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The Evaluation of Public Policy: Normative Economic Theories of Government Failure

Brian E. Dollery ¹

University of New England, AUSTRALIA.

Andrew C. Worthington

University of New England, AUSTRALIA.

Abstract

Conventional economic analysis of public policy has been traditionally conducted in the conceptual context of the theory of market failure. Either a paretian or pigouvian analytical framework enabled analysts to assess the economic efficiency of market outcomes, and prescribe appropriate government intervention where necessary. No corresponding theoretical structure existed to facilitate an equivalent investigation into the economic efficiency of nonmarket outcomes. However, quite distinct from public choice theory, a normative theory of government failure has emerged to form a conceptual analogue to the market failure paradigm. At present this embryonic theory of government failure has three strands: Wolf's theory of nonmarket failure, Le Grand's theory of government failure, and Vining and Weimer's theory of government production failure. The present paper evaluates the extent to which this seminal literature can assist in the design of rational public policy processes.

The difficulties of public policymaking in the complex milieu of modern society can hardly be overstated. The consequent need for coherent analytical frameworks or paradigms to guide policymakers through the myriad of factors surrounding particular policy issues will probably never be fully satisfied. Accordingly, new perspectives on social and economic policymaking require ongoing scrutiny by public policy analysts in order to determine whether they assist in reducing the manifold complexities of policy formulation.

Public policymakers have long enjoyed the benefits of the theory of market failure, which not only facilitated the identification of undesirable market outcomes, but also assisted in the prescription and implementation of corrective government intervention. Until the advent of public choice theory no corresponding theory of government failure existed to evaluate the appropriateness and efficacy of the multifarious forms of government intervention. Moreover, in at least two respects extant public choice theory does not provide policymakers with a conceptual analogue of the market failure

paradigm to inform public policy decisions. Firstly, the public choice approach is a positive, and not a normative, theory of government processes, and thus cannot provide an idealised or optimal vision of policy intervention against which actual government behaviour can be compared, in the same way as pigouvian and paretian welfare economics furnish the theory of market failure with a yardstick to evaluate real-world markets. And secondly, public choice theory is premised on the behavioural postulate of *homo economicus* and follows methodological individualism, which may not always capture the full intricacies of politicised policy environments.

However, several recent attempts have been made to construct a *normative* theory of government failure. Although Wolf's (1979a; 1979b; 1983; 1987; 1989) taxonomy of nonmarket failure is perhaps the most comprehensive of these new theories, criticism of his typology has led to the development of alternative theories of government failure by Le Grand (1991) and Vining and Weimer (1991). The present paper seeks to briefly review these new additions to the policy analysts toolkit, and provide some evaluation of their likely contribution to public decision-making.

The paper itself is divided into five main parts. Section 1 presents an overview of Wolf's taxonomy of nonmarket failure. Section 2 focuses on Le Grand's contribution to policy analysis, whereas Vining and Weimer work is examined in Section 3. Both generic and specific criticisms of the emerging literature on the normative theory of government failure are outlined in Section 4. The paper ends with some concluding remarks on the implications of this literature for public policymaking in Section 5.

I. WOLF'S THEORY OF NONMARKET FAILURE²

In a series of pathbreaking publications Wolf (1979a; 1979b; 1983; 1987; 1989) has consciously sought to construct a theoretical framework to serve as a conceptual analogue to the established theory of market failure. The purpose of his model is "... to redress the asymmetry in the standard economic treatment of the shortcomings to markets and governments by developing and applying a theory of 'nonmarket' - that is, government failure - so that the comparison between markets and governments can be made more systematically, and choice between them arrived at more intelligently" (Wolf, 1987, p.43).

The theory of nonmarket failure itself mirrors the orthodox methodology followed in the theory of market failure by seeking to attribute various kinds of nonmarket failure to peculiarities in underlying "demand" and "supply" conditions. Wolf (1979, p. 117/118) stresses such methodological parallels, and argues that "just as some types of incentive encourage market failure, so too incentives influencing particular non-market organisations may lead to behaviour and outcomes that diverge from ones that are socially preferable, according to the same criteria of preferability as those for markets -

efficiency and distributional equity". Moreover, in response to the question of why certain patterns of nonmarket failure manifest themselves, he hypothesises that "the answer lies in the distinctive supply and demand characteristics that differentiate non-market outputs from market outputs" (Wolf, 1979, p.118).

Wolf (1989, pp. 51-55) identifies four basic attributes of nonmarket supply. Firstly, he argues that "nonmarket outputs are often hard to define in principle, ill-defined in practice, and extremely difficult to measure as to quantity or to evaluate as quality" (Wolf, 1989, p. 51). Accordingly, inputs generally become a proxy measure for output. Secondly, Wolf postulates that nonmarket outputs are generally produced by a single public agency often operating as a legally constituted monopoly. The resultant lack of competition makes any meaningful estimates of economic efficiency difficult, and consequently serves to obscure allocative and productive efficiencies. Thirdly, Wolf (1989, p. 52) argues that "technology of producing nonmarket outputs is frequently unknown, or if known, is associated with considerable uncertainty and ambiguity", and consequently may exacerbate economic inefficiencies. Finally, Wolf proposes nonmarket production activity is usually characterised by the lack of any "bottom-line" evaluation mechanism equivalent to profit or loss for appraising success. Moreover, there is often no specified procedure for terminating unsuccessful production.

Wolf (1989, pp. 39-50) identifies five basic "conditions" of nonmarket demand. In the first instance Wolf (1987, p. 55) postulates that "... an increased public awareness of market shortcomings" has led to a reduced tolerance of them, and consequently heightened public desire for state intervention. A second characteristic attributed to the demand for nonmarket activity resides in "political organisation and enfranchisement" (Wolf, 1988, p.40), and the resultant increases in the effectiveness of special interest groups in the political process. Thirdly, maximising politicians and bureaucrats are rewarded for propagating interventionist "solutions" to perceived social "problems" without reference to the costs of implementation. Fourthly, the demand for nonmarket activity is further enhanced by the "high time-discount of political actors" (Wolf, 1989, p.40) due to relatively short electoral periods of office experienced by politicians in most representative democracies. An important outcome of these constitutional arrangements is a higher rate of time discounting amongst politicians as compared with society at large, and a resultant emphasis on current rather than future costs and benefits. The final "condition" of nonmarket demand identified by Wolf (1989, p.41) is "... the decoupling between those who receive the benefits, and those who pay the costs, of government programmes". Wolf argues that decoupling occurs in two different forms. On the one hand, "microdecoupling" arises when the benefits of collective action accrue to a particular group, whereas the costs of such action are dispersed amongst all groups. On the other hand, "macrodecoupling" occurs where the benefits of

collective action are shared by all groups, but the costs of this action are concentrated on some specific group.

These various peculiarities in the nature of nonmarket demand and supply form the foundation of Wolf's theory of government failure and the resultant taxonomy of nonmarket failure. Moreover, the structure of arguments intrinsic to this theory deliberately replicates the logic of the theory of market failure. Wolf (1979a, p.115) puts the matter thus:

The supply and demand characteristics of the nonmarket sector are fundamental to the theory of nonmarket failure. They provide a basis for formulating a typology of nonmarket failure analogous to that which already exists for market failure. In both cases, the 'failures' - whether market or nonmarket - are evaluated against the same criteria of success: allocative efficiency and distributional equity judged according to some explicit social or ethical norm.

Inclusive of distributional inequities, Wolf has developed a fourfold taxonomy of nonmarket failure. Firstly, and evidently by far the most important form of nonmarket failure (Wolf, 1979b, p.132) resides in "internalities and private goals". These refer to intraorganisational allocation and evaluation procedures which determine distributional outcomes for agencies and agency personnel alike, and accordingly constitutes part of their respective utility functions. Although both market and nonmarket firms must perforce employ an "internal version of the price system" for intrafirm resource allocation, market pressures ensure that the "internal standards" of market organisations are strongly linked to the "external price system", whereas nonmarket organisations may have internalities largely unrelated to optimal performance. This may mean that the actual behaviour of some public firm may diverge from its intended or ideal role. Thus, just as the problem of externalities in market failure arises from a predominance of private costs in private sector decisionmaking, so the problem of internalities in nonmarket failure stems from the ascendancy of private motives in public sector decisionmaking.

Secondly, "redundant and rising costs" represent another kind of nonmarket failure. In essence, Wolf argues that while market processes impose a relationship between production costs and output prices, this relationship is generally absent in nonmarket activity since revenues derive from nonmarket sources, like government tax income. Consequently, "where the revenues that sustain an activity are unrelated to the costs of producing it, more resources may be used than necessary to produce a given output, or more of the nonmarket activity may be provided than is warranted by the original market-failure reason for undertaking it in the first place" (Wolf, 1989, p.63).

The third type of nonmarket failure in the Wolfian taxonomy is termed "derived externalities". Derived externalities are the unintended and unanticipated side effects of

government intervention designed to ameliorate perceived instances of market failure. Just as externalities generated in market relationships represent costs and benefits not considered by economic agents, so derived externalities in the nonmarket sphere "... are side effects that are not realised by the agency responsible for creating them, and hence do not affect the agency's calculations or behaviour" (Wolf, 1989, p.77). In common with market externalities, derived externalities may be both positive and negative.

In his classification of market failure Wolf includes "distributional equity" to the conventional categories of externalities and public goods, increasing returns to scale, and market imperfections, despite acknowledging the fact that most economists view market failures exclusively in terms of efficiency (Wolf, 1989, p.28). Accordingly, in order to maintain the symmetry of his typology of nonmarket failure with the orthodox theory of market failure, Wolf incorporates adverse distributional consequences as his final category of nonmarket failure. Whilst hypothesising that "...there is an identifiable process by which inequities can result from nonmarket activities..." similar to inequalities flowing from market outcomes, Wolf (1989, p.84) nevertheless argues that nonmarket inequities characteristically occur in terms of power and privilege, whereas distributional market failures typically appear in income and wealth differences.

II. LE GRAND'S THEORY OF GOVERNMENT FAILURE

Le Grand (1991) argued that whilst Wolf's attempt at creating a theory of government failure conceptually analogous to the conventional theory of market failure is undoubtedly an innovative step, various problems in the construction of this theory rendered it less influential than may otherwise have been expected. Accordingly, Le Grand (1991, p. 424) has sought " _to construct an alternative formulation of the theory of market failure that is, I hope, clearer, analytically more precise and more comprehensive". In essence, Le Grand's "alternative" theory of government failure amounts to the development of a tripartite classification of government intervention in a market economy, which is subject to evaluation in terms of two measures of economic efficiency and an undefined equity criterion. Le Grand (1991, p. 431) argues that "government can involve itself in an area of social and economic activity in any, or all, of three ways: *provision, taxation or subsidy* and *regulation* (original emphasis), and then examines various examples of these forms of state intervention using allocative efficiency, x-inefficiency, and egalitarianism in economic outcomes. Any perceived limitations of this approach are met with the qualification that "I have only been able to give an outline of a more consistent theory of government failure here" (Le Grand, 1991, p. 442).

Government provision, where government " _can provide a commodity itself through owning and operating the relevant agencies and employing the relevant personnel" (Le

Grand, 1991, p. 431) is argued to be economically inefficient in either of two generic cases. Firstly, where governments enjoy a monopoly in the provision of goods and services, both allocative inefficiency and x-inefficiency can be anticipated in excess of that which would obtain under private provision. And secondly, where government provision occurs in competitive circumstances, but competition derives from organisations which do not seek to maximise profits. In this latter case one can once again anticipate allocative inefficiency and x-inefficiency. No *a priori* expectations are held on the equity consequences of government provision relative to private provision. However, Le Grand (1991, p. 440) does argue that the replacement of a public monopoly by a private monopoly " _might have an inegalitarian impact on that distribution, because (a) the latter would have more incentive to exploit its position to maximise profits and (b) any profits would accrue to its shareholders instead of to all taxpayers".

Under government taxation or subsidy, government " _can *tax* the commodity, thus raising its price above the level that would have been attained in a competitive market, or it can *subsidise* the commodity, thus lowering its price below the market level" (Le Grand, 1991, p. 431) (original emphasis). In both instances prices will diverge from true production costs, or marginal social costs, and consequently the price mechanism will not induce allocative efficiency. Alternative allocative procedures must thus be adopted. Majoritarian voting possesses the twin advantages of enabling all of a given population an equal say in deciding on the optimal level of provision of some good, but also has numerous disadvantages, including no measure of preference intensities, high organisational costs, and problems associated with the median voter theorem. However, taxes and subsidies will certainly modify the incentives confronting consumers and producers, reallocate resources, and impose deadweight welfare losses. Overall, the empirical evidence on the economic efficiency of this form of government intervention is mixed. Moreover, the equity status of government taxation or subsidy is also far from clearcut. Thus, whilst " _it is possible that a combination of tax finance and subsidised service ...is more egalitarian than if neither the taxes concerned nor the subsidies existed ...there is no guarantee that they will promote equity either" (Le Grand, 1991, p. 441).

Finally, governments "...can *regulate* the production and distribution of the commodity, prescribing the structure of the markets or the quantity, quality or price of the commodity concerned" (Le Grand, 1991, p. 431). Le Grand argues that although in principle state regulation can result in optimal quantity, quality, price, and market structure outcomes, in practice at least two factors inhibit the efficiency of regulatory programs. Firstly, it is often difficult, or even impossible, to acquire the information necessary for successful regulatory regimes to operate. And secondly, the phenomenon of regulatory capture means producer groups can control the process of regulation, and

influence it in their own direction. Accordingly, government regulation will usually generate both allocative inefficiency and x-inefficiency, and by stifling long-run incentives may also imbue dynamic inefficiency. In equity terms, Le Grand notes that while regulation can redistribute income towards poorer individuals and groups, perverse regressive distributional consequences are equally likely.

III. VINING AND WEIMER'S THEORY OF GOVERNMENT PRODUCTION FAILURE

Vining and Weimer (1991, p.1) argued that "absent a convincing normative theory of government production, the debates over the appropriate boundaries of government and the desirability of privatisation must be resolved without a firm conceptual grounding". Moreover, they note that whilst "Charles Wolf has made an important start by attempting to draw parallels between market failures and the manifestations of government supply failures" (Vining and Weimer, 1991, p.1), Wolf's taxonomy of nonmarket failure has at least two significant shortcomings. Firstly, since Wolf's approach is neither explicitly normative nor positive, its role as an analytical tool in the evaluation of public policy is limited. And secondly, Vining and Weimer (1991, p.2) observe that "although Wolf draws loose parallels with market failures, he does not take advantage of many of the well-developed implications that can be directly applied to diagnosing problems of government supply". Accordingly, in order to remedy these perceived deficiencies in the existing theory of government failure, Vining and Weimer (1991, p.1) "... seek to provide a useful framework for understanding the efficiency consequences of alternative patterns of government supply by developing a normative perspective on when the government should produce a good or service itself and a positive perspective on government supply in general". This analytical apparatus can also be viewed as "... a framework for diagnosing hierarchical, or organisational, failure" (Vining and Weimer, 1991, p.3).

The theory itself draws heavily on recent developments in the literature on industrial organisation, and especially the theory of contestable markets. A market may be described as perfectly contestable if no barriers to entry or exit exist (Baumol, Panzar and Willig, 1982). Consequently, contestability can act as a surrogate for competition in markets dominated by one or a few firms. In other words, "perfect contestability permits competition *for* the market to substitute effectively for competition *in* the market" (Vining and Weimer, 1991, p.6) (original emphasis). Conventionally, contestability is held to be largely dependent on the extent of asset specificity and the attendant problem of sunk costs.

However, in the realm of government production, Vining and Weimer (1991) argue that it is possible to identify further aspects of contestability. Firstly, they postulate the

existence of *contestability of supply* which corresponds most closely with conventional notions of contestable markets, but nevertheless incorporates some of the unique characteristics of public sector supply. Contestability of supply in this context refers to actual or potential competition faced by a public agency in the market for its output. Given difficulties in monitoring arising from the nature of government supply, "trust that the organisation producing the good will not engage in 'opportunism' ...by not complying with contract terms or by exploiting bargaining power when contract terms do not cover contingencies that arise..." (Vining and Weimer, 1991, p.6) becomes an important element in contestability of supply. Examples of public goods where "trust" is essential abound, and this explains continued public production with the best known example being the armed forces. The underlying argument has been generalised by Vining and Weimer (1991, p. 6/7) as follows:

...[W]hen the risk of opportunism, determined by the cost of non-compliance and the opportunity for non-compliance in contracting, is high, trust is an important specific asset to the production of the good. Thus, the supply of the good is unlikely to be contestable... . Consequently, government production is an appropriate organisational arrangement when the risk of opportunism is high.

A second attribute of the contestability of government production of public goods resides in *contestability of ownership* which refers to "...the credibility of the threat of transfer of ownership of the organisation" (Vining and Weimer, 1991, p.6). Although transfer of ownership of some bureau may occur between agencies or departments within the broad public sector, privatisation is obviously important in this context.

From the perspective of positive economics the efficiency characteristics of these two forms of contestability are relatively straightforward; where both supply and ownership are highly contestable, powerful incentives exist which promote allocative and x-efficiency, and prices should closely reflect marginal cost. The normative conclusion is that under these circumstances contracting will be the most socially efficient mode of provision. Moreover, the converse conclusion may be drawn where contestability is low. Under these latter conditions, government production will be more socially efficient provided the *ex ante* rules limiting managerial discretion are effective in keeping rent capture below levels that would obtain under contracting.

IV. CRITICISMS OF THE THEORY

Various responses to the emerging body of literature on normative economic theories of government or nonmarket failure are possible. One way of organising derivative comment is to consider generic criticism separately from specific critiques of particular theories.

(i) General Criticism

Coase (1964, p. 195) has observed that "until we realise that we are choosing between social arrangements that are more or less all failures, we are not likely to make much headway", and policy analysts are now usually aware that all public policy instruments are significantly less than perfect. Accordingly, since policy analysis often involves selecting the most appropriate policy instrument from a range of market and nonmarket alternatives, analysts require a comprehensive theory which facilitates comparison of the relative efficiency of different instruments. In other words, effective policy analysis requires a general theory of organisational failure, rather than conceptually distinct theories of market failure and nonmarket failure. This has been recognised by Williamson (1989, p. 92) who has argued that "... all forms of organisation, not just markets, need be assessed comparatively...". There is thus a need for common criteria which apply equally to market and government organisations. Put differently, "... whether 'x' is called a comparative efficiency of the market or a comparative inefficiency of the nonmarket is arbitrary if all that matters is that market and nonmarket differ in this respect" (Williamson, 1989, p. 93).

Two of the three normative economic theories of government failure do at least approach this ideal, although they remain problematic in many respects. Le Grand (1991) employs two measures of economic efficiency and an equity criterion to evaluate various forms of government intervention, and since in principle these yardsticks can also be applied to market outcomes, a comparative framework for policy analysis can emerge. Similarly, Vining and Weimer (1991) develop two new criteria, contestability of supply and contestability of ownership, which can supplement existing normative standards for adjudging the performance of nonmarket and market institutions alike. Even Wolf's (1979a; 1979b; 1983; 1987; 1989) theory of nonmarket failure, whilst explicitly concerned with creating a conceptual analogue to the existing theory of market failure, employs distributional equity for evaluating both markets and governments.

However, given the current state of the art in the normative evaluation of alternative social states, a completely unified or general theory of comparative organisational behaviour is unlikely to appear in the near future. In part, the problem revolves around the concept of allocative efficiency, which is not only a standard welfare criterion in the theory of market failure, but is also used by Wolf, Le Grand, and Vining and Weimer. Allocative efficiency refers to a distribution of productive resources amongst alternative uses which yields an optimal mix of output. In markets characterised by perfect competition, the optimal output combination arises through consumers responding to prices which reflect the true costs of production, or marginal social costs. Allocative efficiency thus involves an interaction between the productive capacity of society and

the consumption desires of society. Put differently, both the demand and supply blades of the Marshallian scissors are necessary to determine the allocatively efficient level of output. But government production is often concerned with supplying public goods, and the non-exclusive nature of these goods means that no direct method of revealing consumption preferences and thus demand curves is available. This implies that it is not possible to determine allocative efficiency under these circumstances.³ Because consumers pay directly in market transactions no equivalent problem exists. Consequently, although allocative efficiency is applicable in the theory of market failure, it does not have any operational counterpart in a general theory of government failure.

Finally, some theorists have argued that the entire enterprise aimed at constructing a normative theory of government failure along the lines of the traditional theory of market failure is misplaced. In essence, this line of argument holds that the paretian welfare underpinnings of the market failure paradigm are flawed, and accordingly attempts to simulate this model in the context of government behaviour simply compound these problems. Peacock (1981, p. 41) argues that efforts in this direction encourage confusion between "... the actual incidence of 'collective failure' with the incidence which would obtain were government to follow the strict dictates of welfare economics".

(ii) Specific Criticisms

Wolf's pathbreaking theory of nonmarket failure has been attacked on several counts. Peacock (1981, p. 41) has observed that Wolf's typology of nonmarket failure "... is deficient in not incorporating the incentive given to the private sector to protect its interests in the face of public intervention by methods which will markedly increase the costs of attempting to eradicate market failure by selective means". Quite apart from some reservations over both the "disjunction between costs and revenues" and "internalities and organisational goals" as forms of government failure, Le Grand (1991) is much less sanguine about "derived externalities". Noting that "any activity, whether undertaken in the public or private sector, may have unintended side-effects", Le Grand (1991, p. 431/431) argues that "... there seems no *a priori* reason for supposing that government organisations are likely to create more 'derived externalities' than private ones; and, if that is the case, these kind of externalities are as much a source of market as of government failure". Derived externalities are thus conceptually indistinguishable from the conventional meaning ascribed as externalities. Vining and Weimer (1991) raise two objections to Wolf's taxonomy of nonmarket failure. Firstly, Wolf's typology "... provides neither a positive nor a normative theory of government supply" (Vining and Weimer, 1991, p. 2), which apparently limits its usefulness as a conceptual tool in

the analysis of public policy. And secondly, Vining and Weimer (1991, p. 2) argue that "... although Wolf draws loose parallels with market failures, he does not take advantage of many of the well-developed implications that can be directly applied to diagnosing problems of government supply".

Given its much more recent vintage, Le Grand's theory of government failure has attracted much less attention. However, it can be argued that although Le Grand's conceptual framework does provide a useful way of examining the phenomenon of government failure, it is questionable whether this constitutes a "theory" in its own right. After all, the application of the criteria of economic efficiency and some equity criteria to various public policies (including government provision, taxation or subsidy, and regulation) represents the daily bread of applied welfare economics, and accordingly can hardly be described as a new normative theory of government failure.

The relative youthfulness of Vining and Weimer's theory of government production failure likewise implies that to date it has drawn little comment. Nevertheless, the emphasis they place on the problems posed by "opportunism" in the production of public goods by private contractors may be misleading. It can be argued that opportunism is simply one manifestation of the more universal problem inherent in principal-agent relationships. Thus whether the political process as "principal" appoints either a public bureau or a private firm as "agent" to produce some public good, in both cases a principal-agent relationship comes into being. And given the propensities for private companies to maximise profits, and public agencies to pursue the "quiet life", *a priori* we cannot predict whether the resultant social costs will be higher with direct government production or with contracting, and the question can only be settled empirically.

V. CONCLUDING REMARKS

Notwithstanding the various problems associated with the seminal literature on the normative economic theory of nonmarket of government failure, it is nonetheless clear that significant progress has already been made towards the construction of a workable conceptual framework for policy analysis. Indeed, even though this body of thought is still in its infancy, it already serves to remind practitioners in the art of policy analysis that just as non-intervention has costs in the form of market failure, so too active public intervention may also have costs in the form of government failure. However, much remains to be done.

Given the ideal outcome of a common or unified theory of organisational failure, rather than conceptually distinctive paradigms for market failure and government failure, perhaps progress in this direction is most likely if effort is concentrated on the development of normative criteria which can be applied equally to both public and

private organisational activity. Moreover, this will have the added advantage of being able to employ some existing analytical procedures. If some satisfactory method of evaluating the allocative efficiency of non-priced output can be devised, then theoreticians will be able to use allocative and X-efficiency, as well as current measures of distributional equity, such as vertical equity, horizontal equity, equity of opportunity, and equality of outcomes. Vining and Weimer (1991) have already developed two new benchmarks in the form of contestability of supply and contestability of ownership. Additional criteria somewhat broader than the traditional concerns of conventional welfare economics with economic efficiency and economic equity are essential for successful policy analysis, which is involved not only with the formulation of public policy but also its implementation in real-world circumstances. Wolf's (1989) suggestions regarding participation and accountability as normative measures thus represent considerable progress.

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FOOTNOTES

1. Senior Lecturer, Department of Economics, University of New England, Armidale NSW 2351, Australia.
2. This section essentially summarises an extended discussion of Wolf's theory of nonmarket failure contained in Dollery (1993).
3. Numerous *indirect* methods of revealing the consumer demand for public goods and quasi-public goods have been developed. These include Clark-Groves mechanisms, household surveys, travel costs methods, and hedonic pricing techniques. Unfortunately, however, all methods have significant problems (Johansson, 1987).