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# Non-Market Coordination: Towards an Ecological Response to Austrian Economics

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ABSTRACT

Although the ecological tradition tends to favour a substantive role for non-market institutions in securing objectives such as environmental sustainability, Green theorists have paid relatively little attention to the important challenge posed to such proposals by the pro-market arguments of Austrian economics. The methods of ecological economics, such as multiple criteria evaluation, offer important potential for responding to the Austrian thesis that democratic, non-market institutions face a coordination problem in the face of complexity. However, the development of an adequate ecological response to the Austrians requires clarification of the conceptual underpinnings and potential scope of such methods.

KEYWORDS

Valuation, markets, commensurability, multiple criteria analysis, complexity.

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## 1. INTRODUCTION

The central question of political economy concerning the relative merits of market and non-market institutions has inevitably arisen for Green political theorists, whose recognition of the scale of current problems of ecological degradation is increasingly shaping this long-standing debate. Meadowcroft argues that if there is one lesson to be learned from the debate during the twentieth century it is that markets and planning are not mutually exclusive options. Rather, the question should be that of how best to combine them (Meadowcroft, 1999: 37). This is a point emphasised by the 'Green paradigm' in political thought, which advocates that markets need to operate within the context of a thick layer of democratic political institutions for establishing objectives such as environmental sustainability (Greenwood, 2007a). Writers who fall within the Green paradigm include, to name just three, Herman Daly, Michael Jacobs and John Barry.

While the Green paradigm and the school of ecological economics with which it is associated have a close interest in the institutional questions of political economy, they pay relatively little attention to the important critique of non-market planning developed by the Austrian economists Ludwig von Mises and Friedrich A. Hayek. The ecological tradition, as numerous articles in this journal demonstrate, offers an extensive critique of cost-benefit analysis (CBA) techniques.[1] In seeking to assign monetary prices to ecological services, CBA is criticised for adopting the assumption of neoclassical economics that such values can invariably be fully captured in monetary terms. However, it is Austrian, not neoclassical, economics that offers an explicitly pro-market approach (Mulberg 1992; Pennington, 2001; 2003). The Austrians argue that markets are an indispensable means of achieving social coordination, given the epistemological limitations of economic actors, the dispersion of knowledge across society and the significance of change and uncertainty. While the Green paradigm provides strong normative grounds for contesting the conclusions of Austrian-influenced 'free market environmentalism', the Austrian coordination argument nevertheless poses a significant challenge to Green political economy. This paper explores how Austrian theoretical insights offer a challenge which can spur the further development of an ecological response.

There are some important similarities between the philosophical conceptions of economic choice that underpin the Austrian and ecological schools, as explained in section 2. It is their contrasting normative commitments that lead them to differ markedly in terms of the kinds of political and economic institutions they propose. Section 3 outlines the challenge that the Austrians' case for markets poses for Green proposals to expand the scope of non-market institutions. Research in ecological economics has much to offer in response to this Austrian challenge and section 4 assesses the potential offered by an important set of techniques known as multiple criteria analysis (MCA). Drawing from the insights of Austrian theory, clarification of the meaning and scope of con-

cepts such as 'compensability', 'commensurability' and 'trade-offs' in different MCA methods is offered. This is a necessary first stage in the development of an ecological response to the Austrians, meant to encourage further exploration of important questions concerning the scope for non-market institutions to achieve coordination.

## 2. PHILOSOPHICAL UNDERPINNINGS OF ECOLOGICAL AND AUSTRIAN ECONOMICS

The Austrian tradition in economics has a number of distinguishing features that represent a marked departure from the neoclassical school. Emphasis is placed upon the importance of the concept of time in economic analysis, the radical uncertainty facing economic actors (O'Driscoll and Rizzo, 1985) and the need to understand the process through which economic change occurs, not just the formal analysis of economic outcomes (Kirzner, 1992). Austrian theory has been applied to a number of areas in economics, including capital theory (e.g. Lachmann, 1956) and understanding technological change.[2] It is from this Austrian tradition that a radically pro-market position emerges in the work of Mises and Hayek.

Austrian theory shares with ecological economics a recognition that economic decisions require consideration of a plurality of values that are often 'incommensurable' (Munda, 1997). Previous contributions to this journal have taken incommensurability to mean that values cannot be precisely measured along a common cardinal scale using a single metric unit of value (Beckerman and Pasek, 1997; Aldred, 2002; Fleisher Trainor, 2006).[3] However, this recognition of the incommensurability of values does not necessarily entail a critique of markets. Mises' case for markets starts from an acknowledgement of the existence of 'non-economic' values, such as the natural beauty of a waterfall and the honour of a nation that cannot be expressed in monetary terms (Mises, 1936: 116). Such values, that are not captured by market exchange values, are referred to henceforward as 'excluded' values. Mises makes clear that market prices can only ever imperfectly and incompletely capture the full range of values (Greenwood, 2006). The argument developed by the Austrians is that markets are nevertheless an indispensable means of facilitating coordination in the face of the complex plurality of variables that economic decisions involve.

Mises and Hayek identify two closely inter-related, indispensable functions of markets, those of knowledge encapsulation and discovery (Lavoie, 1990; Greenwood, 2007b). The former is implicitly present in Mises' critique of the non-market socialism proposed by his socialist contemporary, Otto Neurath.[4] For Neurath, economic decisions require consideration of a plurality of qualitatively distinct, incommensurable values, ranging from material living standards to leisure time and environmental quality. From this premise of incommensura-

bility, Neurath infers that monetary prices serve no useful function in rational decision making. Economic calculation should instead be conducted 'in kind', with each qualitatively distinct type of good being measured in terms of the appropriate physical unit, whether it be a quantitative measurement such as weight, length, volume, time etc., or a qualitative description (Uebel and Cohen, 2004). Mises' response accepts Neurath's premise concerning the qualitative heterogeneity of values. Mises refers to these values in terms of utility only in a purely nominal sense (Mises, 1949: 21). He rejects the notion that utility can be defined in phenomenological terms and is cardinally measurable (ibid.: 15). Mises directs his critique towards Neurath's inference from the premise of incommensurability that monetary prices serve no useful function. Although prices emerge from market participants' economic choices involving multiple, incommensurable values, they indicate the relative levels of demand and supply in terms of a single commensurable unit. In modern society, with its complex array of products and resources, each with many alternative uses, such a unit of measurement is, holds Mises, indispensable in enabling economic actors to compare the complex, ever changing range of economic alternatives.

This Misesean thesis is further developed by Hayek, whose case for markets has a strong epistemological emphasis (Lavoie, 1985; Kirzner, 1992). Hayek frequently re-emphasises the Misesean premise of value incommensurability (e.g. Hayek, 1976: 76, 108). He stresses that producers' and consumers' needs and preferences are often particular to a certain time and place. As a result, economic knowledge is necessarily dispersed across society. The market mechanism is the best way not only of encapsulating this knowledge through the price mechanism (Hayek, 1935: 85) but facilitating knowledge discovery (Hayek, 1968). Identification of this second function of markets challenges the neoclassical assumption that the ends of individuals can be identified independently of the market process. The market, it is emphasised, enables economic actors to discover their ends through the process of seeking and assessing the various means of achieving them. This argument was originally directed by the Austrians towards socialist models of non-market pricing. However, CBA also involves non-market institutions seeking to acquire knowledge of what the value of environmental goods would be if they were traded and is thus similarly vulnerable to this Austrian objection (Mulberg, 1992; Pennington, 2003).

Neoclassical and ecological economics can easily be distinguished. The former assumes that excluded values can be fully captured by a monetary unit of measurement, while the latter rejects this claim (O'Neill and Spash, 2000). However, no such straightforward distinction can be made between the assumptions of Austrian theory and ecological economics, for both accept that certain values are incommensurable. The source of the different institutional proposals of the two schools is not to be found in their assumptions concerning the comparability of values. The notion of 'weak comparability', which has been proposed as the defining premise for ecological economics (Martinez-Alier et

al., 1998), is also quite consistent with the assumptions of Austrian theory. The assumption of the weak comparability of values is distinguished by O'Neill (1993; 1997) from strong comparability. Strong comparability does not assume a cardinal measure of value but does mean that there exists 'a single comparative term in terms of which (alternatives) can be ordered' (O'Neill, 1993: 104). O'Neill challenges the assumption of the strong comparability of values, arguing that there can be no such single comparative term. The concept of value, he suggests, is 'attributive', meaning that when describing one alternative as more valuable than another, the criterion in terms of which it is more valuable must be stipulated. This criterion can differ according to the type of good being evaluated. Thus, for example, an old slate works might have historical value to a community whilst being of little or no ecological value. A marshland might have little value as a landscape whilst being of great ecological value (ibid.: 107). It is, he argues, vacuous to say that the marshland is more valuable than the slate works, or vice versa, unless it is made clear who or what it is more valuable for. The concept of 'weak comparability' avoids this non-attributive use of the term 'value,' while still allowing for the possibility of making rational choices where decisions require consideration of multiple values.

As O'Neill acknowledges, choices involving alternative courses of action, of the kind with which all schools of economics are concerned, inevitably involve conflicts between multiple, incommensurable value dimensions. Choices made only on the assumption of weak comparability must still involve consideration of the relative priority of the different values involved. Such decisions take the form of a comparison of alternatives that is 'ordinal' in the straightforward sense that, in the end, one alternative is chosen ahead of another, even though no single unit of valuation is assumed. That the values involved are only weakly comparable does not preclude the 'ordinal' comparison of alternatives in this sense. As noted above, the ordinal comparability of alternatives in this same sense, referred to by Mises as 'the choices of individuals, their preferring of some things and setting aside of other things' (Mises, 1949: 201), underpins the Austrian theory of how exchange values emerge through the market process. Hence the Austrian case for markets is, like the methods of ecological economics, consistent with the assumption of weak comparability only.

Since the work of Robbins in the early 1930s, neoclassical economic theory has moved away from the assumption of values being cardinally measurable and is also now founded upon the premise of ordinal choice. However, neoclassical-inspired CBA methods that seek to capture excluded values in monetary terms differ from ecological economics approaches by assuming that all decision criteria can be treated as compensatory. Compensatory criteria are those where a payment can compensate for their not being fulfilled and so an exchange value can be assigned to them. Ecological economics, by contrast, emphasises the significance of non-compensatory values. Certain excluded values, including some environmental values, are held to be non-compensatory, meaning that there

can be no compensation for failure to fulfil them. It follows that they cannot be captured in terms of an exchange value. In an ordinal ranking of alternatives, those failing to satisfy non-compensatory criteria will always be placed below those that do meet all such criteria, regardless of any compensation that may be offered (Lockwood, 1996). This creates the possibility of a two-tier lexicographical ordering of preferences and represents an important conceptual break from the assumption of Neoclassical economics that all preferences are substitutable (Spash, 2000: 199–200).

Ecological economists emphasise the importance of non-compensatory criteria in their discussion of environmental sustainability. They are committed to a 'strong', as opposed to 'weak', version of sustainability. Weak sustainability, as Ekins puts it, derives 'from a perception that welfare is not normally dependent on a specific form of capital and can be maintained by substituting manufactured for natural capital, though with exceptions' (Ekins, 2000: 76). Strong sustainability 'derives from a different perception that substitutability of manufactured for natural capital is seriously limited by such environmental characteristics as irreversibility, uncertainty and the existence of "critical" components of natural capital, which make a unique contribution to welfare' (ibid.). As Ekins notes, the point at issue between these two views of sustainability is an empirical one concerning the extent to which ecological services are substitutable (ibid.: 77). In addition to this empirical perspective, the ecological school stresses that the notion of compensation becomes entirely inapplicable, even meaningless, when ecological services are non-substitutable (Funtowitz and Ravetz, 1994; Vatn, 2000: 504). Hence, generally speaking, there is scepticism in ecological economics about the applicability of the concept of compensation to environmental valuation (e.g. Martinez-Alier et al., 1998).

This scepticism might, however, be a reflection of the real world case studies that are usually considered in ecological economics. These tend to involve sustainability limits being (or at high risk of being) violated, making the concept of compensability less applicable. In cases where ecological services are substitutable and hence their depletion does not threaten sustainability, a relationship of indifference can be defined between varying levels of the ecological service and the manufactured substitute. In such cases, ecological services could be considered legitimate objects of market exchange. There is recognition of this point in ecological economics, where it is advocated that market exchange occurs within the context of a set of non-market institutions for ensuring that economic activity is sustainable. Hence Martinez-Alier et al. refer to 'the possibility of *limiting* the compensability among indicators' rather than rejecting the notion of compensability entirely (my emphasis, Martinez-Alier et al., 1998: 284).

Lockwood's treatment of the concept of compensation is consistent with this approach. He considers the case of a person for whom certain threshold levels of consumption and environmental protection are essential and hence non-compensatory. For such a person, he points out, a 'decision that involves

choices between changes in personal well-being and nature conservation so that both remain at levels above their respective thresholds may attract compensatory preferences' (Lockwood, 1996: 276). Crowards (1997: 159–60) similarly outlines the possibility of allowing for trade-offs between resources within a framework of certain minimum standards of equity and sustainability.

Just as there is scope for compensability in ecological economics, Austrian theory leaves room for recognition of its limits. Even though neither Mises nor Hayek discuss the possibility, nothing that they say rules out the possibility of excluded values being non-compensatory. It is in terms of their perception of the normative significance and empirical scale of problems excluded from consideration by the market, such as threats to environmental sustainability and social equity, that the ecological and Austrian schools differ. Concern about biophysical limits is absent from the Austrians and is even downplayed by modern day, Austrian-inspired 'free market environmentalism' (Greenwood, 2007a: 82). The Austrians are also less concerned by the inequality of wealth that arises from markets. For example, Hayek's procedural theory of justice is entirely compatible with highly unequal outcomes. By contrast, the Green paradigm emphasises the significance of excluded values and is deeply concerned with the challenge of defining democratically accountable non-market institutions to establish non-compensatory limits to the scope of markets. Austrian economics makes no attempt to address the question of how such non-market institutions might be designed. Nevertheless, Austrian theory, starting from a recognition of the incommensurability of values that it shares with ecological economics, raises some important challenges for these Green proposals, to which I turn next.

## 3. THREE FORMS OF COMPLEXITY

Of central importance for assessing this Austrian challenge is the distinction used by Mises (1920) between the productive and distributive spheres of the economy. Production involves decisions concerning what to produce and how best to produce it. The distributive sphere of the economy involves the distribution of goods once they have been produced. For Mises, non-market production is the defining feature of socialism. Not only is it possible in principle for non-market planning of production to be combined with consumer goods markets but markets of this latter sort would, Mises seems to suggest (1920: 90–92), inevitably arise in a socialist economy. Mises' argument against the feasibility of socialism thus focuses upon the problem of how to plan production in the absence of markets for factors of production (natural resources, labour and manufactured capital). He suggests that it is in this productive sphere of the economy where the complexity challenge that non-market planners would face is most profound.

Three forms of complexity can be identified in Mises work: technical, economic and value complexity. Technical complexity consists of the productive coefficients involved in the vast number of different technologies. Such technical information can indeed, as Neurath points out, be expressed in terms of physical units of measurement. However adept socialist planners might be at gathering technical information, they must still face the problem of economic complexity concerning how to allocate a finite supply of factors of production in order to most efficiently meet production objectives. This problem of economic calculation applies even when it is assumed that a target set of productive outputs for the economy has already been fixed (Mises, 1920). It is one aspect of what Hayek refers to as the 'coordination problem' facing any society. In the face of economic complexity, Mises argues, market prices are indispensable as 'aids to the mind'. This argument has gained widespread acceptance and the Green paradigm considers factor markets to be a necessary, if not sufficient, condition for achieving productive efficiency in the context of economic complexity, as defined here.

The Austrian case for markets is far more contentious in relation to the, logically separable, problem of 'value complexity', and this is where Green theorists part company with the Austrians. The term 'value complexity' is not used by Mises or Hayek but the concept is ever-present in their writings. This third aspect of the complexity challenge arises with the need to define the objectives of production over time. Alternatives must be assessed in terms of the plurality of preferences, values or 'ends' that motivate individuals in society. For the Austrians, just as production goods-markets are indispensable for addressing economic complexity, so are consumer goods-markets essential in the face of value complexity. Exchange values in consumer goods-markets perform the same functions of knowledge encapsulation and discovery as the prices generated by production goods-markets. In the Austrian view, non-market institutions cannot possibly acquire the information about consumer preferences contained in market prices, given the highly specific and changing nature of individual preferences. Furthermore, prices serve as a guide for consumers as they continually seek new, more effective ways of achieving their ends. Achieving coordination between production objectives and the preferences and values held by individuals across society is a further aspect of the coordination problem presented by Hayek. Coupled with a normative commitment to a certain conception of individual liberty, this challenge leads the Austrians to grant primacy to consumer preferences as they are stated through the process of market exchange. They therefore support only the most minimal and consistently applied forms of welfare provision and intervention in the market.

The Austrian commitment to 'consumer sovereignty' has been the subject of strong criticism from political philosophy in general (e.g. O'Neill, 1998) and the Green paradigm in particular (e.g. Barry, 1996: 122-5). There are strong ethical grounds for questioning whether primacy should always be granted to the stated

preferences of consumers where they entail what might be viewed as undesirable consequences, about which the consumers concerned might not even be fully informed. The unsustainable use of ecological services is an important example of such a consequence. While consumer goods markets still have an important role in the Green model of political economy, the aim is for non-market institutions to establish production objectives to shape and sometimes counteract the signals that emerge from these consumer goods-markets.

The Green critique of consumer sovereignty is far from being a denial of value pluralism, which it takes to be an inevitable feature of modern society. While the democratic processes favoured by many Greens might establish a degree of consensus in relation to certain non-market objectives, it is appreciated that opinions will inevitably, to some degree, conflict. So, for example, the task of defining environmental sustainability involves value dimensions relating to the standard of living, time preference and the moral claims of future generations. Definition and implementation of the concept is recognised to be normatively contestable and hence a political issue (Barry, 1996: 119).

On the Green model, non-market forms of decision making must therefore assess a complex space of economic alternatives in terms of the plurality of values held by individuals across society. This challenge of value complexity is somewhat analogous to that of economic complexity in that it involves decisions between different possible means for achieving certain ends. The challenge of value complexity could be said to be even more profound, given that the 'ends' concerned are human ends that are far less tangible than the quantitatively definable ends of economic calculation.

Hayek raises the important question of how, in the face of value complexity, democratic, non-market institutions can achieve this task in a coordinated way. Although the ecological tradition shares with Austrian economics a recognition of the importance of local knowledge (O'Neill, 2004: 434), it is generally accepted that such non-market coordination cannot be achieved through localised decision making alone. Decisions concerning certain resources need to be made across larger geographical scales. As Pennington puts it, '[if] complex inter-community relations are not to be coordinated through impersonal market forces then at some point recourse must be made to some central "coordinating' authority"' (Pennington, 2001: 179). While the need for some larger scale, including global, decisions is acknowledged by some Green theorists (Dobson, 1990: 184; Jacobs, 1991: 131; Barry, 1999: 118), the question remains of how to coordinate non-market decisions across multiple geographical scales. Pennington (2001) argues, from an Austrian perspective, that discursive processes alone are insufficient for adequately addressing such complex decisions. Certainly it seems that, where market prices fail to provide adequate guidance, non-market institutions require some kind of alternative 'aids to the mind' that enable decision-makers to address the coordination problem.[5]

## 4. MULTIPLE CRITERIA EVALUATION

Multiple Criteria Analysis (MCA) is a set of analytical methods for assessing policy alternatives in terms of a plurality of incommensurable values. While MCA methods do involve a formal analysis of a problem, certain MCA approaches are designed to facilitate public involvement and transparency in the decision-making process, enabling participants to explore the various dimensions of complex decisions (Munda, 2004; Rauschmayer and Wittmer, 2006). Whereas the CBA approach typically proceeds by seeking to establish and then aggregate individual valuations (O'Neill and Spash, 2000), MCA, by contrast, can enable participants to develop and revise their views through a dialogical process. No set of property entitlements to the resources concerned need be assumed by MCA. This is in contrast to CBA approaches, which presuppose a certain set of property entitlements to the resources being valued that can influence these individual valuations (ibid.). Another advantage of MCA is that it offers numerous techniques for assisting where information is missing or uncertain, as is the case in so many environmental problems (Munda, 1994: 102).

The potential role of MCA in addressing the coordination problem highlighted by the Austrians has so far been the subject of relatively little discussion.[6] Yet there have been innumerable MCA case studies in environmental planning, albeit primarily on a local scale, where MCA is viewed as a means of 'operationalising' different conceptions of sustainability (Martinez-Alier et al., 1998: 283–5). There is a need to make explicit the potential role of MCA as a means of enabling the problem of non-market coordination to be addressed.

When multiple criteria methods emerged in the 1970s, they tended to be used by small groups or committees, with the wider public having little or no opportunity for direct involvement in the decision-making process. This 'committee-based' use of MCA clearly does not answer the Austrian question of how non-market decision making can reflect the range of values held across society in the way that they say is facilitated by markets. However, there is now a growing recognition that MCA processes can have an important role within the context of participatory democratic institutions (Banville et al., 1998; Lahdelma et al., 2000; Munda, 2004, 2005; Rauschmayer and Wittmer, 2006; Stagl, 2006).

There have so far been relatively few studies exploring the application of MCA to more complex problems involving 'inter-community coordination' of the kind that Pennington suggests are especially problematic for non-market institutions. Yet the challenge of defining the coordinative role of non-market institutions in the Green paradigm demands that the potential scalability of MCA processes be explored. Refraining from addressing this question would leave ecological economics vulnerable to the charge, already made by Özkaynak et al. (2004: 294–6), that it accepts and intends only to complement the current scope of the present day capitalist market economy.

The Austrian presentation of the coordination problem can serve as a framework for evaluating different MCA methods. Vincke (1992) suggests that the numerous different varieties of MCA can be classified into three main types: multi-attribute utility theory (MAUT), outranking techniques and interactive methods. Some techniques might be hybrids of these three kinds of method and the purpose here is not to establish a definitive recommendation of any particular set of techniques. Instead, the aim is to explore some of the key theoretical underpinnings of each generally defined approach, in order to assess the coordinative potential of MCA processes. How, it is asked, does each approach establish 'aids to the mind' for navigating complex decisions involving multiple incommensurable criteria? Addressing this theoretical question is a necessary first step before the broader institutional context of MCA processes can be considered.

In general, the different MCA methods each involve the following essential stages, although the order in which they are conducted can vary.[7]

(i) Define problem
(ii) Define alternatives
(iii) Define criteria
(iv) Assess performance of alternatives in terms of individual criteria
(v) Determine the priority of criteria
(vi) Compare alternatives across all criteria
(vii) Drawing of conclusions

As part of stage iii, it is possible to hierarchically structure the criteria in order to simplify the task of evaluating alternatives. 'Primary' and 'means' criteria can be distinguished. Primary criteria are those things that decision-makers 'fundamentally care about', while means objectives 'matter only through their effect on these fundamental concerns' (Gregory and Keeney, 1994). Although there remains a need to establish the relative importance of the different means objectives within each primary criterion this method offers a way of breaking down the evaluation process into a number of discrete, less complex decisions (see, for example, Gregory and Keeney, 1994).

Some recent MCA case studies have explored how participatory processes can be designed for each of these stages (e.g. Gregory and Keeney, 1994, De Marchi et al., 2000; Mendoza and Prabhu, 2003; Stagl, 2006). Rather than having to stop once stage vii is reached, MCA can be an open-ended process in which stages i–vi can be revisited in light of the conclusions reached. The discussion below focuses upon stages iv–vi, although for interactive methods (discussed in section 4.3 below) the process of defining alternatives (stage ii above) occurs at a later stage in the MCA process and is also discussed. For the purposes of this conceptual discussion, the term 'decision-makers' is used to refer to a set

of people whose preferences are being incorporated into the MCA process. The actual number of people to be included in this set is left unspecified.

### *4.1 Multi-Attribute Utility Theory*

The most long-established set of MCA methods is MAUT. This is based upon a set of assumptions of which both Austrian and ecological economics are strongly critical. MAUT methods seek to define utility functions that express the decision-makers' evaluation of each criterion. The utility scores of each alternative on each of the criteria are then aggregated. One of the most commonly used aggregation methods is the general additive model, which takes the following form:

$$U_j = \sum_{i=1}^{n} u_i [g_{ij}] \qquad \text{Vatn (2005: 345)}$$

where $U_j$ is the utility of alternative $j$, $u_i$ is a utility function which is a non-decreasing function of the scores $g_{ij}$ on criterion $i$ on alternative $j$. One popular version of the additive model is the 'weighted summation' model, which is as follows:

$$U_j = \sum_{i=1}^{n} w_i \cdot p_{ij} \qquad \text{(ibid.)}$$

where $w_i$ is the non-negative weight assigned to each criterion to indicate its relative importance and $i$ and $p_{ij}$ is the standardised, or 'normalised' score on each criterion.[8]

Ecological and Austrian theory provide strong grounds for criticism of some of the core assumptions of MAUT models. Firstly, an assumption of the weighted sum model (though not the additive model in general) is that the utility functions for each criterion are linear (Bouyssou et al., 2000: 106–7). Yet, in the case of many economic decisions, the relationships between the preferences for variables are often non-linear. For certain criteria, there might even be a non-compensatory minimum standard (see section 2), hence the assumption of the compensability of criteria can also be challenged from an ecological perspective. It should be noted, however, that non-compensatory minimum standards can be incorporated into MAUT methods and even interpreted in terms of utility theory (Nijkamp and Rietveld, 1990: 54).

A variety of 'direct' techniques have been developed that seek to separately establish a utility function for each individual criterion (Vincke, 1992: 44–7). Some of these techniques assume that criteria can be evaluated in terms of cardinal utility, seeking to base valuations upon the relative intensity of preferences. All of these direct techniques assume the preferential independence of criteria.[9] As O'Neill puts it, this assumption is that 'each value can be treated

like a discrete item on a list, its contribution to the final appraisal of a particular item's worth being separable from that of others' (O'Neill, 1993: 114). Challenging this assumption, O'Neill makes the distinctively Hayekian point that the value of criteria cannot be pre-specified in abstract terms, independently of context (ibid.). Instead, as Hayek stressed, effective decision making involves a process of discovering the inter-relationships between the variables that particular, concrete alternatives involve (Hayek, 1978: 143). Decision-makers' values can change once their implications are made apparent in terms of concretely defined outcomes, as numerous MCA case studies have shown (e.g. Keeney et al., 1990).

In the light of such epistemological considerations 'indirect' techniques of criteria evaluation have been developed. These involve inferring utility functions from decision-makers' ordinal choices between concrete policy options, rather than requiring a grading of the relative importance of each criterion in isolation (Nijkamp and Rietveld, 1990: 49–51; Vincke, 1992: 47–8). This means that the comparison of alternatives (stage vi) precedes the determination of the relative priority of criteria (stage v). The indirect approach is more sensitive to the inter-relationships between criteria in the particular decision context, although this in turn gives cause for questioning how far the resultant utility functions are applicable to decisions made in different contexts.

Assessing the MAUT approach in general, there are echoes of the Austrian perspective in Roy's important observation that:

> (An actor's) preferences may not be completely formulated, may exhibit internal conflicts, and may not be stable. These characteristics may result from a lack of information, different interpretations of a value system, or divergent value systems. (Roy, 1996: 77)

This insight into the further epistemological problems that arise in multiple criteria decisions highlights the need for a procedure that is transparent and hence enables decision-makers to clarify and further understand the inter-relationships between their values and the decision criteria. As highlighted by Austrian theory, facilitating such a discovery process is crucial for addressing value complexity. In comparison to other MCA approaches, it is more difficult to comprehend how the results of MAUT arise from the information provided by the decision maker. This lack of transparency can restrict the extent to which MAUT facilitates the discovery of new, alternative solutions.

Furthermore, in order that complete utility functions can be defined, MAUT approaches require decision-makers to answer a large number of questions covering the full range of possible values for each variable. As practitioners of MAUT methods recognise, this can be a highly costly and time-consuming process (Keeney et al., 1990). As Vincke points out, such an approach becomes wasteful when many of the questions involve trade-offs between inferior alternatives (Vincke, 1992: 57). Hence, while promising increased precision, MAUT

techniques can be both costly and lacking transparency. This, along with the scope for challenging some of the assumptions of MAUT approaches, has led many practitioners to adopt alternative kinds of MCA method.

### *4.2 Outranking methods*

The suitability of a second set of MCA techniques for addressing the coordination problem, known as 'outranking methods', can be questioned for different reasons. In contrast to MAUT, outranking methods are specifically designed to avoid the assumption of compensatory criteria. Instead, 'outranking relations' between alternatives are established. These relations are based upon a series of ordinal rankings of alternatives according to each of the different criteria. An alternative a1 is said to dominate alternative a2 if a1 is preferred to a2 on at least one criterion and decision-makers are indifferent between them on any criterion where a1 is not preferred. All dominated alternatives are eliminated from the candidate set of solutions. To increase the scope for eliminating alternatives, thresholds can be defined to create a range of criteria scores between which decision-makers are considered to be indifferent.

Even when such thresholds are set, most problems will involve a choice between multiple, non-dominated alternatives. Those outranking methods that refrain from using numerical weights[10] are of limited use for such problems, for they are not designed to capture variation in the relative importance of criteria. A simplifying assumption is sometimes made that all of the criteria are of equal weight but this will be unsuitable in many cases. There are certain kinds of problems for which the more open-ended nature of outranking methods could be viewed as a strength. After all, the primary purpose of MCA is to clarify the different dimensions of a problem (i.e. to serve as a decision *aid*) rather than to necessarily recommend a single, determinate solution. However, for some problems, the number of feasible alternatives is insufficiently reduced in the absence of criteria weights (Lahdelma et al., 2000: 602).

As a further aid to decision making in such cases, some outranking techniques, such as certain versions of the ELECTRE method, have been designed to incorporate criteria weightings. The sum of the weights of the criteria where an alternative a1 dominates a2 is compared to the sum of all weights to provide a 'concordance index'. A 'discordance index' is also used to veto those alternatives where an alternative scores very badly on a particular criterion.[11] The weights used to establish these indices are, 'coefficients of importance' (Munda, 1996) indicating the relative importance of one criterion compared to another. They do not imply compensatory trade-offs between criteria in the sense that 'an increased amount of the less-valued criterion can compensate for the loss related to the higher-valued one' (Vatn, 2005: 341). Such numerical weightings nevertheless express the relative priority of criteria in terms of

a commensurable unit. In this regard, they serve as 'aids to the mind' whilst avoiding the assumption of compensability. A decision is still needed about the level at which to set the criteria weights. This decision could be made through either a direct or indirect method (see section 4.1 above) but either way this involves ordinal choices being made between different possible weightings and the different evaluative outcomes that they imply.

### *4.3 Interactive methods*

The complex coordination problems facing non-market institutions, of the kind with which the Austrian pro-market thesis is particularly concerned, often involve trade-offs between continuous variables. This entails a choice between a theoretically infinite number of non-dominated alternatives. For example, the problem of defining sustainability involves continuous variables such as ecological resource use and productive capacity. A third set of 'interactive' approaches to MCA are especially suitable for exploring complex problems of this kind (Munda, 1993: 44–5).

Interactive methods have important similarities with the market process, as understood in Austrian theory. The value of criteria are not assumed as given but understood to emerge through a dialectical exploration of the inter-relationships between policy alternatives and ordinal preferences. Interactive methods also avoid the drawbacks arising from the requirement in MAUT to make a comprehensive set of pairwise comparisons across the full range of possible criterion scores. Instead, a trial and error search through the space of candidate solutions is undertaken. Starting with a given candidate solution, decision-makers specify the criterion (*c1*) with the least satisfactory value and the criterion on which they are willing to accept a reduced score (*c2*) in exchange for an increase in *c1*. On the basis of this information, a new candidate solution is then identified. This decision process involves addressing 'trade-offs' between criteria without attempting to specify indifference curves between them, and so avoids assuming compensability. Instead, the purpose of the trade-off is to identify a candidate solution that is ordinally preferred. Each stage of the interactive procedure creates a new constraint that narrows down the size of the solution space. This process of specifying preferences is repeated until a solution is reached that the decision maker finds satisfactory. Numerical weights in the sense of 'coefficients of importance' (as described in section 4.2 above) can be inferred from the chosen solution. Some interactive methods allow for previously expressed preferences to be reversed. This allows for decision-makers changing their mind when they discover the implications of their stated preferences.[12] Interactive methods compare favourably to MAUT in enabling decision-makers to focus their attention upon a smaller number of alternatives. Nevertheless, they are still time consuming and this means that they are only feasible for problems involving a small number of criteria (Nijkamp and Rietveld, 1990: 52-3).

*4.4 Defining the ecological approach to MCA*

The criteria weights and/or outranking relations established by different MCA methods offer potential for facilitating the two functions of knowledge encapsulation and discovery that, according to the Austrians, can only be performed by markets. Crucially from an ecological perspective, in certain MCA methods this is achieved whilst avoiding the assumption of the compensability of all criteria across the full range of their possible scores. The concepts of commensurability and trade-offs are present in certain MCA approaches, such as interactive techniques, that avoid this assumption of 'unlimited compensability'. In such MCA methods, commensurable, numerical weights (or 'coefficients of importance') for criteria emerge from a series of ordinal choices involving incommensurable criteria. In this respect the valuation process is analogous to market price formation, as understood by Austrian theory. The ordinal choices concerning the definition and implementation of non-compensatory limits to the scope of markets can also be understood as involving 'trade-offs' in the sense, identified by Farber et al. (2002: 377), of being choices between the different potential implications of each alternative. As indicators of the importance of criteria, such weights offer the potential for serving as 'aids to the mind', enabling comparisons between the preferences of different decision-makers and between the decisions made across different institutions and geographical scales. Such an approach makes MCA potentially scalable to more complex problems, as required in order to address the Austrian problem of non-market coordination.

The suitability of different MCA techniques, such as those concerning the compensability of preferences and the extent to which criteria can be measured in quantitative terms, require careful consideration in each case. MCA methods range from MAUT based techniques where compensatory criteria are assumed (e.g. Keeney et al., 1990; Gregory and Keeney, 1994; Gregory et al., 2001) to the approach used by De Marchi et al. (2000) and Gamboa (2006) that is designed to incorporate uncertainty and non-compensatory criteria. As Stagl (2006) shows, ranking alternatives on each criterion even according to very simple ordinal schemas can serve as an important mechanism for facilitating understanding of certain policy issues. These different MCA approaches might each have a role in the context of Green political economy, where there can be room for recognition of compensatory criteria within the context of certain non-compensatory limits.

Nobody suggests that MCA alone can achieve the broadening of participation that is favoured by the Green paradigm. Yet MCA processes could, for example, be used in combination with other institutional mechanisms, such as in the design and/ or evaluation of a set of policy alternatives before they are opened up to wider forms of democratic decision making. The study by De Marchi et al. (2000) starts to explore such possibilities, using findings from MCA to formulate a questionnaire designed to extend public involvement in the decision-making process. Experiments with MCA methods have so far been

primarily on a relatively small scale. While, such studies provide an important first stage for addressing the challenge of coordination, further research is needed to assess the scalability of such approaches, both in terms of the numbers of participants and the geographical scale of the problems addressed. Only through such a discovery process can the force of the Austrian challenge to ecological economics be thoroughly assessed.

## 5. CONCLUSION

Mises and Hayek's thesis, that the coordination problem is beyond the grasp of even the most well-intentioned politicians and planners, offers important insights for assessing non-market institutional processes such as MCA methods. Viewed from this Austrian perspective, MCA approaches face some significant epistemological challenges. These include the problem of eliciting decision-makers' preferences and of bridging the gap between the abstract modelling and the concrete reality of policy choices. Also, MCA methods tend to be labour intensive and are therefore less suitable for involving larger numbers of participants.

Nevertheless, MCA methods have been shown to offer a structured yet dynamic approach to non-market decisions that involve multiple, incommensurable criteria. MCA offers ways of identifying the key value dimensions of a problem and exploring the implications of policy alternatives in terms of these values. Clarification of the conceptual underpinnings of the different MCA techniques, as demanded by the Austrian thesis, reveals that they can enable the functions of knowledge encapsulation and discovery to be fulfilled. Hence MCA methods offer significant cause for questioning Austrian scepticism about the coordinative capacity of non-market institutions.

## NOTES

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[1] For example, see issues 3(4) and 9(4) of this journal, where the critique is developed in a number of articles.

[2] Here, Schumpeter's contribution is closely associated with the Austrian tradition.

[3] See Chang (1997) for the initial formulation of this definition.

[4] Mises' critique first appears in his seminal 1920 paper 'Economic calculation in the socialist commonwealth'.

[5] Beckerman and Pasek (1997: 77–82) also discuss this problem.

[6] Although, note that O'Neill provides a comparison between MCA and the Austrian approach to environmental valuation (1998: 125–8).

[7] This list is an adapted version of that provided by Nijkamp and Rietveld (1990).

[8] Numerous standardisation techniques are available. One of the most commonly used is the following:

$$p_i = \frac{(g_i - \min g_i)}{(\max g_i - \min g_i)}$$

Nijkamp and Rietveld (1990: 42)

[9] Preferential independence means that preferences between alternatives that differ only according to a certain subset of criteria (I) are independent of their score on the criteria not in I ($\bar{I}$) – $\bar{\bar{I}}$ is referred to as the complement of I (Vincke 1992: 37–8).

[10] See, for example, the ELECTRE IV method devised by Bernard Roy (Vincke 1992: 68–9).

[11] Full details of this ELECTRE I method and some subsequent refinements of the technique are provided by Vincke (1992: 58–69).

[12] The procedure can be extended to include a sensitivity analysis for testing the robustness of a final decision in the face of uncertainty and potential change in criterion scores (Janssen 1994).

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