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Risk in Public Policy-Making: A Neglected Issue in Australia

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Abstract

We argue for greater recognition of the risky nature of most policy decisions. In this context we discuss the gulf between public risk perceptions and attitudes, and those of 'experts'. Public views of risk are often inconsistent and seemingly irrational. They nevertheless influence policy choices in a democracy. On the other hand, experts often claim unjustifiable levels of confidence in their predictions of policy choice outcomes, creating a lack of public faith in their recommendations. While risky policy choices deserve more systematic decision analysis, there is a need for more effective interaction between policy makers, decision analysts and the public.

Key words: Policy-making, risk, uncertainty, decision analysis, perceptions, subjectivity.

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Introduction

Risk seems to loom larger these days than in the past, perhaps because people have grown more cautious or because the rapid rates of social, economic and, especially, technological change have created more instability and unpredictability. Whatever the reasons, governments, certainly in Australia, are increasingly imposing heavier burdens on companies, organisations and individuals to do more about the management of risk. Regulation has been the primary vehicle they have used, with the Institute of Public Affairs (2005, p. 3) reporting rapid growth of Commonwealth regulations since 1986, many of 'highly doubtful merit' (Institute of Public Affairs 2005, p. 1). Yet it seems that governments are not subjecting themselves to the same rigorous discipline of effectively dealing with risk in most of their policy-making. This is so even though many policy decisions have to contend with technologically, socially and environmentally complex and often tendentious contexts (Jones 2005, p. 1). Hence, public policy-making inevitably entails uncertainty.

Policies decisions may not yield the desired outcomes, perhaps because the policy chosen was not sound, or because of unforeseen difficulties in implementation, or because of unexpected events outside the control of the decision makers. Moreover, for many public policies, there is an important time dimension in that policies are aimed at changing circumstances that are evolving over long periods, and the rates of change are often uncertain. Similarly, the impacts of policies also often take a long time to eventuate, and again the time frames are often uncertain, depending as they do on responses by individuals in society whose actions cannot be controlled by governments. And, of course, impacts can only be observed after they have occurred. So policy-making can often be likened to steering a long vessel down a winding river while only being able to look astern.

Evidently, policy-making is a risky business; yet the riskiness is often not fully recognised, or made explicit, and hence not handled well (Morgan and Henrion 1990).

Some major policy failures around the world have led to a rising interest among politicians and commentators, notably in Britain, in the need to handle risk better in public policy-making. In relation to agriculture, failures of policy for serious animal diseases such as BSE and foot-and-mouth disease have caused many people to question the reliability of policy advice from so-called 'scientific experts'. On a

grander scale, policy failures in relation, for example, to terrorism and the war in Iraq have raised general scepticism about the quality of top-level policy formulation in the face of risk. In Australia it is possible to point to policy issues relating to climate change, nuclear power generation and the sale of uranium to Russia and India where the risks are obviously high yet for which the risk analysis, if performed, has generally not been shared with the general public.

In this paper we argue that there is a need for a more open debate about how risky policy decisions are made, which should lead to more transparent and hence to better such choices. To put the debate in a context with contemporary relevance, we use examples of public policy-making on climate change and biosecurity.

Differing assessments of and attitudes to risk

Public attitudes to risk

Since policy-making is clearly a risky business, it should be susceptible to the methods of decision analysis in which risks are assessed using the best information or opinions available in order to reach the most 'rational' choices. But there is a problem in seeking to promote the widespread adoption of these methods of policy-making. We live in a democracy and therefore politicians and their policy advisers must be sensitive to 'the will of the people'. And there is ample evidence that most people do not view risky choices that may affect their lives in such a systematic way. Rather, most of us use an intuitive or affective (i.e., emotional) approach to risk assessment and risky choice. Most of the time it works well enough for everyday choices, but not always.

There is ample evidence of inconsistencies and irrationalities in afffective risk assessment and related choices. The public generally has a qualitative and complex conception of risk that incorporates considerations such as lack of knowledge, dread, catastrophic potential, controllability, involuntariness and equity (Fischhoff et al. 1978, Slovic et al. 1985). The result can be glaring inconsistencies with people assigning much importance to some risks which expert opinion or historical data suggest are relatively minor, yet the same people may pay little attention to what the evidence suggests are more serious risks. An oft-quoted example related to agriculture is that many people are very worried about the dangers of eating GM foods, while cheerfully continuing to smoke tobacco – in the face of abundant evidence that the

relative risks are the other way round. This particular apparently irrational assessment seems to occur because GM foods are seen as 'involuntary' risks while smoking is seen as a matter of personal choice and hence a 'controllable' risk – most smokers believe they can stop if they need to.

Decision analysis

In contrast to affective risk assessment and choice is the more systematic approach of decision analysis. Proponents of this approach argue that major risky policy decisions should be made thoughtfully and after collecting, analysing and considering relevant evidence. Moreover, use of a systematic approach should allow reasonably full disclosure of how such decision analyses were performed, enabling interested parties to follow the logic used and to review the judgments made.

Briefly, decision analysis involves breaking down a risky choice into its two main components of probability assessment and preference identification, then recombining the two assessments into a measure of utility or welfare on which a choice can be based. It is evident that both such assessments are potentially contentious, demanding careful consideration.

Probability assessment. Probability assessment starts with consideration of what possible outcomes or range of outcomes may result from implementing a given choice option. This entails taking account of any possible downside risk (possible adverse outcomes). Such consideration leads logically to consideration of (a) ways to reduce the chances or severity of adverse outcome and (b) how bad consequences might best be handled if and when they eventuate.

Because the consequences of any decision lie in the future, which is inherently uncertain, probability assessment unavoidably involves some subjectivity. But this does not mean that the probabilities chosen can be just guesses. Rather, they need to be carefully and thoughtfully derived, including an examination of what relevant data and other information are available or could be worth collecting. In the all-too-common situation that relevant data are sparse or absent, there is a large and evolving literature on how to reach good probability assessments using expert opinions. Hardaker and Lien (2005) sought to synthesise some general principles of good practice from this literature.

Preference assessment. The need for proper *ex ante* appraisal of public choices raises the issue of what utility (welfare) function should be used in such analyses. In the case where all the consequences of the policy choice are adequately measured in money units via some form of benefit-cost analysis leading to a probability distribution of a measure of worth such as net present value (NPV), Arrow and Lind (1970), in a seminal analysis of public investment under uncertainty, argued that society is usually able, at least potentially, to pool its risks across the whole population. Consequently, they argued, society as a whole should be almost neutral towards all but the most serious risks. This view supported that of Samuelson and Vickrey (1964).

Cases that Arrow and Lind (1970) say are exceptional do, however, occur. Little and Mirrlees (1974, p. 316) outlined when something other than the maximisation of expected NPV would be appropriate. Briefly, when a public policy impact is large relative to national income, when project returns are highly correlated with such income, or when a particular disadvantaged group is involved, there is a case for explicit accounting for the riskiness of alternative actions by use of an appropriate risk-averse social utility function. Policy choice about climate change, which some argue may have catastrophic consequences for everyone, seems to be a case where risk spreading will not work. Anderson (1989) described how to estimate the appropriate risk deduction in such cases.

Cases in which consequences are not expressed in money values may be handled by valuation methods familiar to economists. Or other appropriate measures of performance may be chosen to match particular policy choices, such as lives lost or saved, but again raising issues of the relevant attitude to risk (see, e.g., Fisher, Chestnut and Violette 1989, Viscusi and Aldy 2003).

In many situations policy choices need to meet several objectives, and it may be necessary to turn to methods of multiattribute utility assessment (Keeney and Raiffa 1976, Weirich 2001). Compared with single-objective problems, multi-objective problems are more complex, both analytically and in the communication to the public.

Issues in decision analysis

Probability assessment

As noted, probability assessment for decision analysis inevitably entails forming subjective judgments about the future, yet many scientists (and economists) are

uncomfortable with the concept of subjective probability. This seems to us to lead to some unfortunate consequences.

First, there is a tendency to rely on dubious or even clearly irrelevant historical data to derive relative frequencies for use as probabilities. For example, in a dynamic world, historical prices may be a poor guide to future price risks. Similarly, climate change may have altered the historical patterns of rainfall, droughts and floods. It is worrying to see how often such dubious historical frequencies are used in probability assessment, often with no apparent thought given to their suitability.

Second, there is the tendency of assessors to believe (or pretend) that they know more than they really do about the uncertain future when the outcomes of policy choices will be revealed (Morgan and Henrion 1990, ch. 6).

In a related way, some experts have a tendency to treat as 'fact' statements about the world that are really conjectures. This tendency is well illustrated in the on-going debate about climate change. The world climate system is extremely complex and poorly understood, yet different 'experts' are regularly reported in the media making firm but often contradictory predictions about future temperature and sea-level rises. Some such predictions may be little more than guesses but more often are based on projections from climate models that may track the past and describe the present reasonably well, but which naturally cannot be evaluated in terms of their reliability in predicting the more distant future.[1] A decision analysis of policy for climate change clearly should account for all the uncertainty, including uncertainty about the reliability of the predictions.

There are problems with the view that there can be 'scientific certainties', such as frequently espoused in the climate change debate, as noted above. Even Bruntland

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[1] Presently there are 23 major different Atmosphere-Ocean General Circulation Models. Yet, according to one commentator, these models continue to display a substantial range of global temperature change in response to specified greenhouse gas emissions. It is evident that the stochasticity built into some or all of these models substantially under-estimates the uncertainty about how the climate will change in the future. All or most models are based on similar science, which conceivably could be wrong. See *Evaluating Climate Models* by Bruce Murray, Analysis Online Editor at: http://analysisonline.org/site/aoarticle_display.asp?issue_id=5&sec_id=140002434&news_id=140001888 (accessed 11 Dec 2007).

(1987), in proposing the famous 'precautionary principle', used the term 'full scientific certainty' (albeit in a negative sense). Yet the notion of such certainty in science is at variance with the history of science and Popper's philosophy. As Popper (1970) pointed out, our knowledge of the world is imperfect and scientific understanding of it really comprises the current set of 'unrefuted hypotheses'. Moreover, the process of refuting any of these currently held hypotheses depends on other hypotheses that may themselves be unreliable. This is not to say that there is nothing about the world that we can 'know' with reasonable confidence, but rather that scientists (and economists) should be more cautious and humble in what they claim to know about the world.

Because the future is uncertain and recognising that most probability assessments are therefore subjective, it is logical to adopt a dynamic approach to risky choice called 'Bayesian learning' (Breen 1999) whereby initial or prior probability judgments are progressively updated in the light of new information and experience. Interestingly, Kelly and Kolstad (1999) used a model of Bayesian learning to explore the time taken to resolve uncertainty about the relationship between greenhouse gas levels and global mean temperature changes. Their model showed that, contrary to the popular perception that such uncertainty will soon be resolved, learning could take over 90 years, far longer than widely believed. Such a finding may support the view of Rausser and Just (1981) that full implementation of formal Bayesian analysis tends to be too complex and costly and needs to be combined with intuition.

Evaluating preferences for consequences

The economic arguments about risk aversion in policy decision making should surely not be contentious. That is not to say, of course, that they are always followed. Politicians or their advisers may choose to make such decisions in quite risk-averse ways if they fear that a bad outcome will negatively affect their chances of re-election or of advancement in their careers.

Majumdar and Mukand (2004) found evidence that governments generally are far too conservative in their decision making between elections, persevering too long with failing policies, while becoming much too risk-taking during election campaigns. Recent events in Australia might be viewed as supporting their case. There is a principal-agent problem here in that politicians, elected to govern responsibly, are

driven by personal ambitions and motivations to act in ways that are not necessarily in the best interests of society. Presumably, in this mode, politicians would not welcome policy advice along decision analysis lines that uncovers the weakness in their decisions.

Such problems aside, the notion that policy decision should seldom be made in a very risk-averse way is commonly overlooked for choices such as those relating to some environmental and food safety issues. For example, Brunton (1995) argued for risk-averse decisions in dealing with environmental issues. Similarly, in these fields it is not unusual to find decision makers or analysts invoking such notions as the *precautionary principle*, mentioned above (Ricci et al. 2003), or a *safe minimum standard* (Crowards 1998). Depending on circumstances and on the way they are interpreted and implemented, these rules can imply an extreme but undisclosed degree of risk aversion, which may well be inappropriate. Even though there are indeed cases where extreme caution is justified, it will usually be better not to apply such arbitrary rules but rather to follow a more conventional decision analysis approach in which judgments about probabilities are separated from assessments of the importance of alternative consequences (Morris 2002). That way, choices can be made on the basis of a more discriminating analysis, which will be especially important when there is more than one way to manage the perceived risk of some catastrophic outcome. Unfortunately, these arbitrary and generally very risk-averse choice rules are well entrenched in practice, making it hard to see how they might be replaced with a more balanced form of approach.

Complexity of analyses

While the principles of decision analysis are simple enough, application can be complex and difficult, especially for dynamic decisions. Moreover, Rausser and Just (1981) argued that risk analysis in policy-making should take a "full portfolio or general equilibrium" view, and not a partial analysis or partial equilibrium approach. While there are good theoretical reasons to look at policy-making in such a broad context, the reality is that it would most likely prove to be impossible and the best that can be hoped for would be a one-at-a-time approach.

Decision analysis is 'the art of the possible', but the approximations and abridgments needed in some cases to keep the costs of the analysis to a reasonable level may be so

great as to throw doubt on the reliability of any resulting recommendations. On the other hand, our experience, admittedly rather limited in a policy-making context, is that some decision analysis is almost always better than none because the mere formulation of the problem in a systematic way often leads to new insights that improve the chances of a good decision. We therefore now consider some steps that might be taken towards that end.

Towards better risky policy decisions

We start from a proposition that, despite the difficulties noted above, a shift to more systematic and transparent analyses of risky policy choices is worth striving for.

Risk communication

In a paper intriguingly entitled 'Trust, emotion, sex, politics, and science: Surveying the risk-assessment battlefield', Slovic (1999) comments that policy risk assessment entails a blending of science and judgment with important psychological, social, cultural and political factors. Judgments about risk by both the public and experts are influenced by emotion – by their respective world views, ideologies, and values. The limitations of decision analysis, the importance and difficulty of maintaining trust, and the complex, socio-political nature of risk all point, in Slovic's view, to the need for a new approach—one that focuses on introducing more public participation in both risk assessment and risky decision making. The aim, he says, is to make the decision process more democratic, to improve the relevance and quality of technical analysis, and to increase the legitimacy and public acceptance of the resulting decisions.

Consultation between experts and 'stakeholders' is certainly important and should be a two-way process. Provided they are not too arrogant, so-called experts can learn from other, including from the views and ideas of people affected by policy decisions. Sharing information about the uncertainties to be faced may allow everyone involved to revise their risk perceptions, usually leading to some convergence of views, but without necessarily reaching consensus about the probabilities of occurrence of important risks. On the other hand, it is less clear that consultation will result in any convergence in preferences for consequences. Nevertheless, such consultation will at least allow policy decision makers to be better informed about what stakeholders and others think and believe, even though, sooner or later, it will be up to the decision

makers to make the final policy choices. It is at this stage that we urge the need for more systematic and transparent analysis, at least for important risky policy choices.

Achieving a paradigm shift?

Policy makers might be persuaded to be more systematic in their approach to risky choices (and more transparent about those processes) if there were a groundswell of public opinion that demands change along these lines. On the other hand, it could also be the case that wise political leaders might see a chance to enhance their public standing by adopting at least some features of a more rational approach to risky policy-making decisions along the lines outlined in this paper, then proclaiming the merits of such an approach. We live in hope and meantime look at some of the practicalities of such a shift.

Getting better probabilities

We have argued above for more thoughtful methods to be used in forming probability judgments about policy outcomes. In particular, we have criticised the tendency, not confined to politicians and their advisers, to pretend to more certainty about the future than is reasonable. Evidently, some so-called experts need to learn to be more humble about what they know. Perhaps there is a case for the professional societies (including AARES) to take a more active role in monitoring the behaviour of members, or at least to develop a 'code of conduct' when it comes to making pronouncements about the uncertain future bearing on important policy choices.

Getting policy makers and their advisers to admit the lack of certainty may be an uphill task. The increased politicisation of governments in Australia raises the spectre of Ministers being given the advice they want to hear rather than the advice they should be given. Yet it is surely because of just such anxieties that the public are so sceptical of politicians' integrity.

Useful risk analyses, public or in general, are information demanding. To improve the capacity for effective risk analysis in public policy-making, there is a need for more comprehensive and correlated data bases than are typically available today (Bonnen 2000, Just 2003). A government that embraced policy risk analysis would surely soon come to recognise the need for better information in order to make better probability judgments. Similarly, such a government would recognise the need for better

scientific or economic knowledge to permit more 'evidence-based' decision making, and so would want to sponsor relevant research to generate such information.

Establishing preferences

Should risky policy decisions be based on some social welfare criterion, such as NPV, or is it necessary to account for the more affective preferences of members the public? Is it worse if 50 people die in a single accident than if the same number dies in 50 separate individual accidents? Is it worse if they are killed by terrorists rather than dying due to some natural disaster? These and similar questions which often reveal seeming inconsistencies in public attitudes to risks bedevil efforts to find a preference function to reflect the risk preferences of the 'general public'.

The reality, of course, is that policy makers will typically form their own view of what considerations are important in risky choice. Elected politicians will tend to respond to public pressures, at least to some extent, however seemingly inconsistent those preferences may be. In Australia we have laws that abridge individual freedoms and rights which were passed to reduce the risk of terrorist attack. Yet laws to restrict the use of tobacco and alcohol, which each kill far more Australians than do terrorists, are weak by comparison.

The hope, therefore, for a wholly 'rational' representation of the public interest in risky policy-making (if such a thing were possible) appears to be a lost cause. Nevertheless, a move somewhat in that direction may still be possible if there is the political will. Again, more open discussion of the issues could lead to change for the better.

Training

There is a case for better training of government decision makers and their advisers in systematic decision analysis. There is also merit in combining these measures with strengthened decision support units in at least the main agencies advising on policy formulation and design of new regulations to keep high-level decision makers and their advisers focused on rational rather than affective decision-making approaches. This approach will demand more transparency and communication with professionals, stakeholders and the general public.

Analytical methods

As noted above, the complexity of many policy decisions means that it is unrealistic to expect a full-blown decision analysis for every such choice. Recognising the difficulties in comprehensive analysis, Rausser and Just (1981) advocate instead a 'post-Bayesian' approach which incorporates some main features of formal Bayesian analysis while allowing for use of intuition to sidestep the complexities and costs of a full approach. Within such a framework, risky policy decisions can be phased, reviewed and revised accordingly. For example, it may be wise to test a risky policy on a small scale before full implementation, if such testing is possible and not too costly.

Although ideally we would like to see the application of 'full-blown' subjective expected utility analysis for at least major risky choices, entailing combining probability judgments and preference assessment into a measure of utility, we recognise the difficulty of such complete analysis in many cases. Nevertheless, some simplified or partial risk analysis is likely to be a substantial improvement, compared with ignoring risk. For example, Aven and Kørte (2003) and Aven et al. (2007) argue that consequences and uncertainties from the risk analysis should be highlighted, rather than synthesised measures of utility. Then the weighting of consequences and risk is ultimately the responsibility of the decision maker.

Central to a decision analytic approach is the idea that, as part of the analysis, costs and benefits of gathering more information for risky choice need to be matched. Yet this process too adds complexity, so again some 'post-Bayesianism' will often be inevitable. Nevertheless, a decision analytic perspective will focus attention on the importance of gathering more information so that prior subjective probabilities can be refined on the basis of accumulated evidence. Thus, for example, organisations concerned with biosecurity need to be 'learning organisations' in a Bayesian sense. It has been alleged that the British Government's response to the severe foot-and-mouth disease outbreak in 2001 was too rigid in that a set strategy was persisted with even when it could be seen to be failing (see, e.g. Kirby 2001). This and other examples suggest that there would be merit in cultivating a stronger culture of learning in some of the policy-advising sectors of government.

Real options

Just as collecting more information to learn more about the risks is a central part of decision analysis, so is the need to consider a more complete range of alternative choices and timings of those choices. For example, public policy-making sometimes deals with large investment decisions that lead to significant irreversibilities, such as construction of a nuclear power or desalination plants. Such decisions clearly entail a loss of potentially valuable options. Policy makers are making decisions to invest or not to invest that are contingent on unfolding events. Traditional investment decision tools (such as NPV) have been criticised because it is claimed that they cannot cope with the potential flexibility and irreversibilties that come with investment projects, resulting in changes in the planned cash flow pattern (Trigeorgis 1996, Amram and Kulatilaka 1999). The real options approach is a method or a 'way of thinking' that enables an expansion of the range of alternative future choices. The approach differs from the traditional 'now or never' investment decision tools in that it is extended to account for (stochastic) operational flexibility and strategic aspects of decision making, enabling better policy formulation.

Illustrations of real option approaches for public policy-making includes policies to encourage consumers to purchase new energy-efficient technologies (e.g. energy-saving products in the household), and decisions about whether regulators should permit new, uncertain production technology (e.g. allow GM foods now rather than waiting for more information). Real option reasoning takes behaviour (reactions to risk) into account, so improving understanding of how people respond to alternative public decisions, and leading to better information for enduring public policy choices (Bjornstad and McKee 2006).

Valuing real options can be based on the use of either market-priced securities (Dixit and Pindyck 1994, Amram and Kulatilaka 1999) or a certainty-equivalent version of the NPV formula (de Reyck et al. 2008) that eliminates the need to identify market-based 'twin securities'.[2]

[2] A twin market-based security is a security that is sufficiently similar to some real option that is not traded in the market so that the market data for the former can represent the latter.

In the Australian context, an example of a potential application of an options-based solution in an uncertain policy environment concerns the public management of the Murray-Darling Basin. The importance of environmental flows has been increasingly recognised, but they vary over time and are highly uncertain. With the introduction of openly traded water markets in inland water resources and with the separation of land and water property rights, the focus turns to how the Federal and State Governments can allocate these flows more efficiently, given the need to provide for environmental flows in competition with irrigation and urban water demands. The possible effects of government actions on the open-traded water market (such as alternative regulation or investment policies) might be analysed by employing real options methods, or elements of them.

While the full scope for application of real options in policy formulation is still being explored, it seems that, in at least some cases, the approach offers a feasible way of handling risky dynamic decisions that would be too hard to analyse via a full Bayesian approach.

Conclusion

We recognise that this paper may have raised more issues than it has resolved. When we set out to write on the topic we believed that the issues were simple, at least in principle. More systematic analysis of risky policy decisions seemed obviously desirable. Our view is not changed, but we are now more aware of the difficulties to be faced if that is to be achieved. We have sought to describe at least some steps along that route and we look forward to useful discussion that might advance the cause of better risk analysis in policy-making.

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