to capture (or perhaps shape) community attitudes regarding what is fair and equitable.

This section is a brief discussion of some of these rules of thumb. Recently, a commonly cited approach to distributional questions is the 'user-pays principle' under which the beneficiary of a good or service should bear the costs of its provision. It is not a principle in the sense of a scientific principle, but rather a view of what is a fair thing. Ironically it has been associated with the ideology tagged as 'economic rationalism', although there is nothing in economic theory to favour it as an approach to decisions on distributional issues.

Footnote

^E In fact, one of the most celebrated theorems in economics, Arrow's Impossibility Theorem, purports to prove that it would be impossible for society to agree on a method for judging the merits of different distributions.

Another commonly cited system for distributing costs is the 'polluter-pays principle'. It is notable that for several prominent weed management issues, this approach is in direct conflict with the user-pays approach. For example, if a farmer is legally prevented from spraying a particular herbicide because of the risk of damage to neighbours' crops, the beneficiaries (i.e. users) are the neighbours while the polluter is the first farmer. The two 'principles' have different implications about who should bear the cost of preventing the damage.

A second example is the control of declared noxious weeds. The current law in Western Australia requires farmers to kill noxious weeds at their own expense if present on their properties. This is consistent with 'polluter pays' as the weeds would presumably have spread to 'pollute' other farms. It is not consistent with 'user pays' since these farmers are not the ones who will benefit from the reduction in external costs. Of course they may themselves benefit from the control, but they would already have factored these benefits into their own decisions on the optimal level of expenditure on control.

There are further problems in trying to rigorously implement either of these approaches. In cases of weed spread and the like, it is often difficult to accurately identify the beneficiaries and polluters. The 'user-pays' approach would dictate that farmers should pay in proportion to their benefits from the control. The 'polluter-pays' approach requires costs to be borne in proportion to the level of pollution produced. For weed spread, each of these is impossible in any practical sense, although approximations are sometimes feasible. For example, each wheat farmer in Western Australia pays a levy of the same size (regardless of the amount of wheat they produce) to fund a containment programme for skeleton weed. Farmer leaders argue that this is justified on the basis that almost all wheat farmers in the state benefit from the programme.

In their decisions about distributing benefits and costs, governments may also be influenced by a range of other considerations, including political gain, parochialism, the activities of lobby groups or a wish to benefit particular groups due to a perception that they are disadvantaged in some way.

The market will also have an influence on the distribution of wealth. For example if farmers' costs go up, they may or may not be able to pass on the increase to consumers, depending on how responsive consumers are to price changes. If they are too responsive, farmers lose more than they gain by passing on the extra costs. Australian wheat farmers cannot pass on increased costs as buyers can easily purchase substitute products from

other sellers. In a free market, this distribution of costs between farmers and consumers is completely outside government control as it depends entirely on the responsiveness of supply and demand to price changes.

Concluding comments

There are many examples of market failure related to weeds. Consequently there is a risk that a simple 'small government' philosophy may be detrimental to society as a whole and to farmers in particular. This is more the pity because it is often the case that the cost of government action need not be high. Often the problem can be solved by legal changes, such as constraints on herbicide use or movement of weed seeds. These options are much cheaper than that of the government actually undertaking the control.

On the other hand, it is important to recognize that the mere existence of market failure is not a sufficient justification for government involvement. Justification requires that the cost of the market failure be great enough to offset the cost of government involvement and the risk of government failure.

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