Risk, wellbeing and public policy

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This article explores the relationship between risk and wellbeing, and the implications for public policy. Risk is an important dimension of wellbeing in its own right. People have different risk preferences, so policies to improve the match between preferences and risk actually borne have the potential to improve wellbeing. However, policies that affect risk often have significant trade-offs in other dimensions of wellbeing. Overall, a more sophisticated understanding of risk can make an important contribution to deliberations across almost the full range of government policy areas.

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Introduction

Risk is one of the five dimensions included in Treasury's wellbeing framework, as set out in 'Policy Advice and Treasury's Wellbeing Framework' (*Economic Round Up*, Winter 2004). The justification for risk being considered a dimension of wellbeing is expressed eloquently by Arrow (1951, p. 404), who argued that:

> There is no need to enlarge upon the importance of a realistic theory explaining how individuals choose among alternate courses of action when the consequences of their actions are incompletely known to them. It is no exaggeration to say that every choice made by human beings would meet this description if attention were paid to the ultimate implications.

Following Arrow, risk is defined in this article to be the intrinsic uncertainty in possible outcomes that is present in almost all decisions.[2] In this broadest conceptual sense, risk impacts on all individuals, and is everywhere in the economy and in society.[3]

This article explores the relationship between risk and wellbeing, and the implications for public policy. The article first sets out some conceptual tools for the economic understanding of risk, derived from both the classical theories of risk, and more recent developments from behavioural economics. With these tools, the article then examines the implications that risk has for the rationale and design of government policy across a range of areas. It concludes with a discussion of risk as a dimension of wellbeing in its own right, as well as the interactions that risk has with the other dimensions of wellbeing.

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2 We take uncertainty to be intrinsic in the sense that it is not possible, in practice, to assemble an information set about most decisions that is sufficiently complete as to predict the outcome with certainty. It is beyond the scope of this paper to enter the philosophical debate as to whether, in theory, such a complete set might be possible even for archetypal uncertain decisions such as coin tosses.

3 Note that this definition does not distinguish between *risk* and *uncertainty* when describing variability in outcomes. This is in accordance with modern risk literature, but in contrast to Knight's famous distinction between them (Knight, 1921). Although the Knightian distinction between 'measurable' risk and 'unmeasurable' uncertainty has intuitive appeal, it is extremely difficult to apply in practice. Risks are only entirely measurable in highly simplified representations of decisions. Instead, they almost always include some degree of subjective judgment, and are hence not substantively different to the Knightian unmeasurable uncertainties in all subsequent analysis.

The intent is to provide a broad overview, rather than pursuing the detail of various risk concepts or policies. Through providing this overview, it is hoped to provide a richer background context for policy discussions in this area.[4]

Classical analysis of risk

This section outlines the conventional or 'classical' analysis of risk, which is founded on the assumption that an individual's risk preferences are essentially well-ordered.[5] The use of an historical chronology of the development of theory in this area is designed to illustrate the critical role of risk in the development of modern economic thought.[6]

The fundamental theoretical framework for the consideration of risk in decision-making is the *theory of probability*, developed by French mathematicians Pascal and Fermat in the mid 17th century (Bernstein, 1996). This allowed sophisticated mathematical techniques to be applied, for the first time, to build up risk profiles from uncertainties in disparate decisions, whether those decisions occurred simultaneously, in series, or complex combinations of both.

Decision-making under uncertainty cannot be fully described by considering the probability of various outcomes alone. It is also necessary to consider the consequences of the outcomes themselves. Huygens in 1657 showed that this could be done by rank-ordering decisions in terms of their *expected values*, defined to be the average of all possible outcomes weighted by their respective probabilities (Moss, 2001).[7]

Daniel Bernoulli challenged the usefulness of this expected value decision rule in 1738, on the grounds that 'the determination of the *value* of an item must not be based on its *price* but rather on the *utility* it yields' (Bernoulli, translation, italics in the original,

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4 In conventional usage, discussion of risk often focuses on risk management, that is, decision-making processes and frameworks that enable an individual or organisation to better manage risks. However, in this paper, the focus is instead on the risks themselves, and their implications for public policy. In effect, it is assumed that individuals are perfect risk managers. That is, they have full awareness of the risks that they face and how to manipulate them efficiently (for example, by trading them in risk markets such as insurance, and by constructing appropriate portfolios of risk).

5 'Well-ordered' means broadly that choices on the basis of these preferences are consistent. The term will be defined more precisely as technical terms are introduced later in the article.

6 The historical overview is, by necessity, highly simplified and selective. It draws heavily from Bernstein (1996), which provides a far more detailed historical treatment. Moss (2002) also provides some interesting historical context.

7 For example, the expected value of lottery with an equal chance of paying \$0 or \$1000 is ½ x \$0+½ x \$1000 = \$500.

1954). Bernoulli used this new concept of *utility* to describe two results of fundamental ongoing importance regarding the impact of risk on wellbeing, namely that individuals generally have a *diminishing marginal utility of wealth*, and that this leads them to be generally *risk-averse*.[8]

The concept of utility was the centrepiece of the development of modern classical economics in the 19th century. As Bernstein (1996, p. 110) explains:

> Utility provided the underpinnings for the Law of Supply and Demand, the striking innovation of Victorian economists that marked the jumping off point for understanding how markets behave and how buyers and sellers reach agreement on price. Utility was such a powerful concept that over the next two hundred years it formed the foundation for the dominant paradigm that explained human decision-making and theories of choice in areas far beyond financial matters.

In this incarnation, utility had lost its direct connection with risk *per se*, as initially conceived by Bernoulli. Instead, 'classical economists had defined economics as a riskless system that always produced optimal results' (Bernstein, 1996, p. 216).

In the early 20th century, the riskless classical theory was challenged by authors such as Knight and Keynes. They considered that these existing models were inadequate in modelling real-world complexity, and in particular, the critical economic driver of entrepreneurial activity. In their view, the fundamental dynamics of the economy could only be explained if risk was (again) explicitly incorporated into models of economic decision-making.

Von Neumann and Morgenstern developed a mathematical formalisation of this re-connection between risk, utility and decision-making through their *game theory (*also known as *rational choice* or *expected utility theory)*, published in 1944. This theory brought together all of the strands of the risk story explored thus far:

- Decision making under uncertainty was the fundamental action of all agents.
- The characteristics of the agents were expressed in terms of utility curves, which were required to satisfy conditions of a diminishing marginal utility of wealth, and of risk aversion.

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8 Diminishing marginal utility of wealth describes the result that people generally value each successive unit of wealth less highly than the one before it. This implies that rational actors will generally be risk averse, that is, they will prefer a sure pay-off rather than an equivalent expected value gamble (since the potential losses outweigh the equivalent potential gains).

- Choices were codified according to probabilities in various strategy games, and decisions were ranked by their expected utility.[9]

- Agents then sought to make decisions that maximise their expected utility under their particular circumstances.

Von Neumann and Morgenstern's theory provided comprehensive conceptual tools for understanding the impact of risks on individuals. The integration of these impacts into an aggregate model was done by Arrow and Debreu in 1954, as part of their pioneering theoretical work on the theorems of welfare economics and general equilibrium formulations of the economy.

Arrow and Debreu developed a different formulation to von Neumann and Morgenstern for modelling decision-making under uncertainty. This involved mapping choices in terms of *contingent states,* rather than uncertain outcomes.[10]

Using this formulation, Arrow and Debreu showed that, in the presence of a full set of contingent-state markets, competition will lead to an equilibrium with a Pareto-optimal allocation of risk in the economy.[11]

In their formulation, risk has all the properties of a standard good within conventional welfare economics. Risk trading must, by definition, leave both parties better-off in terms of their risk-return commodity bundle.[12] This means that, to the extent that individuals are able to trade risk as much as they desire, they will be able to meet their

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9 This is underpinned by the classical assumption of well-ordered preferences noted earlier. That is, the expected utility functions are required to be mathematically well-behaved, so that choices are consistent. This is in contrast to prospect theory, as described in the next section, where risk preferences may be inconsistent. For instance, while classical theory suggests that a choice between two possible choices should always be treated the same regardless of how it is presented, prospect theory finds that issues such as framing can (in some circumstances) determine which of the two possible choices will be made.

10 Contingent states refer to the proposition that 'commodities can be differentiated not only by their physical properties and location in space and time but also by their location in 'state'. By this we mean that 'ice cream when it is raining' is a different commodity than 'ice cream when it is sunny' and thus is treated differently by agents and can command different prices' (Fonseca and Ussher, 2004).

11 Pareto optimality for the allocation implies that 'no other choice will make every individual better off' (Arrow, 1964, p. 91). Note that different initial allocations are likely to lead to different Pareto-optimal outcomes. The relative social value of these outcomes can only be judged by applying the weightings of a specific social welfare function, as determined (implicitly) by the political process.

12 This is a 'by definition' argument because unless both parties are better-off, there would be no trade.

preferences for risk more fully within given resource constraints.[13] This is an allocative welfare gain, and hence would be expected to improve wellbeing.[14]

In addition, when individuals are able to tailor risks to their preferences, it enhances their capacity to undertake entrepreneurial activities (Bernstein, 1996). That is, in the absence of risk trading arrangements, many new economic activities may involve substantial risk for the entrepreneur. Facilitating risk trading provides the possibility for the risk borne to be made commensurate to the expected return. As well as an initial allocative welfare gain, risk trading would then also be expected to lead to dynamic welfare gains.

Risk trading for entrepreneurial activity often happens through the market for equity, where there is a 'risk premium', which reflects how the return on the equity differs from that of a risk free asset. This premium then represents the price that the investors receive for taking on the risks that have been implicitly traded.

The Arrow-Debreu approach, and subsequent general equilibrium analysis, involves high level conceptual modelling of the economy. Its value is in providing a general framework for understanding how risk operates in the economy and society, rather than providing detailed guidance for understanding individual decision-making.

Possible imperfections in risk markets

As noted above, the theoretical Arrow-Debreu construct relies on a complete set of contingent-state markets for a Pareto-optimal risk allocation to be achieved. Arrow and Lind (1970, p. 374) argued that the existence of missing or failed risk markets was 'perhaps one of the strongest criticisms of a system of freely competitive markets'. There are three main categories of possible risk market failures identified in the classical approach: i*nformation problems*, *contractual problems* and *externalities*.

13 Individuals may well seek to arrange a portfolio of (at least partially) offsetting risks to meet an overall risk preference, rather than trying to arrange risk trades to meet a uniform risk condition for all goods.

14 That is, assuming an underlying social welfare function that put a strong (or even exclusive) value on the utility of individuals, all risk trades would be expected to be welfare enhancing (since the utility of both parties must increase). Indeed, the Arrow-Debreu result is even stronger — full risk trading will achieve a Pareto optimal point, such that there are no further welfare gains to be made (assuming a given distribution of resources).

Many risk markets suffer *information problems* due to asymmetric information, where the underwriter is not party to critical information about the risk profile of the other party.[15] Specific examples include *moral hazard* and *adverse selection*.[16]

Asymmetric information problems can lead to markets rapidly becoming unsustainable, with the result that they can no longer perform their economic risk-trading function. Under some circumstances, the information constraint may be so severe as to prevent the formation of a risk market at all.[17]

Contractual problems refer to the difficulty of constructing complete contracts for some types of risk-trading. An example is the impossibility of contracting directly between generations over time. As Stiglitz notes, 'of necessity, then, the set of contingent claims markets must be incomplete' (as quoted by Moss, 2002, p. 47).

In some cases, even though a contract can be constructed in theory, it is impossible to guarantee that it will be honoured. For example, 'private financial institutions face commitment problems whenever there exists a threat of systematic (highly correlated) losses' (Moss, 2002, p. 307).[18]

Finally, *externalities* arise when operations have an external impact that is not captured in prices in the risk market. As per the standard treatment in welfare economics, competition may not then push towards a market equilibrium outcome that is Pareto-optimal.

In some cases, risk externalities can induce positive feedback loops. For example, during the Great Depression, Douglas argued that the provision of unemployment benefits 'would diminish the fears which the employed workers would entertain towards the prospect of unemployment and hence would lessen their frantic personal savings at such times … there would be a better balance between spending and saving and less unemployment would be created' (as quoted by Moss, 2002, p. 311).

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15 Not all information problems need be asymmetric, of course. There are many areas where understanding of the risks involved is relatively poor. One example of this is in environmental systems, where our scientific understanding of the long term possible consequences of some changes is still relatively undeveloped. These ill-defined risks may be particularly difficult to manage effectively.

16 *Moral hazard* is where there is an incentive to stop taking precautions against risky events (or even induce their occurrence) once the costs of the risk is being borne by an insurer (for example, in fire insurance). *Adverse selection* is where parties most at risk are most likely to purchase insurance (for example, in health insurance), hence biasing the selection pool.

17 It is interesting to note that the use of sophisticated derivatives and other risk instruments in financial markets has increased vastly the range and sophistication or risk trading in the modern economy (Shiller, 2003).

18 For instance, when there are systemic losses due to an economic downturn.

Insights for risk from behavioural economics

Recent work in behavioural economics, under the rubric of 'prospect theory', has challenged the key classical assumption of well-ordered risk preferences.

Kahneman and Tversky, in a landmark paper published in 1979, documented the following inconsistent risk preference behaviours in empirical tests:

- *Loss aversion*: People generally regard a loss as being more 'costly' than an equivalent gain would be 'beneficial'.
- *Framing*: The way that problems are framed is important, independent of the underlying risks involved in the decision.
- *Nonlinear perception of risk*: A change in the probability of the event will have different effects depending on what is the starting probability.
- *Losses versus costs*: Whether a change in wealth is structured as a cost (for example, the payment of an amount) or as a loss (for example, a foregone earning) can have a significant impact.
- *Source dependence*: Where uncertainty comes from seems to matter. For instance, people prefer a flip of a fair coin to a flip of a coin with an unknown bias. This reflects different treatment about uncertainty in the risk itself than in risk generally.
- *Risk seeking*: Despite the near universality of risk aversion, most people show a preference for risk under some conditions.

The key issue in these scenarios may appear to be 'incorrect' perceptions, or a failure to grasp the underlying structure of the problem. That is, it might be assumed that with further information, people may change their choices to be more consistent.

But when well informed observers are questioned, they are normally puzzled that their initial choices would be seen as inconsistent, and have no inclination to change their choice. This suggests that these are not solely issues of perception, but instead reflect true underlying preferences of individuals.

Kahneman and Tversky's 'prospect theory' developed some systematic predictions regarding these behavioural puzzles.

First, rather than using the full set of information available, prospect theory suggests that any set of possible outcomes (called a 'prospect') is edited to simplify the

information used. For example, this might be done by reducing the number of options, rounding numbers, or focusing on the parts of the different options that are identical.

The second major difference is in the way that the value of each outcome is measured. The classical approach suggests that these can be measured in absolute terms. In prospect theory, they are measured relative to a reference point which is dependent on how the prospect has been framed.

The third, and most significant, difference that prospect theory suggests is the way each of these possible outcomes is weighted. In the classical approach, this decision weight is simply the probability of the possible outcome. Prospect theory suggests that the decision weight is more complicated than this, and may include a component based on the subjective perception of the event's likelihood.

There is a consistent pattern that decision weights are generally higher than the actual probability for very unlikely events, and lower than the actual probability for very likely events.

There may be an additional weighting according to whether the uncertainty is 'known' or 'unknown'.[19] Specifically, when people are aware of the extent of their ignorance they are more likely to be averse to the risks involved.

More generally, the source of the uncertainty appears to be important. People generally preferred to take risks in the areas of their expertise. For example, football fans would generally prefer to be more risk seeking on gambles on a football game than on a pure chance.

Prospect theory thus provides a more sophisticated understanding of actual behaviours in decision-making under uncertainty. These newer forms of expected utilities mean that higher order classical analysis may need to be treated somewhat more carefully, with a greater consideration of behaviours in the real world.[20] In some cases, the newer forms may indicate that some risk market failures identified under the

19 This difference is reminiscent of Knight's predictions regarding different behaviour under 'measurable' risk and 'unmeasurable' uncertainty (Knight, 1921).

20 In more formal terms, higher order classical analysis requires that expected utility functions are mathematically well-behaved. It is beyond the scope of this article to examine the question of when the expected utilities implied by prospect theory may no longer meet this condition. Instead, it is assumed, in broad terms, that any behavioural impacts can be treated as a small perturbation on the underlying classical analysis.

classical theory are more severe than previously recognised. They may also point to market failures in risk that would not be identified at all under the classical theory.[21]

Risk and public policy

In this section, the concepts discussed in previous sections are applied at a more practical level to some issues surrounding risk and public policy.[22]

As noted previously, in its broadest conceptual sense, risk impacts on all individuals, and is everywhere in the economy and in society. By definition then, government is inextricably involved with risk in almost all of its activities.

A fundamental distinction for the impact of government actions on risk is between those which affect the *level of overall risk* in society, and those which *reallocate risk* between groups in society.

Government actions which seek to affect the level of risk in society are generally aimed at reducing overall risk. Examples range from general actions such as providing a system of enforceable and consistent property rights, to risk-specific regulation which seeks to prohibit or constrain risky activities.

While the presence of government tends to reduce overall risk, some government actions can also add to the level of risk at the margin. For example, sovereign risk is created by the possibility of unexpected changes in government decisions.

Government actions can also affect the *distribution of risks* between groups in society. Such risk reallocation may shift risk from one group to another, or spread the risk across a large number of groups. As Moss (2003, p. 18) notes, 'in some cases, risk reallocation can lead to risk reduction, but not always'.

Risk rationales for policies

The classical analysis notes that guaranteeing a Pareto-optimal allocation requires full risk trading across a complete set of risk markets. However, in some cases, markets for risk may be missing altogether. Even where they do exist, they may suffer market failures associated with information problems, contractual problems or externalities.

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21 More recent work addresses some of the issues raised by prospect theory through extensions to the classical expected utility approach, which are beyond the scope of our discussion here. See Quiggin (1993) for more details on this area.

22 It is emphasised again that the analysis is highly simplified, and only intended to provide a broad overview. In particular, the examples are for illustrative purposes only, and do not capture real-world policy complexity.

In addition, from prospect theory, it was noted that some observed behaviours which deviate from classical expected utilities may indicate that some risk market failures identified under the classical theory are more severe than previously recognised, and may also point to additional risk market failures not recognised under the classical theory.

The desire to address these risk market failures thus provides a range of risk-related rationales for government policies to work towards a Pareto-optimal allocation of risk across the economy.[23]

Policies to address market failures might take the form of intervention in *explicit risk markets*. For example, a possible (second order) rationale for government intervention in the health insurance market is to address the potential market failure due to adverse selection in the private health insurance pool. In this case, policy may be aimed at reallocating risk by expanding the group over which it can be pooled, and hence improving the efficiency of an explicit risk market.

In some cases, governments may seek to reduce the number of *missing markets for risk*. Indeed, the increasing availability and lower price of information through modern information technology may mean this can be done purely through information provision and market infrastructure regulation, rather than through more traditional intervention instruments (Shiller, 2003).

Intervention may also occur in markets which are not conventionally thought of as explicit risk markets, but are instead *implicit risk markets*. For example, Diamond (1977) and Merton (1983) have conceptualised the social security system as an implicit means of risk sharing between generations. This addresses a contractual risk market failure by reallocating risk between groups, in an attempt to improve (or substitute for) the operation of an implicit risk market.

One important type of intervention across most areas relating to risk is to increase transparency. When consumers and decision makers are better able to observe the true position or structure of other agents in the economy they will be able to make better judgments about the risks that they might take on. Transparency alone will not improve risk allocations, however, unless consumers are able to use this information to more closely match their own allocation of risk to their preferences.

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23 As noted previously, pushing towards Pareto-optimality implicitly assumes a social welfare function that has a strong (or even exclusive) value on the utility of individuals. Furthermore, it is noted again that any particular Pareto-optimal outcome will depend strongly on the initial allocation.

Risk interventions can also happen even in policy areas that are not normally thought of as being related to risk. For example, see Box 1 for a discussion of how tariff policy can have flow-on impacts on risk.

The risk rationale may also apply to government actions which are on a *whole-of-economy basis*, rather than acting on any specific market, risk-related or otherwise. For example, dealing with risk is a key feature of overall Commonwealth Government fiscal strategy. The government can address certain market failures through fiscal policy that are almost impossible to deal with on an individual basis. For example, during an economic downturn, individually rational risk decisions might involve individuals and businesses reducing their expenditure levels. However, in aggregate, this could further reduce economic activity, thus imposing a risk externality. Fiscal policy aimed at enhancing macroeconomic stability can thus be framed as having a risk rationale of reducing the incidence of such feedback loops.[24] Unlike the private health insurance and social security examples, however, this policy aims to reduce the level of risk in society, not merely reallocate it.

24 Shiller (2003) has proposed a means of addressing some of the risk implications of broad macroeconomic fluctuations through the creation of 'macro markets'. At a conceptual level, such macro markets do seem to have the potential to provide additional useful markets for risk, but it is beyond the scope of this paper to provide an analysis of the practicalities of their application. The Economist (2004) notes that Goldman Sachs and Deutsche Bank have set up prototypes of these forms of economic derivatives.

Box 1: Tariffs and barriers to trade

The conventional economic analysis of trade protection focuses on the impact of trade barriers on the potential efficiency of the economy, and hence the potential income and consumption levels of individuals within the economy. Lowering trade barriers, such as tariff levels, has significant positive benefits for an economy, expanding opportunities for consumption and the competitiveness of the economy. But lowering trade barriers will have impacts on the risk dimension.

The most prominent risk associated with reducing a tariff wall is the increased risk of unemployment and business failure in the short term in the sectors that have had their effective level of assistance reduced. Firms behind a tariff wall are likely to be relatively uncompetitive internationally, due to the price protection afforded by the tariff wall. The entry of competing imports will cause some firms to improve their business practices and become more competitive. But some firms may find themselves unable to do so, and their business may contract or fail with a consequent reduction in employment, other factors unchanged.

At the same time, however, other areas of the economy will expand — the change in relative prices for the economy will create new opportunities that firms will take up. Indeed, there are likely to be positive overall impacts on economy wide employment and the unemployment rate over the medium term, once these adjustments take place, and national income is likely to be higher, reflecting a more efficient use of the nation's resources.

Nevertheless, for some individuals there are more risks — an employee within the protected area of the economy will have a greater risk of becoming unemployed, at least temporarily, when the tariffs are lowered. In the longer run this increased risk of unemployment is reduced by the increase in the possibility of getting a new job in another expanding sector of the economy. But the short run risk of unemployment for the individual is likely to increase.

With many trade barrier changes it is likely that incidents of unemployment will be concentrated in only a few areas of the economy, while the positive benefits from increased employment will be more broadly dispersed. This distribution element to risk is critical to how the impact of tariff reforms is perceived in the general community. The impact on those that bear the increase in risk may be more apparent than the impact on those that benefited from a reduction in risk. The connection between the reforms and decrease in job security in some areas appears to be far more direct than any possible connection between reforms and an increase in job security in another sector (such increases are often indistinguishable from the impacts of normal economic growth). So while lowering trade barriers is positive for the overall economy, some individuals may experience increased levels of risk.

Risk implications for policy design

Prospect theory provides some additional insights regarding the design of policies, whether or not the original intent of the action is risk-related.

First, framing is critically important to understanding behaviour when risk is involved. In particular, the way that a transaction is structured will have a real impact on the way that people behave. For example, individuals may prefer government bearing of risk, even at higher overall cost, because of the perception that such costs are only a small part of the overall government budget.

Second, different paths to the same result may have different implications for society, due to the asymmetry of gains and losses. This has some significant implications for how risks should be treated. It implies that paths matter, and in particular, that decisions about the initial allocations matter deeply.

Finally, the way that things are perceived can affect the end result. Unlike the classical theory, prospect theory does not assume that people always perceive probabilities accurately. Particularly with regard to very likely or very unlikely events, the decision weights do not appear to accord with the actual probabilities. For example, events such as the failure of a large company, or a 100 year flood will be rare enough that people tend not to experience them personally. Within a population there will normally be a wide range of perceptions about the likelihood of these events, which will most likely not be very accurate, and are likely to change with exposure to news reports. People tend to exhibit a very strong aversion to large potential losses, even if such losses only have a very small actual probability.

Resource impacts of risk-related government policies

Governments may use a variety of conventional government policy instruments such as outlays, taxation measures or regulations for risk-related purposes. In addition, they may also use specific risk transfer instruments (RTIs), such as concessional loans, government guarantees and non-traded equity. Regardless of the specific instrument used, it is important to consider the full economy-wide impacts of any risk-related government policy.

General equilibrium models emphasise that risk and resources are inextricably linked together in decision-making under uncertainty, so each of these risk-related policies has real resource implications.[25]

Under the assumption that a policy addresses a risk market failure and does not have any flow-on impacts in related risk markets, wider risk trading would be predicted to lead to an overall efficiency dividend. However, even under these circumstances, the intervention will usually impose additional transactions costs in the market, and may require further fiscal expenditures for purposes of verification and compliance.

For example, the Commonwealth's involvement in prudential supervision of the financial system can be considered a policy to manage risk. Amongst other issues, it addresses the externality issue that failure of financial institutions can have system-wide effects, and the information issue that depositors cannot make a fully informed decision about the solvency of core financial institutions. However, at a conceptual level at least, the prudential safeguards on matters such as capital requirements place restrictions at the margin on the operation of risk markets. This will have real efficiency costs in resource allocation. In addition, substantial resources are devoted to such prudential supervision by the Commonwealth. However, these costs must, of course, be weighed against the benefits accruing to depositors due to the increased security of their investments, and the society wide benefits from increased financial sector stability.

In practice, given the complex interrelationships between risk markets, it is likely that most government interventions will have flow-on impacts in related risk markets. The static resource implications of these flow-on impacts thus need to be taken into account when assessing the net impact of any such policies. In addition, there are likely to be dynamic incentive impacts in the economy, since the operation of risk markets underpins ongoing entrepreneurial economic activity.

In some cases, government policies which ostensibly seek to mitigate a market failure may even increase risk-related costs. For example, Kaplow (1991, p. 167) notes that in the presence of certain moral hazard problems and for certain designs of intervention,

> … government relief distorts individuals' incentives: individuals' decisions take into account only their own exposure to loss — the portion of loss uncompensated by government relief — rather than the total loss. Moreover, given the availability of private insurance, the resulting loss from distorted incentives exceeds any benefit from relief in allocating risk.

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25 The general equilibrium approach also implies the converse, namely that almost all government actions that have resource impacts will also change risk distributions in the economy.

Government preference for risk

As discussed above, government is inextricably involved with risk in almost all of its activities. It is then of interest to consider the characteristics of the government's own preferences for risk.

Even if a stylised government preference function was identical to a generic individual, the government may react differently to risk because of scale effects. That is, for any particular venture, the government has the capacity to spread the risk over a much larger budget.[26] It can also take a risk that affects a particular subset of the population, and spread it over the whole of the population.

In addition to these scale effects, however, governments might actually have different preferences than a generic individual.[27] Most notably, in conceptual terms at least, government may have the capacity to be less risk-averse than individuals because of its capacity to make decisions based on an indefinite time horizon, its capacity to arrange its portfolio so that some of its risks are offsetting, its lower cost of capital or its reduced exposure to some perception problems. However, it is important to remember that risk-bearing by government still has real resource costs, so these costs may still potentially offset all of these risk-bearing benefits.

The government's preferences for risk may also change over time, reflecting judgments made through the political process.

Risk as a dimension of wellbeing

People have different preferences regarding risk, and this can be codified in terms of their expected utility functions. Their preferences may depend on factors such as their relative financial security, their aspirations for the future, or their desire for risk as a good in its own right.

This underlines that *risk is an important dimension of wellbeing in its own right*. All else being equal, it would be expected that wellbeing would be improved if there is a better match between people's risk preferences and the risk borne.

The classical analysis suggests that, for a given initial allocation, the optimal matching between individual's risk preferences and the risk borne occurs with the facilitation of

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26 Even with the (same) marginal utility of wealth curve, the government would place a lower value on an extra dollar than a generic individual because of the different scale of respective budgets.

27 If the government and the generic individual had the same size budget and risk-spreading capacity, there still might be differences in risk preferences.

full risk trading in complete risk markets. While much work has been done on this area in recent years, there are still risk market failures of information, contractual problems and externalities that provide a potential agenda for future risk-related economic policy reform to improve wellbeing.[28]

However, prospect theory suggests that people's expected utility functions may not necessarily be well-ordered. Under these circumstances, simply facilitating risk trading may not be sufficient to improve the match between their preferences and the risk borne. Instead, policies may need to be designed specifically to address issues of context, paths and perceptions.

Interactions with the other dimensions of wellbeing

As well as being a dimension of wellbeing in its own right, risk has strong interactions with the other dimensions of Treasury's wellbeing framework.[29]

Reflecting the current literature, the focus in this article has mainly been on the critical interaction of risk with the *consumption possibilities* dimension. However, it has also drawn out some important interactions with the other dimensions of the wellbeing framework (*distribution, complexity* and *opportunity and freedom*).

These strong interactions emphasise that decisions about risk-related policies require judgments to be made about valuing different aspects of social welfare. This means that they can only ultimately be made through the political process.

Level of consumption possibilities

The central feature of the classical analysis is that risks and resources are inextricably bound together in all decision-making under uncertainty. This means that changes in risk distributions impact directly on the level of consumption possibilities throughout the economy.

Some policies may lead both to a better matching of risk to preferences, and an increased level of consumption possibilities. That is, the static and dynamic efficiency dividend from addressing a risk market failure may more than offset any additional economic costs.

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28 Again with the caveat that this is on the basis that achieving a Pareto-optimal outcome is desirable, which implicitly assumes a social welfare function that has a strong (or even exclusive) value on the utility of individuals.

29 See 'Policy Advice and Treasury's Wellbeing Framework' (*Economic Roundup, Winter 2004*) for more detail on the other dimensions of the framework.

However, in many cases, risk policies involve a trade-off where improved risk matching leads to a reduction in the aggregate level of consumption possibilities.[30] For example, policies to regulate against various risky behaviours, or to address various perception issues regarding risk, are likely to involve this trade-off.

The insights from prospect theory may also complicate the understanding of such trade-offs. For example, if a policy involves losses for a part of the population, prospect theory suggests that losers may need to be more than equivalently compensated to return to their original level of wellbeing. The extent of this trade-off, and the capacity for government to ameliorate it, will depend critically on the specific risk-related costs for the issue at stake.

Distribution of consumption possibilities

The direct link between risks and resources also means policies that have a distributional implication for risk must have a distributional implication for consumption possibilities as well.

For example, some government policies act to pool risks which were previously borne by particular groups. Others may reallocate risks to individuals which were previously borne by government.

When considering the equity implications of such distributive impacts, a key consideration is the capacity of different groups to deal with the risks that they bear. This may depend on factors such as the level of information available to them, their command of resources and their access to risk markets.

Complexity

The classical analysis notes that extensive risk-trading may be required to optimise the risk allocation within the economy. In theory, this requires a sophisticated understanding of an individual's own risk preferences, and a willingness to execute beneficial risk trades over a wide variety of contingent states. This may introduce a significant degree of complexity to individual decision-making.

For example, financial deregulation in Australia has substantially expanded the choices for individuals with respect to various investment products.

30 This may sometimes be due to flow-on impacts in related risk-markets.

This has enabled greater matching of risks to individual preferences, but has also significantly increased the complexity of the choice of the appropriate financial product.[31]

Opportunity and freedom

Risk trading facilitates individual's capacity to undertake risky activities, which can substantially increase their future life opportunities. Although this was applied specifically to increasing the capacity to undertake entrepreneurial activities in the preceding analysis, it can be interpreted as broadly as desired.[32]

For example, the Higher Education Contribution Scheme (HECS) can be conceptualised as a risk instrument to overcome the contracting problems caused by the inability to trade in human capital. This facilitates educational opportunities, which are held by authors such as Sen to play a foundation role in expanding human capabilities (Sen, 1999). Box 2 further discusses the role of HECS as a risk policy instrument.

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31 Another complexity interaction from financial deregulation arises due to the increasing intricacy of financial institutions 'laying off' their risks through risk trading. This has made it increasingly difficult to determine the final destination of this risk for prudential regulation purposes (*The Economist*, 2004).

32 The work of Rawls (1971) provides a possible alternative perspective on the interaction between risk and opportunity and freedom. In his philosophical thought experiment of an 'original position', all individuals face an equal risk of facing severely constrained opportunities and freedom in society. He argues that the essential ethical justification for the social compact is to ameliorate this risk.

Box 2: The Higher Education Contribution Scheme

The cost of a university education in Australia is heavily subsidised by the Australian Government, which covers around three quarters of the costs while students themselves are responsible for the remaining quarter. To assist students in financing this cost, the Higher Education Contribution Scheme (HECS) was introduced in 1989. It provides students with a loan from the government to finance a portion of university costs during study, with students agreeing to repay a set fee per course. HECS substantially reduces the up front cost of education to the individual.

In terms of a broad economic analysis, the impact of the HECS scheme can be separated into a financing and subsidy component. The financing component relates to the provision of deferred loans, which may not have otherwise been accessible to students. The subsidy component is due to limiting the interest charges and the fees themselves to below commercial rates, with some of the cost then being borne by the government. The need for an individual contribution arises whenever the subsidy is not sufficient on its own to cover the complete costs of education. Most of the gains from education flow to the individual, and so providing education without any fees would be a subsidy to future high earners. This discussion focuses on the role of risk, and hence will look only at the first of these two effects.

HECS substitutes for private provision of finance for the individual's share of university fees. The risk analysis suggests that such a scheme can potentially be beneficial for overall economic efficiency if it addresses the contractual and informational risk constraints otherwise faced in private provision.

The contractual issue arises because people undertake education now to increase their income in the future, but they aren't able to access these future earnings when they need to pay the current costs. They therefore require finance to bridge this intertemporal gap. What makes this case different from most investments is that the individual about to undertake education generally has little in the way of available collateral, which will in turn mean that finance providers will either charge a risk premium, or not provide finance at all.

In addition, the finance provider faces a substantial information constraint, since they have little control over the most important factors involved in determining if the education will actually lead to increased earnings in the future. For example, it is extremely difficult to monitor the effort put in by the individual, which is a crucial predictor of university success. A substantial number of people never complete

Box 2: The Higher Education Contribution Scheme (continued)

their university course, and some will not end up with any improvement in their earning ability. These problems also exist in many forms of business lending, but the unsecured nature of loans for education may make them particularly problematic. The collection of HECS payments through the tax system provides some immediate advantages over private arrangements. The financing contract with the student is over the course of their working life in Australia, and hence the debt is much less vulnerable to short-term evasion mechanisms. Also, wholesale provision through HECS enables risk-pooling in a manner which minimises the impact of the individual risks. For example, while the individual default rate due to non-completions may be the same as for private provision, the government may be in a better position to spread these losses across a larger pool. Education is an investment that can sometimes fail, with the possibility of significant costs for little or no gain. The reallocation of risks from individuals to the government because of the HECS system has a dramatic effect on the risk that an individual faces when deciding whether or not to enter higher education.

First, they face no risk of having to make repayments when they have a very low income level. This is a benefit regardless of whether the individual succeeds in their course of study or not, as it removes the risk of having to make payments when suffering serious illness, or during an extended period of unemployment.

Second, repayments vary with income, and don't start at all until a moderate level of income is reached. As successful higher education is associated with generally higher incomes, those who fail their course can be expected to have a lower income on average. Hence those who don't succeed in education will face a lower, possibly zero, burden of repayments as they aren't receiving the benefits of education. This reduces the risk of failure, although does not eliminate it, as HECS covers only a portion of the total costs of education.

Overall the HECS system substantially reduces the risk levels faced by individuals choosing to enter the higher education system. This reduction in risk is likely to enhance the individual's wellbeing, as they face lower risk while still consuming the same amount of education (or indeed, they may now be able to consume education where previously this was not accessible due to financing constraints). This facilitates educational opportunities, which are held by authors such as Sen to play a foundation role in expanding human capabilities (Sen, 1999).

This reduction in risk may not be without cost to the individual, however, as it also reduces the incentive for individuals to apply a high level of effort to passing their studies. The reduced cost of failure could be expected, on the margin, to reduce the amount of effort people choose to put into studying. However, as there are still substantial costs of education even with HECS, this effect is likely to be small.

Conclusion

This article has provided a conceptual overview of the relationship between risk and wellbeing, and the implications for public policy.

The key messages are that risk is ubiquitous in the economy and in society, that risks and resources are bound inextricably together, and hence that changes in risk distributions impact directly on resource allocation throughout the economy.

Policy reforms to facilitate optimal allocation through risk trading across the economy have the potential to improve wellbeing. However, issues of context, paths and perceptions are crucial as well, and apply in areas of policy that may have little to do with explicit risk trading.

The benefits of such risk-related reforms must, of course, be judged against the real costs imposed through changing decision structures in the economy, and also against potential trade-offs in other dimensions of wellbeing.

Overall, a more sophisticated understanding of risk can make an important contribution to deliberations across almost the full range of government policy areas.

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