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The Role of Second-Best Theory in Public Economics

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ABSTRACT

This paper surveys the evolution of the use of the theory of second best in public economics. It argues that much of modern normative public economics can be interpreted as simply applied second-best analysis. The original theory of second best as expounded by Lipsey and Lancaster involved analysing policy in a single-consumer economy with a fixed distortion, and was especially interested in whether marginal cost pricing, or piecemeal prescriptions, could still be maintained. That analysis was subsequently extended to multi-household economies, to multi-distortion cases and to dynamic settings, and became the basis for the optimal tax revolution in public economics. However, more significantly, in the wake of optimal tax analysis and duality theory, the second-best distortion has effectively been made endogenous; and the general government policy problem has been posed as a principal-agent one. The most common method is by assuming non-observability of some important household characteristic or behavioural outcome. As a consequence of these developments, most public policy problems can be viewed as special applications of second-best analysis. For example, the general problem of the efficiency-equity trade-off (the 'optimal income tax' problem) and the limit to redistribution can be viewed as second-best problems. A couple of the interesting features of viewing policy problems as second-best problems are as follows. For one, simple policy prescriptions no longer become possible. For another, seemingly odd types of policies, such as quantity restrictions, in-kind transfers and public provision of social insurance become 'efficient' policy instruments in certain circumstances. The literature also stresses that second-best policies are typically time-inconsistent. In the face of this, standard second-best optima cannot be attained. Optimal time-consistent policies can also include unusual policy instruments that would otherwise be ruled out in a second-best setting.

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I. INTRODUCTION

When Lipsey and Lancaster formalised the concept of the theory of second best in the mid-1950s, both modern public sector economics and modern welfare economics were in their infancy. Welfare economics, following the influential contributions of economists such as Kaldor (1939), Hicks (1940), Samuelson (1947) and Arrow (1951a), seemed preoccupied with characterising the circumstances under which competitive economies would be efficient, a preoccupation that has not fully disappeared from economics to this day. Public economics was appropriately timid, and almost naive in its prescriptions. Samuelson's characterisation of public goods was just in print; optimal tax theory had not yet been quite rediscovered (after having been prematurely analysed by Ramsey (1927) and Hotelling (1932)); and the revolutionary impact of the economics of incentives and information had not yet been first hinted at by Vickrey (1961).

Public sector economics has changed immeasurably since then, though the extent of the change has probably gone unnoticed by almost all but specific practitioners in the field. Part of the change has been a result of technical advances such as duality theory and game theory, which have enabled economists to model government behaviour and its relationship with citizens in much more sophisticated and manageable ways than before. At the same time, innovations in economic thinking have had their impact on public economics at least as much as in other fields. Problems of asymmetric information and their resolution through principal-agent relationships have become standard ways of conditioning our view of the role of government. Moreover, they have led to new ways of looking at both the limits to government and the possibilities for beneficial intervention.[1]

On the surface, it might seem from a cursory reading of the literature that interest in second-best theory has waned and that normative public economics has moved on to other concerns. Nothing could be farther from the truth. In fact, most of the current issues and research in public economics involve second-best type analysis, in other words, policy analysis in economies in which a first-best optimum (either a Pareto-efficient allocation or an *optimum optimorum*, as discussed below) cannot be achieved for some extraneous reasons. In the original Lipsey-Lancaster formulation, the economy could not reach an

[1] One ought to include in any characterisation of public sector economics the enormous impact that the public choice perspective has had on economists' views of the role of government. I have chosen to set aside these sorts of issues, partly because second-best theory has been very much in the spirit of normative analysis and partly because positive public choice theory seems to me not yet to have yielded a definitive and convincing model of government behaviour. A more complete discussion of public economics would presumably pay more attention to public choice theory.

efficient outcome because of some exogenously given and immutable distortion between price and marginal cost in some market(s). The conditions for Arrow's First Basic Theorem of Welfare Economics (i.e., that any competitive equilibrium was Pareto optimal) were violated. The question posed by Lipsey and Lancaster was what implications this had for pricing rules that ought to be followed by the other, non-distorted, sectors of the economy. Of particular interest was whether decentralised pricing in these other sectors was optimal, or almost equivalently, whether *piecemeal* policies could be undertaken in these other sectors that were independent of the existence of distortions elsewhere in the economy.

Public economics is still very much concerned with policy prescriptions in distorted economies. Now, however, the sources of the distortions are spelled out in more detail and are very much part of the problem being analysed. Following more general developments in economic theory, distortions can arise for a variety of reasons, most of which are instances of imperfect competition, incomplete markets, or imperfect information. Information problems are especially relevant for public policy. Indeed, the second-best policy problem as originally formulated has come to be thought of as a special example of a principal-agent problem in which the government is the principal and the taxpayers are the agents. This way of looking at the problem highlights the fact that the inability of the government to achieve a first best is due essentially to its imperfect ability either to monitor the behaviour of taxpayers or to observe salient individual characteristics of them. The existing paradigm of government behaviour is in fact that of a principal-agent problem in one of its various forms. This fits nicely into the traditional second-best mold, except that rather than the market distortions being exogenously given with no apparent explanation, they are very much explained as a consequence of imperfect information or incomplete markets.

Along with the advances made in economic theory that have affected the ways in which the second-best problem is formulated, there has been an evolution in the way that welfare economists and normative public economists have come to view the role of government. Put simply, much of modern public economics has become preoccupied with the failure of Arrow's Second Theorem of Welfare Economics (that any Pareto-optimal allocation can be achieved in a competitive economy by a suitable redistribution of endowments among households) rather than the First Theorem as in the traditional second-best model. It has always been recognised that the Second Theorem required that lump-sum transfers be permissible in order to move society along its utility possibility frontier; failures of the Theorem were attributed to an inability to make lump-sum transfers. It is now realised, due largely to the theory of optimal income taxation, that the absence of lump-sum transfers are not the source of the problem. Governments can obviously make lump-sum transfers (transfers that do not depend upon behavioural variables) if they choose to do so. The problem is that they cannot observe the characteristics of households on which to condition the lump-sum transfers, that is, the characteristics that make one household able to reach a higher level of utility than another. In these circumstances, transfers must be made dependent upon things that are observable, and those tend to be variables that depend upon household behaviour. Thus, the failure of the Second Theorem is a consequence not of limited instruments but of limited information.

As discussed below, viewing the failure of the Second Theorem as a problem of asym-

metric information turns out to have rather dramatic consequences for the extent of redistribution that can be achieved by the tax-transfer system. Not only that, it leads to some rather surprising policy prescriptions. In particular, it provides a case for using policy instruments that would be hard to justify in standard welfare economic analysis, such as the provision of transfers in kind and quantity controls.

It has always been known that in second-best circumstances, standard policy prescriptions go out the window; indeed, that is one part of the message of the Lipsey-Lancaster analysis. However, the full extent of this has only gradually become clear.[2] In second-best economies, prices no longer reflect scarcity values, so decentralised pricing is generally non-optimal. Combining this with the failure of the Second Theorem yields a strong indictment of the private sector and a potentially important role for the public sector. Whether the public sector is fully capable of assuming that role is not at all clear; the same informational problems that plague the private sector also plague the government. Optimal second-best policy may well involve much more information than the government has available to it.

The absence of full information leading to a failure of the Second Theorem provides one reason why governments engage in seemingly unjustified forms of intervention in market economies. However, it is not the only one. Once one views the government as principal in a principal-agent relationship with its citizens, the timing of decision making becomes relevant. In the standard principal-agent framework for viewing the second-best problem, the principal is the leader and the agents the followers. In cases where the actions of the agents have longer-run consequences (e.g., savings decisions), problems of time consistency immediately arise; policies that are optimal when announced *before* agents act may no longer be so *after* they have acted. For second-best policy solutions to be implemented, either the policies announced by the principal (leader) must be time-consistent, or the principal must be able to commit to announced actions. Unfortunately, one of the general features of second-best economies is that policies are no longer time-consistent.[3] Moreover, governments are generally not bound to policies announced in the past, so commitment is not possible. In these circumstances, perfectly rational governments cannot implement second-best policies; they are restricted to the best time-consistent policies available. It turns out that the best time-consistent policies that can be attained using conventional policy instruments can be improved upon by using instruments that would otherwise be ruled out, such as quantity controls, in-kind transfers and other forms of intervention. Thus, we have another general sort of reason why, in second-best economies, the range of policy instruments is much broader than that encountered in older conventional models.

The importance of studying the use of non-conventional policy instruments is borne out when one looks at what governments actually do. The conventional view of government as found in a standard public economics textbook is that it should provide public goods,

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[2] Blackorby (1990) in his Innis Lecture to the Canadian Economics Association addresses this issue in a concise and convincing way. This paper seems so far to have escaped the attention of mainstream policy economists, but ought to be required reading for all who work in the area. Our paper could be considered as an extension of Blackorby's excellent piece. Another paper that covers some similar ground is Hammond (1990).

[3] This was first illustrated for a simple economy by Hillier and Malcomson (1984) and generalised to a fully dynamic multi-agent economy by Calvo and Obstfeld (1988).

correct externalities and perhaps regulate non-competitive behaviour. It should finance its activities and achieve its redistributive goals by an income-based tax-transfer system. In fact, this describes surprisingly little of what governments actually do. Relatively little of their expenditures are on public goods, and relatively little of their regulatory activity is directed towards imperfect competition. Moreover, relatively little of their redistributive goals are attained by the tax-transfer system. On the expenditure side, a substantial proportion of their spending is on the provision of private-type goods (typically referred to as *quasi-private goods* since they are provided through the public sector without using pricing) and on social insurance. The former category would include education, health care and welfare services, while the latter would include unemployment insurance, public pensions and workers' injury compensation. On conventional welfare analytic grounds, a case could not be made for providing either quasi-private goods or social insurance through the public sector.

One of our purposes in reviewing recent advances in second-best analysis to public sector economics is to show how the problems of asymmetric information and time inconsistency can lead rational welfare-maximising governments to use these widely-observed sorts of instruments. As with all normative analysis, our discussion can be suggestive only. There may be more sinister explanations for governments engaging in policies that many economists regard as irrational. However, given their observed importance, we can no longer ignore them. It turns out that applying second-best analysis can lead to cogent explanations for their use as policy instruments.

To illustrate some of these points, we proceed in three steps. In the next section, we briefly review the standard second-best problem and some of the key results that have been obtained in that context, including especially its application to the optimal tax problem. Then, we discuss the failure of the Second Theorem due to informational asymmetries and the consequences of that for optimal redistributive polices. Finally, we consider time-inconsistency problems in second-best economies, emphasising how they can be used to explain seemingly irrational government policies.

II. STANDARD SECOND-BEST THEORY AND PUBLIC ECONOMICS

The theory of second best concerns the consequences for policy of the fact that some distortions prevent the economy from being on, or moving along, its first-best utility possibility frontier. In the original Lipsey-Lancaster analysis, the problem of second-best was posed as one of prescribing policy for some controllable sector(s) of the economy given an uncontrollable, distorted sector elsewhere. The focus of this and subsequent analysis has been on two key issues of interest. The first is whether or not piecemeal policy is optimal, that is, whether or not policy-makers can ignore the distorted sector and simply apply optimal policies defined over the controllable sectors. The second is the form that second-best optimal policy take, in the event that piecemeal policy is not optimal,

Their results concerning the first issue were agnostic to say the least. In general, interdependencies on either the supply or the demand side between distorted and controlled sectors would render piecemeal policy non-optimal. Unfortunately, given the technical form of modeling general equilibrium systems available at the time (i.e., analysis in primal, or goods, space), it was not possible to specify clearly the characteristics of preferences and technology that would lead to the optimality of piecemeal policy. Nor was it possible,

given the failure of piecemeal policy, to obtain meaningful second-best policy rules for the controllable sector. With the advent of duality theory, the analysis of second-best policies became feasible. Now, however, the case for piecemeal policy went from agnostic to downright pessimistic.[4] We begin with a brief review of the evolution of results in traditional second-best analysis and then point out some examples of instances in which second-best analysis has been applied to problems in public economics.

1. The Optimality of Piecemeal Policies

There has been a large literature on the theory of second best following on from the original Lipsey-Lancaster paper. Much of the earlier analysis attempted to refine and reinterpret what Lipsey and Lancaster had found using models similar to theirs.[5] It turns out that the general message of second-best can more readily be derived by working in dual (price) space.

One example of reworking the Lipsey-Lancaster analysis in this way was by Boadway and Harris (1977). They considered a single-consumer economy consisting of many competitive industries. A portion of these industries, the distorted sector, were subject to given distortions between price and marginal cost that the government could not control; the government could control the divergence between price and marginal cost in the other industries, the controlled sector. In this context, piecemeal policy was characterised by a uniform *ad valorem* divergence between price and marginal cost in all industries in the controlled sector.[6] They showed that, in a setting where producer prices were fixed (i.e., the transformation function was linear), a sufficient condition for piecemeal policy to be valid was that *all* derivatives of demand in the distorted sector with respect to prices in the control sector be zero. And, the latter required that the commodities in the distorted sector be weakly separable from those in the controlled sector in the consumer's utility function.[7] In the case in which producer prices are variable, they argued that a sufficient condition for piecemeal policy is that, in addition to the condition on demand derivatives mentioned above, the derivatives of supply functions in the distorted sector with respect to prices in the controlled sector also be zero. Subsequently, Jewitt (1982) in an important

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[4] At least that would be the view of the economic purist. In fact, the information about tastes and technologies needed to apply second-best policy rules is unlikely to be known with any degree of certainly. Given that, a good case can be made for piecemeal policies being 'third-best' optimal in expected terms. See Ng (1979) and Bruce (1990b).

[5] A comprehensive survey of traditional second-best theory may be found in Harris (1981). Some of its implications for economic policy-making may be found in Blackorby (1990).

[6] The characterisation of piecemeal policy as the uniform proportionality between prices and marginal costs was for convenience only. It arose because in their model, the policy instruments were taken to be *ad valorem* taxes and the government was subject to a budget constraint. The size of the divergence between prices and marginal cost depended on the amount of revenue that had to be raised. However, the absolute level of distortion in the controlled sectors was not of particular relevance. If the government were free to make lump-sum transfers, they could always choose them such that the size of the distortion is zero in the case in which piecemeal policy is valid.

[7] A similar result applies to piecemeal policy in a subset of the controlled sector.

paper showed that, in the fixed-producer price model, a necessary and sufficient condition for piecemeal policy was that distorted commodities be implicitly separable from those in the controlled sector.[8] This requirement on preferences is obviously a stringent one, quite apart from any further requirement on the structure of production that might be imposed if producer prices are variable.

Jewitt's result confirmed and re-enforced the Lipsey-Lancaster finding that piecemeal policy was unlikely to be optimal, but it was incomplete in a significant way. It involved only a single representative consumer. While it is fairly conventional for economists to conduct policy analysis in a single-consumer setting, thereby hoping to avoid issues of equity and concentrate solely on efficiency, it is well-documented (though not well-known!) that this is an indefensible procedure.[9] The usual justifications for this are either that efficiency and equity are separable, with the latter being pursued optimally by redistributive transfers, so that 'a dollar is worth a dollar' in any household's hands; or that a hypothetical compensation criterion can be appealed to as a justification for aggregating net benefits across households in monetary terms. Neither of these justifications generally holds up in distorted economies.[10] The implication is that one cannot avoid dealing with multi-person economies for policy purposes.

The relevance of investigating the second-best problem in a multi-consumer setting is amply illustrated by Blackorby *et al* (1991). They extend the analysis of Jewitt (1982) by deriving necessary and sufficient conditions for the validity of piecemeal policy in an economy consisting of many consumers. Their analysis shows not only that the results for the single-consumer setting do not apply when their are many consumers, but also that the conditions for piecemeal policy are at least as demanding. The model they use is a multi-consumer version of that used by Boadway-Harris and Jewitt with fixed producer prices. Despite there being many consumers, the analysis is distinctly efficiency-based. The question posed is whether piecemeal policy can take the economy to its restricted Pareto efficiency frontier (i.e., to an allocation such that no redistribution of commodities that respects the exogenous distortions can be Pareto-improving). They find that a necessary and sufficient condition for the second-best optimality of piecemeal policy is that Scitovsky community preferences have what they refer to as a 'two-sector representation' in the distorted commodities and the controlled commodities. To have a two-sector representation, the expenditure function associated with Scitovsky community preferences need to be conditionally additive, a property that is analogous with implicit separability

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[8] Implicit separability between the distorted and controlled sectors means that the consumer's expenditure function (whose arguments are the utility level and all prices) can be written as a function of the utility level and two sectoral 'cost' functions each involving the utility level and the prices within the sector. For a fuller discussion see Deaton and Muellbauer (1980), pp. 133–6. Boadway and Harris had argued that weak separability was a necessary condition for piecemeal policy, but Jewitt showed that this was in error.

[9] For a careful statement of the reasons for that, see Blackorby and Donaldson (1990), another paper that should be required reading for policy economists.

[10] The ability to separate efficiency from equity considerations does have some substance when fully optimal policies are in place. This is one of the contributions of optimal tax analysis, as we shall see below.

of preferences in the single-consumer case. As they show, however, implicit separability of all households' preferences is not sufficient to yield conditional additivity of community preferences, and therefore is not sufficient for the validity of piecemeal policy.

It should be recognised at least parenthetically that not all market failures that yield inefficiencies in competitive economies call for public sector interventions. In some cases, the public sector is no better equipped than the private sector to deal with them. A classic example of that consists of incomplete markets for the sharing of risk. Diamond (1967) noted in his seminal paper on stock market equilibria that if there are fewer independent assets than states of the world, competitive equilibria will only be 'constrained Pareto-optimal'. Moreover, since the government should have no advantage over private capital markets in creating securities, the optimal second-best policy response is one of *laissez-faire*.

An interesting example that has relevance for our later discussion concerns imperfections in the trading of risk due to asymmetric information (e.g., moral hazard and adverse selection). Again, since the government will typically have no better information than private agents, direct intervention will not improve efficiency.[11] The fact that a strong efficiency argument cannot be made for, say, public intervention in markets for insurance has implications for interpreting the widespread tendency for governments to become involved with such things as unemployment and health insurance, and other forms of social insurance. We return to government participation in these activities later.

We turn now to a brief summary of some more specific applications of second-best reasoning to problems in public economics.

2. Applied Welfare Economics

Perhaps the ultimate, and certainly the seminal, practitioner of applied welfare analysis is Harberger, whose name has been given to the triangles and rectangles used in various applications. In his famous 'interpretive essay', Harberger (1971) laid out what he referred to as the 'basic postulates of applied welfare economics'. These were nothing other than decision rules for policy or project evaluation in second-best (distorted) economies. In it, he provided a useful characterisation of the procedure that ought to be followed in evaluating policies in one sector, given distortions elsewhere in the economy, precisely one of the objectives of second-best analysis.

Harberger's procedure was appealingly simple and intuitive. In evaluating the welfare effects of a small policy change that induces a general equilibrium reallocation of resources, one should include both the direct effects of the policy itself (e.g., a public project or a tax change on a particular market) as well as the indirect effect on other markets. However, the indirect effects arise only on markets that are already distorted; for those

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[11] Of course, distortions due to asymmetric information can give rise to a case for intervention on related markets on standard second-best grounds. For example, Arnott and Stiglitz (1986) have argued in a moral hazard context that subsidising activities that are complementary with risk-preventing actions can be welfare-improving even if the preventive action cannot be observed. Moreover, adverse selection may give rise to existence problems (Rothschild and Stiglitz, 1976) in which case compulsory insurance mandated by government may be welfare-improving.

where price equals marginal cost a small reallocation of resources has no net welfare effect (or incremental deadweight loss). On distorted markets, the indirect welfare effect is simply the distortion times the change in quantity exchanged on that market. This procedure was used by Harberger in a variety of contexts, including the measurement of the deadweight loss from tax changes and the evaluation of projects in distorted economies (see below). Indeed, Harberger (1964) had actually used his method to derive optimal indirect tax rules, something that went largely unnoticed in the subsequent optimal tax literature.

Harberger's method suffers from two major deficiencies. One is that it is applicable only to a single-consumer economy, a drawback we have mentioned above; the other is that it involves only small projects. Both of these have been remedied to some extent. Harberger's method has been extended to multi-consumer economies in two different ways. First, the rules for deriving the welfare effects of small policy changes on the basis of a social welfare function have been derived and interpreted by Boadway (1976), and form the basis of the Drèze and Stern (1987) shadow pricing rules for project evaluation. Second, Bruce and Harris (1982) have derived explicit decision rules for evaluating small projects using the possibility of hypothetical compensation as the welfare criterion. In both cases, the results are intuitive and operational, though they embody conflicting value judgments. The former presumes the existence of a social welfare function, while the latter eschews that and assumes that the hypothetical compensation can be used to rank social outcomes. Critics may find fault in either. The Possibility Theorem of Arrow (1951b) precludes an agreed upon social welfare function; and the compensation criterion suffers jointly from the fact that the compensation is hypothetical and may never be paid, the fact that the satisfaction of the criterion depends upon the type of compensation that is paid, and the fact that the criterion cannot give a complete ranking of outcomes and may not even be transitive.

The second problem with Harberger's method, its restriction to small projects, has been addressed in two ways. Harris (1978) has derived cost-benefit rules for evaluating large projects, though rules that retain the single-person assumption. Perhaps better known is the advent of computable general equilibrium (CGE) models that can be used to calculate the changes in resource allocation arising from virtually any policy change. The early uses of CGE models were precisely to confirm the welfare effects of policy changes that Harberger had calculated to a first-order approximation by applying his method to large tax changes.[12] However, as is well-known, CGE models have been used to evaluate most imaginable policy changes, making them the ultimate tool for applied welfare economics.[13] What is perhaps a bit surprising is that the application of these models rarely takes seriously the implications of multi-consumer economies; most follow Harberger's advice and simply aggregate welfare changes over individuals on a dollar-for-dollar basis despite the fact that such aggregate measures have no clear normative interpretation either in terms of social welfare changes or hypothetical welfare changes (Blackorby and Donaldson, 1990).

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[12] Interestingly, the magnitude of the welfare effects were surprisingly similar under the two methods.

[13] See the survey by Shoven and Whalley (1984).

3. Shadow Pricing

A particular application of applied welfare analysis is the derivation of shadow prices of inputs for use in cost-benefit analysis. The need for shadow pricing arises specifically because of distortions in the economy. Agencies that use shadow pricing are typically those that have no control over the size of distortions such as taxes and regulations. Their use is therefore a direct application of standard second-best analysis.

There is a vast literature on shadow pricing, much of it in the context of developing countries.[14] Shadow pricing rules are traditionally applications of the Harberger methodology. In the case where price distortions exist, the derivation of shadow pricing rules is direct and is often done using partial equilibrium techniques. The shadow price of an input purchased on a distorted market is the supply price of that input plus the product of the change in quantity induced elsewhere in that market and the size of the distortion. Following Harberger (1972), this can be translated directly into a *weighted-average shadow price* that is, a shadow price that is a weighted average of demand and supply prices whose weights are the shares of the inputs purchased for the project coming from reduced demand elsewhere and increased supply. Harberger has applied this technique to foreign exchange, capital and goods markets. Although it has turned out to be an extremely useful tool for project evaluation, it suffers from being partial equilibrium in nature and from neglecting equity considerations.

The shadow pricing literature spans much more than the Harberger weighted-average rule. The following sorts of results are particularly noteworthy:

i. In a general equilibrium setting in which all distortions are taxes, if the government chooses the tax structure optimally, shadow prices are simply producer prices. That is, piecemeal policy of a sort can be applied to cost-benefit analysis. This is a straightforward application of the famous Production Efficiency Theorem of Diamond and Mirrlees (1971).

ii. Shadow pricing rules in general equilibrium can incorporate equity considerations in ways that are quite flexible and operational. A full demonstration of that may be found in Drèze and Stern (1987).

iii. An interesting case, again attributable to Harberger (1972), concerns the shadow wage rate. Conventional analysis has suggested that in developing countries where there is a wage differential between sectors (e.g., rural versus urban), the shadow wage in the high-wage sector should be below the market wage since some labour hired for a project will be drawn from the low-wage sector where it has a lower opportunity cost. Harberger pointed out that, if the wage differential is an equilibrium phenomenon reflecting different probabilities of landing a job, the shadow wage should be the market wage. This piecemeal result has obvious implications for evaluating a public project in developing countries, many of which are highly labour-intensive.

4. Optimal Commodity Taxation

The most revolutionary change in public economics over the past 25 years was the advent of optimal tax theory. Its subsequent proliferation dominated the field throughout the

[14] See the comprehensive survey by Drèze and Stern (1987) as well as the summary of shadow pricing principles in Boadway and Bruce (1984).

1970s and 1980s.[15]. The optimal tax problem as it was originally conceived and applied by Diamond and Mirrlees (1971) was straightforward second-best analysis.[16] The basic form of the problem involved a government needing to raise tax revenues from a representative taxpayer, but being restricted by the inability to tax one of the commodities (usually taken to be leisure) or to levy a lump-sum tax. The analysis was second-best by virtue of the imposed requirement to use distortionary taxes, albeit the least distortionary ones.

In the enormous literature that followed, much was learned about techniques of analysis of second-best problems, but relatively little was learned about commodity tax policy. Part of the reason for this was that many interesting features of actual tax structures were left out of the analysis.[17] However, the paucity of results from the optimal commodity tax literature mainly reflected the very agnosticism of second-best theory itself. The first-order conditions characterising optimal commodity taxes turn out, in general, to be quite impenetrable from an intuitive point of view.[18] Various attempts to interpret them as proportional output reduction rules or inverse elasticity rules turn out to rely on unreasonable simplifications. Moreover, the rules are far from operational; the empirical information needed to implement them is unlikely ever to be available.

The most substantial results turned out to be those that focused on the conditions sufficient for equal proportional tax rates on all commodities (not including the untaxed one, leisure), the analogue of piecemeal policy rules in an optimal tax context. Proportional commodity taxes (equivalent to proportional income taxes in these models) would be optimal if goods are separable from leisure in utility and if utility is homothetic in goods. Equivalently, proportional taxation is optimal if leisure and goods are implicitly

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[15] An indication of that is the extent to which standard graduate textbooks of the period covered this issue, such as Atkinson and Stiglitz (1980) and Tresch (1981).

[16] Of course, Diamond and Mirrlees did not discover the optimal tax problem, but they formalised it in a way that has become standard. There were many antecedents. Ramsey (1927) was the seminal paper, though his analysis was only for differential tax changes starting at a zero-tax equilibrium. Hotelling (1932), in a paper better known for producing Hotelling's Lemma, was the first to derive optimal tax rules in a general equilibrium setting. Samuelson's famous memorandum to the U.S. Treasury analysed the single-consumer case using the essential tools of modern duality theory (Samuelson (1951)). And, Harberger (1964) derived precise optimal tax rules for the three-commodity case, taking the Corlett and Hague (1953–4) analysis (see below) to its logical conclusion. The rules derived by Harberger were later reported independently by Diamond and Mirrlees. Dixit (1970) extended the single-consumer optimal tax problem to the case where some commodities may be untaxable, thus formalising an approach proposed by Lerner (1970), one that bears an obvious resemblance to the standard second-best problem. Of course, one should not forget the literature on public sector pricing, especially Boiteux (1956) and its rediscovery by Baumol and Bradford (1970), that was analytically equivalent to the optimal tax problem, though unnecessarily restrictive in its objectives.

[17] One of these was administrative costs; see the evaluative survey of optimal taxation by Slemrod (1990).

[18] Moreover, as Harris (1975) showed, there is no guarantee that satisfaction of these conditions, though necessary, will be sufficient for an optimum, given standard preferences.

separable in the utility function (Deaton (1979)).

Optimal commodity taxation applied to a single household is, of course, not intrinsically very interesting. For one thing, there is no particular reason why taxes could not be obtained from a single household in a lump-sum fashion. More important, as mentioned earlier, one can typically not justify aggregating a population of heterogeneous households into a single representative one in a distorted economy for purposes of normative analysis. Moreover, problems of redistributive equity are normally thought to a crucial component of tax policy that can only be dealt with in multi-consumer economies. The optimal commodity tax methodology has been extended to multi-household settings and to a broader menu of (linear) taxes. In a multi-consumer setting in which all households have the same utility functions (but different resources), if the government is restricted to using commodity taxes to raise revenues and redistribute utility, uniform taxation applies only if income elasticities of demand are unity for all commodities; in this case, differential commodity taxes are incapable of redistributing incomes. Expanding the menu of taxes to include a uniform lump-sum levy on all households enhances the ability to use proportional commodity taxes.[19] Now, for example, the linear expenditure system is sufficient for proportionality of commodity taxes alongside the lump-sum levy; so is a quadratic utility function, which gives rise to linear demand functions.

The restriction of policy instruments to linear taxes is a severe one, given that taxes can be levied on a personal basis. The most significant extension of optimal taxation was that to non-linear (income) taxes. This was initially accomplished in the seminal, but difficult, paper by Mirrlees (1971); but the full implications only became apparent gradually. Much of the following section will be taken up with some of the implications of optimal non-linear income taxation. For now, we simply reveal some of its consequences for optimal (indirect) commodity taxation. Atkinson and Stiglitz (1976) analysed the case of a social-welfare maximising government that could employ both differential linear commodity taxes and non-linear income taxes in a world in which all households had the same utility functions but different ability endowments, reflected in different wage rates. Wages rates were not directly observable, but total incomes earned were, so taxes could not be levied on labour (or leisure) but only on income. They showed that commodity tax rates would be uniform if goods were weakly separable from leisure in the common utility function, which is a relatively mild restriction. In this case, commodity taxes could be dispensed with entirely since proportional commodity taxes are equivalent to a proportional increase in income tax rates.[20] In the case where the weak separability condition does not apply, tax rules are complex as usual. Nonetheless, Edwards *et al* (1994) have recently shown for this case that relatively higher tax rates should apply to commodities that are relatively more complementary with leisure. This is, of course, reminiscent of a result from one of

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[19] This is equivalent to a linear progressive, or flat rate, income tax.

[20] Note that optimal taxation analysis of this sort represents a theory of *tax structure*, not of the *tax mix* of direct and indirect taxes, that is, the share of revenues raised by direct and indirect taxes. Any given optimal tax structure is compatible with an indefinite number of tax mixes since the former involves only the relative sizes of commodity taxes, not their absolute levels. The theory of the tax mix is in its infancy and involves further second-best constraints, such as the ability to evade taxes of various types.

the first and most widely cited papers on second-best policy analysis by Corlett and Hague (1953–4), to which we return below.

Before leaving this section, brief mention should be made of a useful form of second-best tax analysis, that of differential tax analysis. This involves studying the welfare effects of small tax changes starting at a distorted initial situation. We have already encountered this in discussing applied welfare analysis and cost-benefit analysis above; here we mention applications involving tax policies. It is helpful to distinguish two separate strands in the literature. One involves the analysis of *tax reform*, especially the investigation of revenue-neutral tax reforms that are Pareto-improving. The second concerns rules for evaluating increments in total revenue to finance increased expenditures in tax-distorted economies. It involves determining the so-called *marginal cost of public funds.*

The seminal paper on tax reform is that of Corlett and Hague (1953–4). They investigated the effects on the welfare of a single household of small revenue-neutral changes in commodity tax rates starting in a situation with uniform tax rates. They showed, for the case with two goods and leisure, that welfare would improve if the tax rate were increased on the good most complementary with leisure. The result generalises in an obvious way to the multi-commodity case. However, once one moves away from their simple case, results depend upon the specifics of the situation; in general, almost anything can happen. For example, starting in a tax-distorted situation, reducing some tax rates and substituting lump-sum taxation to maintain budget balance may increase or decrease welfare, depending on which tax rates are reduced (Dixit, 1975). This reflects the general agnosticism about piecemeal reforms in a second-best world.

On the other hand, several positive results on the beneficial effects of tax reform have been derived. One is that starting from a tax-distorted situation, a proportional reduction in the size of all distortions will generally raise welfare (Atkinson and Stiglitz, 1980). Another one with potential policy relevance is that of Hatta (1986), which builds on Hatta (1977). He showed that starting with an arbitrary set of commodity tax rates on a single consumer, increasing the lowest tax rate and reducing the highest will be welfare-improving under relatively weak (and readily observable) conditions (if tax revenues rise in response to an increase in each of the tax rates and if both goods are substitutes for the aggregate of all other goods). This result provides some support for movements of tax structures towards uniformity. Finally, Keen (1987) has obtained a rather remarkable result on the benefits of moving towards similarity of tax structures internationally. In a two-country multi-commodity world with one representative consumer in each country, he shows that if initially the two countries have commodity tax structures that vary arbitrarily from one another, a harmonising tax reform that involves each country's tax rates changing proportionately in the direction of some weighted average of the two tax structures will be potentially Pareto-improving. That is, the representative consumer in each country could be made better off by such a reform accompanied by an appropriate lump-sum transfer from one to the other. This has obvious relevance for commodity tax harmonisation among trading countries.

As with the issue of the optimality of piecemeal policy, moving to a multi-consumer setting complicates matters considerably. Here, the tax reform analysis typically involves looking for directions of tax change that are Pareto-improving (and revenue-neutral); see,

for example, Guesnerie (1977), Weymark (1978, 1981) and Diewert (1978). Again, relatively little of a general nature can be said. Moreover, the analysis is relatively complicated. Diewert provides a comprehensive account of the circumstances under which Pareto-improving tax reforms are or are not possible in a variety of different models. Unfortunately, they are fairly technical and not easy to interpret.

A more intuitive and influential literature is that on the so-called marginal cost of public funds (MCPF). Its original impetus came from the optimal tax literature rather than from that on tax reform. Atkinson and Stern (1974) derived a decision rule for the provision of public goods in a simple representative-household model with optimal commodity taxes. They found that the well-known Samuelson Rule had to be amended to account for commodity tax distortions. The amendment involved two components. One was that an additional dollar of tax revenue cost society one dollar plus the marginal excess burden. Tt was this that eventually came to be identified with the MCPF, though the concept is now taken to apply more generally to the marginal cost of increasing tax revenues from any given tax system, not just an optimal one as in Atkinson and Stern. The other was that an increment of spending on public goods could have indirect revenue effects if the public good interacted with taxable commodities in household preferences. They showed that the net effect of these two on the public goods decision rule was ambiguous, confirming an earlier argument of Pigou (1947).

The MCPF has gone on to lead a charmed life of its own owing especially to some simple calculations by Browning (1978) that seemed to indicate that the total cost to society of raising an additional amount of tax revenue was considerably in excess of one dollar. His calculations were for increments to labour tax revenues in an economy in which marginal tax rates on labour income were already very high, and in which elasticities of supply of labour (the source of the excess burden) were of reasonable magnitudes. A vast literature has developed refining both Browning's calculations and his methodology, though typically maintaining his simple specification of linear taxation.[21] Given the fact that the size of the MCPF according to these calculations can range from \$1.20–\$2.00, there is a great deal at stake.

The MCPF has come to play an important part in discussions of whether government is too large. Unfortunately, it is not clear that existing calculations alone can resolve the issue. Their main drawback is that they are based on the assumption that tax revenues at the margin must be raised by increasing existing marginal rates. To see that this is not an innocuous assumption, consider what happens when the Atkinson-Stern analysis of public goods decision rules in distorted economies, on which the MCPF methodology is ultimately based, is extended beyond its confines of commodity taxes to include non-linear income taxes. Dramatic results occur. It turns out that when taxes are being raised optimally using the full range of non-linear progressive taxes available, the decision rule for public goods is the Samuelson Rule under mild separability assumptions involving leisure and commodities (*viz.*, if both private and public goods are separable from leisure in the common household utility function). If these separability assumptions do not apply, the

[21] Some representative examples include Wildasin (1984), Stuart (1984), Ballard (1988), Usher (1986), Wilson (1991) and Dahlby (1994). See the recent review of the literature in Fullerton (1991).

direction of deviation from the Samuelson Rule could go either way depending upon the relationship between leisure and the public goods.[22] In other words, the MCPF calculation is very clearly model-driven, and one ought at this stage be careful about using it for prescriptive purposes.

There is an obvious relationship between the MCPF and the welfare effects of tax reform, one that was brought out by Ahmad and Stern (1984). In a multi-good world in which each good bears its own indirect tax, a MCPF can be computed for each such tax. It consists of the welfare cost per dollar of tax revenue from an incremental change in the tax rate. A revenue-neutral tax reform that increases the rate on a good with a relatively low MCPF and decreases it on a good with a relatively high MCPF will be welfare-improving. No further improvements will be possible when the MCPF is equated for all goods. The same principle can be extended to a multi-consumer economy for any given social welfare function by calculating a marginal social cost of public funds as the change in social welfare per dollar of revenue raised from a small increase increase in the tax rate on each good. Ahmad and Stern apply the methodology to computing social welfare-improving directions of reform for the commodity tax system in India.[23] The advantage of this technique is that the informational requirements are much less than those needed to compute fully optimal tax structures. A disadvantage is that one can calculate only directions for reform, not magnitudes. Moreover, the methodology has only been applied to linear taxes, such as indirect taxes.

We have come a long way from the original pre-occupation of Lipsey and Lancaster with the consequences for economic policy of an immutable distortion somewhere in the economy. At that time of their work, the concern was akin to the standard market failure argument for public sector intervention — what to do to minimise the efficiency loss from distortions in the market place, that is, about violations in the First Theorem of Welfare Economics. With the development of optimal income tax analysis and the growing recognition that governments are largely in the business of redressing inequities in market outcomes, emphasis has shifted towards what has been referred to as the 'limits to redistribution' (Roberts, 1984) and what can be done to relax them. We are in the realm of the failure of the Second Theorem of Welfare Economics.

III. SECOND-BEST THEORY AND REDISTRIBUTIVE POLICY

As mentioned, second-best theory was originally conceived as a market failure problem, that is, as a problem arising out of the failure of the First Theorem of Welfare Economics. Given some distortions in the pricing system that could not be corrected directly, how could policies be applied to the controllable sectors to achieve the highest feasible level of efficiency, the second-best level. The analysis of policy in distorted economies has evolved well beyond concerns of that sort. It is being gradually but increasingly recognised

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[22] See Christiansen (1981) and Tuomala (1990) for an analysis of this for the continuum of abilities case, and a restatement by Boadway and Keen (1993a) for the discrete case.

[23] Dahlby and Wilson (1994) have applied similar reasoning to a federation by observing that the marginal social cost of public funds is likely to differ across member provinces. They argue that welfare would be improved by a system of intergovernmental transfers from provinces with lower to those with higher marginal social costs of public funds.

that policies introduced for redistributive reasons are much more pervasive than those for efficiency reasons. This has also been reflected in recent public economic theory, an increasing amount of which has focused on optimal redistributive policy. In this section, we outline some of the key features of that literature. Obviously, in the short space available, full justice cannot be done to it.[24]

The view that governments are institutions more for redistributing resources than for correcting market failures of the conventional efficiency sort does not sit well with all economists, even though it is borne out by simple observation of the budgetary activities of virtually all governments in the industrialised world. Their resistance results from the notion that economics is a positive social science with no particular advantage at dealing with normative issues.[25] However, as Blackorby and Donaldson (1990) have forcibly argued, that view is fundamentally incompatible with economic policy prescription or advice. For reasons they summarise succinctly, it is impossible to evaluate economic policy in normative-free way, or from a purely efficiency point of view; introducing equity considerations is indispensable. As they point out, that is a consequence of logic alone.

Nonetheless, one of the key features of the recent literature on optimal redistribution policy is that many of the key results depend on a minimal amount of value judgment. Essentially, all they require is acceptance of individualism, the Pareto principle, and, in some cases, some unspecified concave welfaristic social welfare function whose degree of aversion to inequality can be virtually any non-negative value.[26] To put the matter differently, most of the important results of optimal redistribution policy involve finding more efficient (Pareto-superior) mechanisms for achieving a given degree of redistribution.[27]

The classic paper on optimal redistribution policy is that by Mirrlees (1971) which formalised the problem of redistributing income in an economy of heterogeneous individuals using a distortionary non-linear tax-transfer mechanism. Mirrlees found, to his and others' surprise, that the optimal income tax was not very progressive, much less so than, say, an optimal redistributive lump-sum tax-transfer system of the Edgeworth (1881) sort. Precisely why that was the case was not easy to discern from Mirrlees' paper, which employed a combination of optimal control theory with a continuum of households and simulation analysis, neither of which yielded intuitively understandable results. Nor were subsequent works that refined his analysis much more helpful in terms of insight (e.g., Sadka, 1976; Seade, 1977; Cooter, 1978; Atkinson and Stiglitz, 1980; and Tuomala, 1990). Restricting

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[24] Blackorby (1990) has also dealt with some of the same issues of redistributive policy in a distorted world.

[25] It is, of course, ironic that this positivistic view of economics is one that Richard Lipsey has done much to accentuate in his introductory treatises.

[26] For an elementary discussion of the notions of individualism, welfarism and inequality aversion, see Boadway and Bruce (1984).

[27] This is *not* to be confused with the sizable literature on 'Pareto-optimal redistribution' identified with Hochman and Rodgers (1969) that investigates redistribution resulting from altruism. It has the alleged advantage of basing redistribution solely on efficiency grounds. But, it is unlikely to explain a significant proportion of actual redistribution, and may result in none at all if one accepts the convincing arguments of Bernheim and Bagwell (1988).

the analysis to optimal linear taxes helped (Sheshinski, 1972), but also effectively threw out the baby with the bath water since a linear tax system could not possibly reflect efficient redistribution (as subsequently became clear).

The real insight to the limits to redistribution underlying Mirrlees' analysis came in a parallel series of papers, seemingly independently conceived, most of which simplified the problem of Mirrlees to a discrete number of households (Guesnerie and Seade, 1982; Nichols and Zeckhauser, 1982; Roberts, 1984; Stern, 1982; and Stiglitz, 1982). The authors of these papers all recognised, at least to some extent, that the problem of optimal redistributive policy posed by Mirrlees could be looked at as a standard principle-agent one of adverse selection in which the key constraint on redistribution was a self-selection constraint. Moreover, the role of this constraint could be seen most clearly in a model with a discrete number of individuals rather than a continuum, though it is clearly operational in the latter. The idea is as follows. The ability of households to generate utility ultimately depends upon exogenous characteristics with which they are endowed. Examples can include ability or talent, health status, preferences, demographic characteristics, even the date and place of birth. Some of these are private information to the household. The government cannot observe them directly, but can observe variables that depend jointly on an individual's characteristics and behaviour. The government can condition redistributive policy instruments only on observed variables and characteristics.

In the optimal income tax literature, the example typically used involves ability as the exogenous characteristic, assumed to be reflected directly in the wage rate, and income (the product of the wage rate and labour supply) as the endogenous variable. Redistributive policy involves choosing a non-linear tax function relating tax liabilities to observed income. Redistribution from a person of high ability to a person of low ability involves a tax function that is progressively increasing in income. However, as one tries to redistribute more and more, eventually a point comes at which high-ability persons would be better off mimicking the incomes of low-ability persons by working appropriately fewer hours at a higher wage rate. Once this happens, no redistribution occurs — all that is achieved is that the high-ability persons have been made worse off (by being forced to mimic the low-ability ones) and the low-ability persons no better off.

To prevent this outcome, self-selection constraints must be imposed on the government's problem that effectively state that optimal tax structures are restricted to those such that persons of a given ability can be no better off by mimicking the incomes of persons of any different ability. These self-selection constraints constitute the 'limits to redistribution'. In optimal redistribution policies that are of typical interest, these will be binding constraints.

The way in which self-selection constraints restrict redistribution is illustrated in Figure 1 which depicts utility possibility curves for a simple economy consisting of two types of individuals — type 1 (low-ability) and type 2 (high-ability). The curve PP represents the utility possibility curve under full information in which the government can implement any point on the curve PP by a lump-sum transfer based on individual abilities (the Second Theorem of Welfare Economics). The points labelled L, U and M represent three outcomes of interest. L is the *laissez-faire* allocation in which person 2 is better off than person 1. U is the *utilitarian* optimum; with full information, the low-ability person is actually better

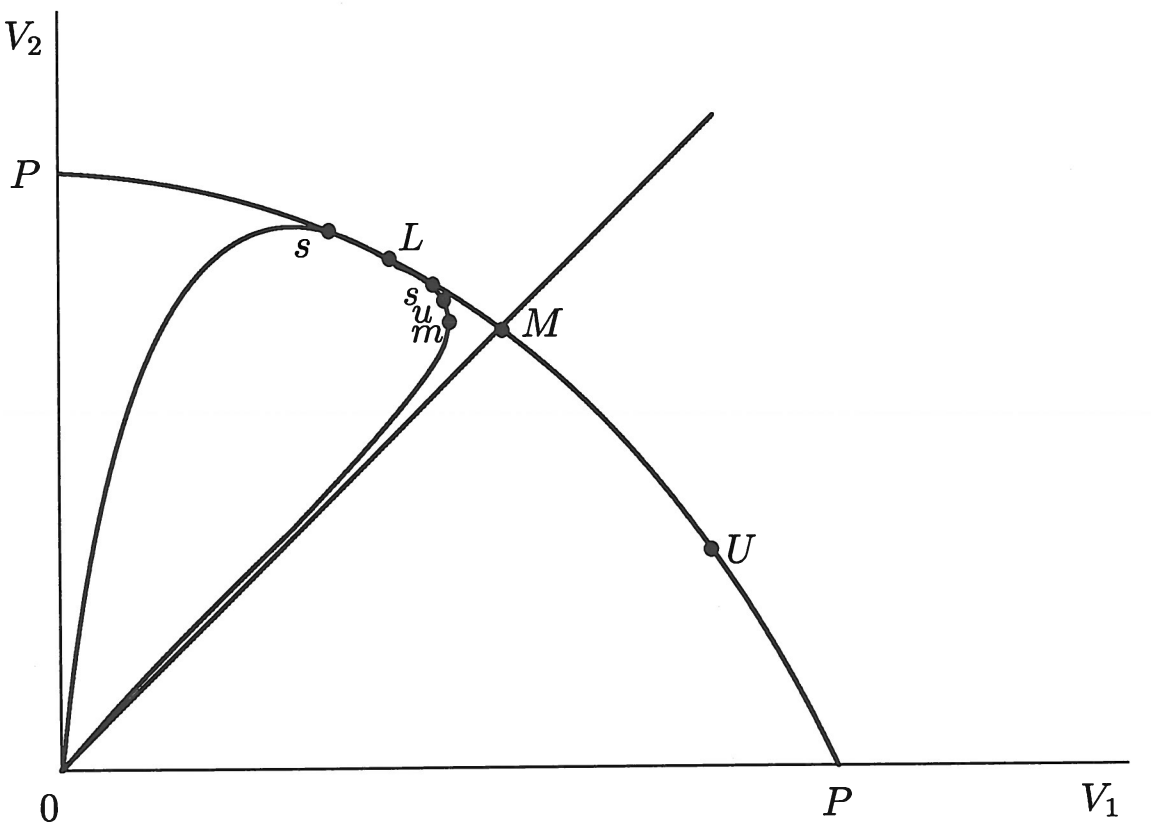

Figure 1

off than the high-ability person, a reflection of the fact that it is efficient to make use of the latter's higher productivity through higher labour supply. M is the *maxi-min* optimum; it involves equal utilities for both households and effectively *less* redistribution away from the *laissez-faire* compared with the utilitarian case.

The enclosed curve starting at the origin and passing through L represents the utility possibility curve drawn for redistributive schemes that are subject to a self-selection constraint because abilities cannot be observed. Several things can be noted about it. There is a portion ss around L such that the self-selection constraint is not binding. Beyond ss on either side, the possibilities for redistribution are significantly limited. For example, it is impossible to equalise utilities. The maxi-min solution m, which makes the low-ability person as well off as possible, leaves the high-ability person with higher utility than the low-ability person. And, unlike with full information, the utilitarian solution u is less redistributive than the maxi-min. More generally, the greater the degree of inequality aversion, the closer the social optimum will be to m so the more progressive will be the tax.

The properties of the tax function that generate an outcome along the constrained portion of the curve sm are well-known and need not detain us much here.[28] For example, the marginal tax rate of the highest-ability person is zero, while that for all others is between zero and 100%. Average tax rates will, however, rise with abilities, though not dramatically. In the multi-person case, self-selection constraints tend to be binding between adjacent ability levels, though there may be some bunching (partial pooling).[29]

Of special importance for us is the following observation, implicit in the analyses in he literature, but explicitly pointed out by Nichols and Zeckhauser (1982). The observation is that it is certainly *feasible* to construct a non-linear tax schedule such that self-selection constraints are all binding, yet the tax system is non-distorting (i.e., all persons have zero marginal income tax rates). In other words, distorting taxes are not a necessary feature of second-best redistribution. Nonetheless, such non-distorting redistribution is not efficient. That is, utility possibilities under non-distorting redistribution are Pareto-dominated by those with distorting non-linear taxes. Thus, distortionary tax-transfer mechanisms are a *consequence* of second-best optimal redistribution rather than an exogenously imposed property of it.

The fact that creating distortions becomes desirable in a second-best world is another manifestation of the fact that market prices no longer reflect social values in these economies. There are some other, perhaps more startling, consequences of second-best economies that result in unconventional policy recommendations, some of which might have considerable power in explaining what governments actually do. The cases we consider are ultimately related to an important general result discovered by Guesnerie and Roberts (1984), which can be interpreted as a 1980s version of the Lipsey-Lancaster result. They showed that in a second-best distorted economy, not only is it the case that prices do not reflect social values, but quantity restrictions can be welfare-improving. They

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[28] See, for example, Guesnerie and Seade (1982) and Stiglitz (1982) for a full discussion of the properties of optimal income taxation.

[29] It is worth noting that with tax instruments limited to linear progressive ones, self-selection constraints will not be binding; that is, redistribution will not be pushed to its efficient limits.

suggested on this account that policy instruments such as minimum wages could be welfare-improving, though they did not proceed to show circumstances in which policies of these types would be reasonable.

The most interesting applications to date of the Guesnerie-Roberts finding come when we combine the possibility of quantity restrictions with the existence of binding self-selection constraints that limit the extent of redistribution. It turns out that quantity restrictions can be welfare-improving ways of relaxing the self-selection constraint, and can thereby enhance the efficiency of redistributive policy. This is potentially a very significant finding since it can help explain the widespread engagement by governments in providing transfers in kind or quasi-private goods and services to their residents. Some examples of the application of this principle are as follows:

i. *Minimum wages:* While Guesnerie and Roberts suggested minimum wages as one application of their result on the desirability of quantity restrictions, their subsequent attempt to derive conditions under which minimum wages would be welfare-improving was not successful.[30] However, once a minimum wage is viewed as an instrument for relaxing the self-selection constraint, reasonable sufficiency conditions become possible. For example, Marceau and Boadway (1994) construct a simple model to demonstrate that minimum wages combined with unemployment insurance will be welfare-improving (either in Pareto-improvement or in social welfare terms) under fairly weak assumptions (i.e., that labour supply curves be upward sloping and that the lowest-ability workers have negative tax liabilities).

ii. *Workfare:* An equally-convincing case can be made for workfare schemes, that is, schemes that require transfer recipients to perform work as a condition for receiving transfers. Workfare weakens the self-selection constraint by making it less attractive for higher-ability persons to mimic lower-ability ones for whom the opportunity cost of working is lower. This case for workfare seems first to have been discovered by Nichols and Zeckhauser (1982) in a highly innovative paper.

iii. *Health care:* The view of social insurance schemes like health care as in-kind transfers that are implemented for redistributive reasons was put forward by Blackorby and Donaldson (1988) in an early application of the use of quantity restrictions for relaxing the self-selection constraint. Health care is an interesting case of redistributive policy in its own right. The rationale for it is based on the recognition that differences in endowed health characteristics are analogous to differences in ability in terms of generating utility inequality; and, health characteristics are private information just like ability is. While incomes are imperfect indicators of ability, health expenditures are imperfect indicators of heath status. Redistribution conditional on health expenditures is restricted by the same sorts of self-selection constraints as income redistribution. Blackorby and Donaldson construct an example in which the efficiency of redistribution can be improved by providing health care as an in-kind transfer, essentially because it relaxes the self-selection constraint.[31]

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[30] Guesnerie and Roberts (1987); see also Allen (1987) for another attempt that led to discouraging results.

[31] In their example, households have different preferences for health care rather than having

iv. *Education:* By similar reasoning, other large-scale public services that serve a largely redistributive role can be viewed as instruments for efficient redistribution in a second-best world. Boadway and Marchand (1994) have constructed a model in which education combined with ability determine household wage rates. They show that systems of public education that force households to consume more education that they would otherwise purchase privately can improve the efficiency of redistribution by relaxing the standard self-selection constraint under relatively mild conditions (particularly that the elasticity of the wage rate with respect to education expenditures be at least as great for the low-ability person as for the high-ability mimicker). As they mention, the same principles could be applied to other types of public services like public pensions, which are in-kind transfers of future consumption.[32]

The Boadway-Marchand analysis is a general one of the circumstances in which public provision of a private good or service (which is not retradeable) can relax the limits of redistribution. One characteristic of their analysis is that in precisely the circumstances in which public provision is welfare-improving, subsidisation of the private purchase of the commodity would also be welfare-improving. The two policies would lead to different local optima; which one would be preferable depends upon a global comparison that is not easy to make. This is yet another indication of the complexity and ambiguity of policy analysis in second-best settings.

IV. SECOND-BEST THEORY AND TIME INCONSISTENCY

As a final example of policy-making in second-best economies, we consider the consequences of time-inconsistency of government policies in distorted economies. The possibility of time inconsistency arises naturally in settings in which the government is in a principal-agent relationship with its citizens. Polices that the government sets as a principal or leader in anticipation of household behaviour may no longer be optimal after households have acted and governments are able to re-optimise. Indeed, this is a general feature of policies in second-best economies. In this section, we consider some of the consequences of the time inconsistency of second-best policies for explaining observed government behaviour.

A succinct statement of the problem of time inconsistency in the context of tax policy was first provided by Fischer (1980) in a simple, if somewhat artificial, two-period extension of the single-person Ramsey optimal tax problem.[33] The household was endowed with resources in the first period that had to be allocated between current consumption and saving for second-period consumption. In the second period, labour supply was chosen and consumption was financed from wage income and saving plus interest from the first period. The government had to raise revenues in the second period using wage and capital income taxation to finance a public good. If the government could choose its tax policy

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different health characteristics and the same preferences. However, these are really alternative ways of putting the same phenomenon.

[32] The role of in-kind transfers as policy instruments in a second-best world are discussed in detail in Boadway and Bruce (1994).

[33] The problem of raising a given amount of revenues from a single consumer using commodity taxes is conventionally referred to as the Ramsey problem despite not being what Ramsey (1927) actually did.

at the beginning of the first period, it would do so taking account of the implications for household saving in the first period and labour supply in the second. The optimal tax structure would generally tax both labour and capital income, though with appropriate separability and homotheticity assumptions, only labour income would be taxed. Fischer refers to this as second-best tax policy.

However, the announced second-best tax policy would be time-inconsistent. At the end of the first period, after households had taken their savings decision, a benevolent government would treat accumulated capital as fixed, and would opt to change its tax policy to one that taxed capital income to the fullest extent possible rather than labour income, since accumulated wealth was now a fixed factor. As a result, the household would be made better off than in the second best. Unfortunately, this would not likely be a tenable outcome. Rational households would realise that the government cannot help taxing their wealth in the second period and would take their savings decision in anticipation. In a rational expectations, *time-consistent*, equilibrium in which government policy is correctly anticipated, savings would be lower and capital taxes higher than in the second-best equilibrium. Moreover, household welfare would be lower.

This outcome is obviously an undesirable feature of second-best economies, and naturally leads one to ask whether anything can be done to prevent it. Two lines of investigation have been taken in the literature. In the first, the consequences of being able to restrict governments to certain types of policies have been investigated. For example, in an extension of the Fischer model to one in which labour supply decisions are taken in both periods, Rogers (1987) has shown that time-consistent optimal taxes may have quite different welfare rankings to second-best optimal taxes. She constructs an example in which a system of wage taxes is welfare-superior to a system of consumption taxes. However, consumption taxes are time-consistent while wage taxes are not; and the time-consistent set of wage taxes may be inferior to consumption taxes. Thus, restricting governments to consumption taxation rather than wage taxation may be welfare-improving, even though the latter is second-best optimal. In a similar vein, Bruce (1990a) has shown that restricting governments to indirect rather than direct taxes will be welfare-improving in an overlapping-generations extension of the Fischer model. The problem with these papers is that it is assumed that the government is somehow to be restricted to using certain tax instruments rather than others, despite the fact that governments might prefer to implement the restricted taxes.

Others have simply proceeded by assuming that, as of some time, governments can commit to future tax policies that they have not been able to commit to on the past. The celebrated and oft-cited papers by Chamley (1986), Judd (1987) and Lucas (1990), and more recent extensions such as Chari *et al* (1994), are of this sort. They examine the future dynamic paths of capital and labour income taxes in a representative-agent model beginning at some initial time at which some previously accumulated capital exists. They show that the tax structure evolves over time from one that taxes capital at relatively high rates to one in which capital is not taxed at all. Unfortunately, this well-known result is basically a cheat since it relies on governments being able to commit to future capital tax rates starting at some arbitrary point of time before which they presumably could not

commit at all (since they are free to tax old capital).[34]

Another tack that has been taken in the literature, and one that is of more interest for our purposes, is to investigate whether the existence of time-consistency problems can give rise to policies, or policy instruments, that would not be optimal in second-best settings. It turns out that the answer to that is a definite yes, and recognition of it helps us to explain some observed government policies that would be very difficult to explain otherwise. We conclude with a summary of the kinds of policies that fall under this characterisation, beginning with tax/subsidy policies and then moving on to expenditure policies. The examples we provide are illustrative only; the literature is still in its infancy.

i. *Investment incentives:* Given the irresistibility to governments of taxing previously accumulated capital, and the resulting high rates of tax on capital income (that we actually observe), it is natural to ask whether there are other measures that governments might take to counter the adverse effects of time-consistent tax regimes on capital accumulation. There are a couple of examples in the literature of this. The first one is for governments to offer up-front tax incentives (e.g., investment tax credits, reduced tax rates, cheap loans, equity participation) to induce firms to undertake more investment. Policies of these sorts are almost universally observed in practice, though they are hard to explain using standard normative analysis. It can be shown that in a world in which second-best capital tax policies are time-inconsistent, up-front investment incentives can be welfare-improving (Wen, 1992; Vigneault, 1993).

ii. *Tax enforcement:* A second example of the sort of policy response that might result from the time-inconsistency of second-best capital income taxation is the observed laxity of governments in the auditing and enforcement of capital income tax evasion. By any reasonable cost-benefit analysis, putting more resources into tax auditing is a paying proposition. Governments do not seem willing to do this. One possible explanation is that this is a way for governments to counter the fact that the only reason for taxing capital income as highly as is done in time inconsistency.[35] For this story to be a believable one, it must be the case that the commitment of resources to auditing be made before tax policy. That may or may not be the case. It is, however, hard to find other explanations as to why governments do not police capital income tax evasion more vigorously.

iii. *Subsidies to unlucky firms:* Another example of the implications of time inconsistency might be that of assistance to declining activities, policies that are difficult to explain on standard second-best grounds. Far-sighted governments may want to establish policies which encourage firms to take risks, but which force firms to bear the consequences of being unlucky. However, once an adverse shock occurs to the firm, the government may not be able to prevent itself from helping the firm. The result will be a misallocation of resources by the firm from a social point of view. In this case,

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[34] It is conceivable that governments could establish the ability to commit themselves to future policies through the building of reputations. A fuller discussion of the general problem of time consistency in policy economics, see Persson and Tabellini (1990).

[35] This is analysed in Boadway and Keen (1993b).

it is not obvious what the offsetting policy response should be.[36]

iv. *Public pensions and tax assistance to retirement savings:* The existence of public pensions can be explained as a rational government policy in a time-consistent equilibrium. Households correctly anticipate that if they do not save enough for their own retirement (and there is plenty of evidence that suggests that levels of saving for retirement are much lower than reasonable preferences would generate), governments cannot help but provide the necessary pension income. In a time-consistent equilibrium, savings would be too low and public pensions too high compared with the second-best optimum. In these circumstances, a rational policy response would be to provide a stimulus to saving for retirement, such as through tax preferences to retirement savings as observed in most countries.

v. *Education:* A related phenomenon applies in the case of another important long-run decision taken by households, that is, how much human capital accumulation to undertake. This case gives rise to some potentially interesting insights. The issue here is not only that of taxing capital versus labour income as in the Fischer case. It is also that of taxing differentially persons with higher incomes from whatever source. The rewards to human capital accumulation take the form of higher incomes in the future. Different persons, of course, have different abilities to convert human capital accumulation into future income. Once the human capital accumulation decision is taken, the pattern of future incomes are set. If the government could pre-commit itself to a future tax system, it would take account of the fact that the more progressive the tax system, the less the incentive to invest in human capital accumulation, and therefore the less income there is to redistribute. There would, therefore, be limited redistribution. On the other hand, if the government cannot commit to a future redistribution policy, it would essentially be taking redistribution decisions after persons have already decided on their human capital accumulation. It is not hard to see that the extent of redistribution would be higher in these circumstances. In a time-consistent equilibrium, the level of investment in human capital could be significantly lower than in the second-best optimum. In these circumstances, it can be shown that public sector intervention in the provision of education can be welfare-improving, either through a subsidy to education, or through more direct intervention such as mandatory education or the public provision of education (Boadway *et al*, 1992).

vi. *Unemployment insurance:* An interesting consequence of the inability of governments to commit themselves to future actions involves unemployment insurance. Publicly provided unemployment insurance has always been difficult for economists to justify. There is no apparent reason why governments should be better than the private sector at insuring against unemployment, given the usual problems of moral hazard and adverse selection. A cogent story as to why governments need to intervene in the provision of unemployment insurance is based on the notion that the government itself has control over the aggregate unemployment rate, although the relative incidence of unemployment among, say, industries, is random and depends upon exogenous shocks. Suppose that the government can control the level of unemployment by choice of a

[36] For an example of this reasoning applied in the trade policy context, see Staiger and Tabellini (1987).

particular policy instrument. There are various instruments that could be used, such as the money supply or tax policy or even the minimum wage and social support system. If the government could commit to an employment policy, the aggregate level of unemployment would be given, and its incidence would be randomly allocated among industries. Unemployment would be an insurable risk, and could be offered by the private sector. In fact, there would be full insurance in the absence of moral hazard problems. Suppose, however, the government cannot commit itself to an employment policy. If a system of full insurance were implemented by the private sector, the government would have an incentive to exploit it by increasing the unemployment rate as long as it placed more weight on workers' than on capitalists' income. The insurance companies, by anticipating it, would reduce their level of unemployment insurance provision, and the result would be a sub-optimal time-consistent equilibrium. Indeed, it is quite possible to construct the model such that no private insurance is provided at all (Boadway and Marceau, 1994). In these circumstances, it makes sense for the government to provide unemployment insurance, which is what most governments do. Again, it is the absence of commitment which is used to provide an explanation of a phenomenon which standard public economics theory is unable to provide.

These examples should suffice to convince the reader that the inability to commit to future policies can itself explain many of the policies that governments engage in that would otherwise be difficult to explain in standard second-best models of government policy.

V. SUMMING UP

As should be clear from the above discussion, the analysis of problems in second-best settings has obviously gone well beyond what was first envisaged when Lipsey and Lancaster proposed their General Theory of Second Best. Not only has the notion of second best been a fertile one for research by welfare economists, it has turned out to be the prime paradigm for the study of normative public economics itself, which is essentially the study of how governments should behave in an imperfect world.

Much progress has been made. The initial response to the theory of second best was agnosticism. Its message was that in a world of distortions, which the real world most certainly is, we can no longer guarantee that market prices reflect scarcity or social values. Nor can we any longer necessarily abide by simple piecemeal policy prescriptions with their limited demands of information. Not only that, we cannot hope to know what the exact policy prescriptions ought to be, since they depend upon preferences and technology in a complicated way. The implication was taken to be that we cannot say anything with confidence about policy.

By the same token, the opposite view could be held. While no policy presciption could be held with certainly, circumstances could be devised for rationalising a wide variety of types of intervention that would otherwise be unsupportable. In other words, anything goes. Thus, far from being cautious about policy presciptions, second-best theory may lead to precisely the opposite effect.

More likely, the truth is somewhere in between. Second-best theory has undoubtedly made life more complicated for the policy analyst, and has made economists be both more cautious in their policy presciptions and more careful in their approach. Moreover, it has led to the development of many useful techniques and ways of analysing policy problems

that would otherwise have been unnecessary. These have led to some important findings of relevance for real-world policy, many of which we have touched upon in this paper. One of the clearest and most influential examples of this is the production efficiency theorem of Diamond and Mirrlees, which says optimal government behaviour typically entails aggregate production efficiency when the availability of tax instruments is not restricted. This has led to operational rules for cost-benefit analysis (i.e., use producer prices) as well as to the design of tax systems (avoid taxes that entail obvious production inefficiencies, like turnover taxes or taxes on producer inputs). However, much work remains to be done; second best theory is here to stay.

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