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PRODUCTIVITY COMMISSION DRAFT REPORT: BARRIERS TO EFFECTIVE CLIMATE CHANGE ADAPTATION

The Productivity Commission enjoys a well-earned reputation for its rigorous analysis of market structures and barriers to allocative efficiency. This submission is not intended to derogate from that reputation, but it does raise a number of questions about the appropriateness of the underlying approach to analysing adaptation to climate change within a conventional framework.

The April 2012 draft report bears a strong resemblance to the pattern of standard market analyses by the Commission in that barriers to efficiency or effectiveness are identified and corrective measures are proposed. It is not clear, however, why adaptation to climate change effects should be treated like a conventional market situation. It is possible that the Commission is constrained by its Terms of Reference, but it would be useful if a broader perspective could also be provided. This report is likely to set the stage for government action well into the future, and it would be a pity to miss the opportunity to develop a more comprehensive conceptual approach.

In particular, it is increasingly acknowledged in the academic literature that the hallmark of climate change is uncertainty. Despite the very wide range of analytical perspectives adopted, case studies investigated, and solutions proffered, the only common factor that can be specified with reasonable confidence is that the nature, intensity and timing of climate change is uncertain. Its actual effects are even more uncertain. Indeed, the most recent report of the Intergovernmental Panel on Climate Change[1], appears to be more tentative and qualified than its predecessor publications. The cascade of uncertainties that characterises climate model simulations means that even probabilistic predictions of the timing, frequency and intensity of extreme events must be tenuous at best.

Given that uncertainty is the defining feature of climate change, adaptation measures – whether concrete adaptation projects or broader policy – must be implemented in the absence of full knowledge of their likely costs and benefits over time. If this proposition is acknowledged, as it should be, then it is not appropriate to employ standard analytical methods that have been developed for markets where events and their probabilities are reasonably well known or predictable.

Fortunately, economic theory has advanced sufficiently in recent decades to provide tools for evaluating projects under conditions of uncertainty. The Commission is clearly aware of this in raising the 'real options' approach in its draft report. Nevertheless, a number of issues would appear to merit further consideration by the Commission in finalising its report.

[1] IPCC, 2012: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation.* A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA.

The real options approach

Greater emphasis by the Commission on the uncertainties associated with climate change would be beneficial in the longer term because there is already a growing risk of ill-advised policy formulation on adaptation. (See below, for example, on resumption of threatened property by local governments.) Unless the Commission gives greater prominence to the inappropriateness of developing deterministic solutions in the face of uncertainty, there is a high likelihood that local enthusiasms will result in a misallocation of resources through overinvestment in adaptation projects. Productivity Commission reports are generally influential in setting the tone for public debate, and this factor should not be ignored, given the emotion that the topic of climate change can potentially elicit.

A key aspect of addressing decision-making under uncertainty is that flexibility is critical. That is one of the precepts on which the real options approach is based. But the principle is also pertinent on a broader scale. Real options are relevant for project evaluation in the case of Knightian uncertainty (see quadrant II in the diagram below). However, governments also have a role to play in promoting flexibility in situations of total unpredictability (quadrant IV) and ignorance (quadrant III). Some aspects are addressed in the Commission's Figure 1 (p. 11) but they could be misinterpreted by the casual reader as referring to identifiable barriers to adaptation. In other words, the element of uncertainty is not sufficiently emphasised. Box 4.4 (p. 72) illustrating an Expected Value approach is a case in point – it is far from clear how one would realistically determine probabilities in practice, the main reason why a real options approach is useful.

Figure 1 Known and unknown aspects of climate change

	known probability	**unknown probability**
known event or consequence	(I) 'known knowns' (e.g. increased local temperatures for longer periods will affect crop cycles)	(II) 'known unknowns' (e.g. rising ocean temperatures may increase the intensity of cyclones but the frequency of occurrence is not known)
unknown event or consequence	(III) 'unknown knowns' (e.g an indigenous person knows of a rare pest that will thrive in a warmer climate but has not told the responsible authorities about it)	(IV) 'unknown unknowns' (ex post only: e.g. corroded sewer pipes due to reduced water flow in adaptation to drought)

source: http://ccep.anu.edu.au/data/2012/pdf/wpaper/CCEP1201Dobes.pdf

The issue of ostensibly insufficient emphasis of uncertainty arises on p. 47 of the Commission's draft report. The statement in the first paragraph that adaptive capacity '… is a function of the availability of resources' is a common, but ill-defined theme in the literature, particularly where ethical or income issues are considered, particularly for developing countries. This conventional, deterministic approach unfortunately begs the question of what resources and in what quantity. A more apt formulation would define adaptive capacity in terms of the *options available* (i.e. potential for flexibility in future action) to communities because it recognises the importance of choice in how resources are used across *all* competing social needs, including adjustment to climate change.

It is an appropriate role for government to focus on maintaining as many options as practicable for the community. One means of doing so is to foster flexibility in all factor and product markets to allow structural adjustment to occur as smoothly as possible (relevant to quadrant IV). Given the Commission's advocacy of micro-economic reform in the past, it is not clear why this aspect is not given greater prominence. If micro-economic reform is beneficial in itself, then its promotion in the cause of adaptation to climate change would merit designation as a 'low regrets' or 'no regrets' strategy. Promoting appropriately flexible governance arrangements in areas where governments are active (e.g. greater coordination between jurisdictions, sharing emergency services resources, application of the principle of subsidiarity, etc) is also likely to be beneficial.

Government also has a role to play in collecting, analysing and disseminating information about climatic conditions. This aspect fits neatly within quadrant III, where relevant information is not readily available from market sources.

Feasibility of applying real options at the local government level

Real options can be portrayed as a purely quantitative technique for evaluating projects in a cost-benefit analysis framework where there is uncertainty about the future stream of benefits. However, they can also be conceptualised as an intuitive, everyday method of thinking. Carrying an umbrella during a walk on a cloudy day is an obvious example. Sidney Kidman[2] very successfully applied real options thinking to his cattle empire, an example of its application on a transformational, continental scale by a private individual in the face of hostile governments.

Recent work by Linquiti and Vonortas[3] compares five strategies that boundedly-rational planners or decision-makers might employ to protect coastal cities from uncertain levels, frequency, and timing of inundation by constructing a seawall. Dhaka (riverine delta) and Dar es Salaam (ocean coast) are used as case studies. Stochastic simulation modelling employing a Monte Carlo approach was used to incorporate the uncertainties involved in physical, economic and decision-making processes.

1. "Do nothing": the baseline case where no action is taken to protect either physical assets of people from inundation.
2. "100-year event strategy": the height of the seawall is determined at the start of the planning period, based on an expected 100-year storm-surge event, plus a 0.5 metre safety factor. The wall is built immediately, with no changes made (i.e. no flexibility) over the next 100 years.
3. "Decide Once & Build in Stages": if a seawall of 5 metres were considered to be optimal by minimising the present value of the costs of construction plus residual flood damage costs over

[2] http://www.publish.csiro.au/paper/RJ11045

[3] Linquiti, P & Vonortas, N 2012 (forthcoming), 'The value of flexibility in adapting to climate change: a real option analysis of investments in coastal defense', *Climate Change Economics*.

the 100 year period, one metre of wall would be added in equal increments in years 1, 21, 41, 61, and 81 in order to reach the target height.

4. "Predict and Respond": planners undertake a cost-only optimisation analysis in years 1, 21, 41, 61, and 81, rather than only once at the beginning of the 100-year period. Planners in effect can exercise a sequence of 'real options' (to raise the seawall, or not) in each of the five years based on an increasing amount of knowledge of storm surges, and only needing to predict 20 years ahead, rather than 100 years.
5. "Sense & Respond": no economic optimisation is used. Rather, planners simply observe maximum sea levels. If the maximum sea level comes within 0.5 metres of the top of the sea wall, then the wall is raised in the next year to the observed maximum sea level plus 0.5 meters. To create a minimum level of protection in year 1, planners construct a wall suitable for a 10-year event plus a 0.5 metre safety factor.

The first three strategies are inflexible because decisions are taken at the outset, with no variation thereafter. The last two strategies correspond to a real options approach because decisions are taken sequentially and flexibly over the 100 year period. Each of these five strategies is compared against a 'first best' solution that estimates benefits using the gross product of the two cities, with discounting of costs and benefits at 3 per cent and 7 per cent for sensitivity analysis.

Simulations based on available data for the two cities show that there is always value to flexibility and the ability to delay action, except in the case of Dar es Salaam using a 7 per cent discount rate, so that flexible approaches outperform deterministic ones. The case of Dar es Salaam is interpreted by Linquiti & Vonortas as a reminder that appraisal of adaptation measures must be location specific and cannot be generalised.

A key result of the simulations is that the intuitive "Sense and Respond" approach ranks well alongside the more technically demanding "Predict and Respond" method. Local governments that lack sufficient resources to undertake regular technical analyses may well find that applying the essence of the real options approach – some initial steps to provide a precautionary basis for further sequential adjustments, coupled with continuous monitoring and re-evaluation – is a cost-effective alternative. Particularly so for low-cost, low-risk areas.

Application of real options thinking can also have beneficial governance effects. In interviews with 34 companies in seven different industries, Triantis & Borison (2001)[4] found that even managers who had previously used decision analysis techniques:

> 'indicated that the real options mindset makes them think more about downstream decisions, about breaking down and measuring uncertainty, and about splitting up decisions into several stages. … Furthermore, given its financial heritage, real options helps managers focus on the metric of shareholder value – something of great significance to more and more firms.' (pp. 11-12)

Governments and their commercial agencies may also find it useful to employ a similar mode of appraisal of policies and projects in situations where there is uncertainty about key variables.

To ensure balance in its presentation of the real options approach, the Commission may wish to consider referring to the fact that real options cannot eliminate risk. They offer a means of adjusting to changing conditions by reacting to new knowledge in a quasi-Bayesian way, but it is still possible that delay in implementing measures may result in costs to the community. This is

[4] Triantis, A & Borison, A 2001, 'Real options: state of the practice', *Journal of Applied Corporate Finance*, vol. 14, no. 2, pp. 8-24.

one reason why the "Sense & Respond" scenario used by Linquiti and Vonortas (see above) includes an initial safety factor based on a 10-year event. As the Commission's draft report correctly notes (p. 75), the real options approach incorporates an element of precaution. Overall, real options offer a means of balancing cost and risk in situations of uncertainty.

In his 26 June 2012 plenary speech to the National Climate Change Adaptation Research Facility conference in Melbourne, Mr Blair Comley, Secretary of the Department of Climate Change and Energy Efficiency, stated that the Productivity Commission's emphasis on real options was unrealistic. If I understood him correctly, Mr Comley argued that 'political path dependence' meant that governments were most unlikely to move away from the status quo, even in the future. Whatever adaptive action was taken now would tend to stay in place due to social and political inertia, so the concept of flexibility could not be applied in practice.

While acknowledging Mr Comley's point about the realities of social and political inertia, there are a number of reasons why they may not necessarily play a key role in the future:

1. community attitudes are unlikely to remain the same as they are today if climate change becomes more pervasive or intense, especially once increasing numbers of individuals are affected directly. Moreover, slow-onset impacts such as sea-level rise are likely to see gradual adjustment of community attitudes, and the number of individuals affected at any one time over the course of the century would not be great, so political pressures may not be as great as conjectured. To seek to second-guess future community attitudes thus risks the countervailing 'lock-in' or path dependence of maladaptation. The criticism based on 'political path dependence' is itself based on an overly 'stationary', static view of adaptation in social thinking and attitudes.

2. a future government that is intent on taking a leadership role may push measures through, even if they are not politically palatable. For example, the head of the Australian Greenhouse Office in the mid-1990s scotched an informal proposal by the Department of Transport to trial an emissions trading scheme for private transport in a regional town on the grounds that no Minister would ever countenance a 'carbon tax'.

3. it may not be necessary for a government to make a politically unpalatable decision if there is autonomous adaptation. The example is given below of riverside property owners in Brisbane already raising their homes along the lines of the traditional 'Queenslander'.

4. the Productivity Commission's example on pages 72-73 of land-use permits being subject to future 'options' of tighter Council restrictions may not have been entirely felicitous, but it is essentially correct in the point that it makes. In fact, allowing houses in areas subject to potential inundation may have *positive* distributional effects, just like permitting houses under flight paths of aircraft. Low income households may well have a preference for low cost housing if it increases their disposable income, particularly if they are indifferent, or inured to aircraft noise. Areas subject to inundation with clearly defined property rights that permit councils to evacuate housing are likely to see construction of low cost homes with shorter design lives. And local governments already have the right to condemn housing and to force the occupants to vacate it.

Concordance between 'real options' and other approaches to adaptation.

The concept of 'real options' has not been widely applied to the issue of adaptation to climate change. It is possible that the consequential lack of familiarity with the concept is partly responsible for the initially negative reaction to it by some of those working in the area.

As well as providing more detail on the nature of real options, it may be worthwhile for the Commission to draw attention to the parallels between real options and other approaches that have been advocated for adaptation to climate change. Examples might include those presented in Figure 2 below.

Figure 2 Features common to the real options approach and other adaptation issues and methodologies.

Issue/approach	Real options approach
Uncertainty	Avoids specifying nature of uncertainty, leaving determination of next steps to the future, after better information becomes available. Allows for flexible response, but quantitative methods may make assumptions about probabilities or type of probability distribution.
Incremental adjustment	Sequential implementation of stages is based on successful implementation of preceding stage.
Adjustment through learning	Sequential implementation of project stages is based on gaining improved information about future climate and the degree of success of prior steps. Use of real options requires continuous, or at least periodic review and re-evaluation of adaptation measures. In the sense that new information is used to adjust prior behaviour or expectations, there is a parallel between the real options and Bayesian approaches to decision making.
Precautionary approach	Automatic implementation of an initial stage of a project combined with creation of opportunity to expand scope if required
Scaleability	A key feature of expansion and abandonment options. They can be used at both the project level and at the strategic policy level
Flexible approach	A key feature of real options is the inherent flexibility in implementation contingent on better information becoming available.
Scenario analysis	Consideration of various possibilities and scenarios is essential in developing real options, but there is no 'lock-in' to specific scenarios because they are reviewed periodically in the light of any new information that becomes available.
Robust Decision Making	Robust Decision Making methods include a stage where proposed adaptation measures are reviewed to include real options or other forms of hedging.
Risk management	Real options are designed to incorporate features that reduce or eliminate downside risk.
Institutional issues	Institutional governance is a key requirement for the application of real options to adaptation because of the need to institute reliable mechanisms for periodic reviews and timely implementation of adaptation measures

Without wishing to overstate the case, Figures 1 and 2 could provide the basis for developing an over-arching conceptual approach to adaptation.

Local government purchases at market prices of threatened coastal property

Sections of the draft report (e.g. pp. 164-167) could be misinterpreted as giving tacit support to the current practice by a number of local government organisations of either voluntary purchase of property at risk of inundation, or its compulsory acquisition with payment of compensation. (Wollongong and Waringah are two examples that could be added to the Redlands and Port Macquarie-Hastings situations referred to in the draft report.) It is not clear why state governments and local Councils have chosen to take the most expensive, least rational path to addressing the problem of coastal and riverine inundation.

The Commission may wish to consider the alternative of a mortgage-contingent loans scheme, analogous to the Higher Education Contribution Scheme, to assist property owners who are not able to access commercial housing loans. An outline of the alternative approach is available at http://ccep.anu.edu.au/data/2011/pdf/wpapers/CCEP1113Dobes.pdf. Subsequent modelling, to be presented at the Australian Conference of Economists in Melbourne in July, indicates that, depending on growth rates in property values, a contingent loans scheme would be financially more attractive to governments than either the provision of rental assistance to those made homeless or the purchase at market prices of threatened properties.

'Climate proofing' versus retrofitting

A commonly repeated statement that appeared on a Department of Climate Change website some years ago (http://www.greenhouse.gov.au/impacts/howtoadapt/
indexs.html ; viewed 6 July 2008 but apparently now inactive) is the following:

> 'It has been argued that the high uncertainties inherent in projections of both climate change and economic conditions preclude formulation of a cost-effective adaptation strategy. However, most analysts conclude that delayed action will be much more costly than anticipatory action. Investment in climate-proofing of new infrastructure and housing, for example, is much cheaper than retrofitting or rebuilding later.'
> <http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Browse_by_Topic/ClimateChange/responses/adaptation> viewed 19 June 2012.

It would be useful to identify any available evidence in support of this statement. The contention may or may not be true, but it is difficult to believe that it can be made as a general proposition that is valid in all locations for all types of adaptation measures, or even just for most buildings. If there is no readily-available evidence for the claim, then it may be appropriate for the Commission to recommend that more detailed analysis be carried out for different adaptation measures in order to provide more evidence-based guidance to both governments and individuals.

Consultants and government officials are prone to accepting the apparent wisdom of needing to make a special case for long-lived infrastructure by 'climate-proofing' it at the time of construction. Even in such cases, however, a purely deterministic, inflexible approach may not be ideal. If there is a concern about higher temperatures, for example, bridges can be designed to take additional expansion joints, or options can be arranged to purchase land around airports if runway lengthening is required in the future[5].

Where over-flooding of low bridges is expected, it is also possible to apply real options principles. The Tagus River bridge in Lisbon[6] provides an example. Built in 1966, it was designed to permit

[5] Further examples are provided in Dobes, L 2008, 'Getting real about adapting to climate change: using "real options" to address the uncertainties', *Agenda*, 15(3): 5-69.
[6] Gesner, GA & Jardim, J 1998, 'Bridge within a bridge', *Civil Engineering*, 68: 44-47.

the future addition of a railway deck if warranted by population growth, an option that was reportedly exercised some three decades later without disruption to automobile traffic on the deck below. A climate-relevant example today might be to incorporate in the design of a bridge stronger abutments or foundations that would permit the future addition of a higher deck if flooding events increased substantially.

Alternatively, a mechanical device might be incorporated within the bridge to allow incremental raising of the deck in the future. Such an option is simply the obverse of modern submersible bridges that can be lowered to allow the passage of ships, for example in the Corinth canal[7].

In the final analysis, it is potentially possible to identify real options for all infrastructure projects. The essential ingredients are creative 'out of the box' thinking combined with technical expertise. However, their viability from a social cost-benefit perspective always needs to be tested as well.

Historical experience and commissioned research

Presentations at conferences sometimes refer to Australia's experience with significant climatic variability, with the implication that our experience and knowledge will stand us in good stead in the future. Yet there seems to be a dearth of rigorously researched material available to throw light on adaptation to the vicissitudes of the weather in days gone by. For example, how effective were houses on stilts in areas subject to cyclonic wind and flooding in avoiding damage? How effective were pitched roofs in dissipating heat? Did the elderly manage to reduce heat stress using wet strips of material in doorways (the Coolgardie principle) or other long-forgotten means? The Commission may wish to consider recommending a broader approach to research than that currently being commissioned by governments.

It is instructive that, as at June 2012:

> 'Brisbane City Council statistics show 144 homes in flood-affected suburbs have been either lifted [127] or are under assessment to be raised [17] since [the] January 2011 [floods]. … Archicentre Queensland general manager Ian Agnew said there was renewed genuine interest from flood-affected Brisbane residents in the advantages of the high-set Queenslander. (*Brisbane Times*, 9 June 2012

This development underlines the desirability of researching general historical adaptation measures to harsh climatic conditions. It is possible that now-forgotten practices can be re-introduced to facilitate adjustment to future conditions.

A related issue is that of better inter-disciplinary integration of commissioned research. Pure scientific research into the effects of climate change should not be stymied or constrained. However, there is some risk that current funding arrangements may be less than optimal from a policy perspective. For example, the then Department of Climate Change issued a report in 2009[8] that stated (p. 7) that:

> 'Up to $63 billion (replacement value) of existing residential buildings are potentially at risk of inundation from a 1.1 metre sea-level rise, with a lower and upper estimate of risk identified for between 157,000 and 247,600 individual buildings.'

[7] http://en.wikipedia.org/wiki/Submersible_bridge <viewed 21 June 2012>
[8] *Climate change risks to Australia's coast*, http://www.climatechange.gov.au/~/media/publications/coastline/cc-risks-full-report.pdf viewed 20 June 2012.

The prediction appears to be based on scientific modelling commissioned by the Department. To make use of it for marginal economic analysis of costs and benefits over the course of the century, it would have been particularly useful to have estimates of the number of buildings likely to be affected in each of the years (or decades or some other incremental amount) between 2009 and 2100. That no such estimates appear to be available underlines the point that better coordination of interdisciplinary needs by government agencies commissioning research would not only be more cost-effective, but would also facilitate the provision of more rigorous policy advice.

Evaluating adaptation projects

Common practice in research commissioned by the National Climate Change Adaptation Research Facility and by consultants engaged by governments is to estimate benefits of adaptation measures in terms of 'damage avoided'. While use of this proxy measure is understandable in some situations, there is a risk of it becoming standard practice despite the conceptually preferable measure of willingness to pay. The problem is apparent in Box 4.4 which has a heading related to "cost-benefit analysis" but cites Fankhauser, who uses a 'damage avoided' approach that is more accurately categorised as a cost-effectiveness methodology.

Estimates of adaptation costs that are based on the 'damages avoided' approach in sectors such as agriculture, where outputs are at the private end of the public-private spectrum, can be particularly misleading because farmers will tend to adjust in their own self-interest. The 'damage cost' approach typically estimates the value of crop output forgone due to adverse climatic conditions. But farmers are likely to adjust, even in the short run, by switching to different crops or by substituting capital for inputs like water (e.g. using drip irrigation)[9], so that the 'damage cost' approach leads to an over-estimate of actual costs attributable to climate change. In studies of inundation or cyclonic events, 'damage costs' are generally only financial costs and thus exclude any willingness to pay to avoid inconvenience, loss of personal mementoes, etc, thus underestimating benefits.

The Commission may wish to consider in its final report the desirability of drawing attention to the current situation, and to the desirability of governments commissioning stated or revealed preference studies to obtain better estimates of the benefits of adaptation measures. Jointly commissioned or shared databases of such estimates could be used as 'plug-in values' by analysts, saving resources and making available better data to inform decision-makers. Commissioned surveys that simultaneously cover different geographic regions across Australia, as well as a variety of socio-economic conditions, would facilitate 'benefit transfer' in estimating benefits in different locations.

A further rationale for commissioning studies of willingness to pay for adaptation measures is to gauge the preferences of the community. If the choice of adaptation measures subject to analysis is left to government officials, a highly selective set of projects may be implemented that does not match that of individual residents in the area. Government agencies themselves could gain from willingness to pay studies in seeking additional budget funding, or by reallocating their use of existing resources.

It would be appropriate to sound a note of caution about the implementation of adaptation measures, even if they indicate favourable Net Present Value levels. A silo mentality, where adaptation measures are analysed in isolation from other social preferences, may well result in a lower level of well-being for the community as a whole. A similar point can be made in terms of

[9] International trade is an important price-based adaptation mechanism in such cases, emphasising the need for undistorted product and factor markets to facilitate efficient structural adjustment. See Mendelsohn, R 2006, 'The role of markets and governments in helping society adapt to a changing climate', *Climatic Change*, 78: 203-215.

alternatives analysed. A deterministic approach (apparently based on a Multi-criteria Analysis but classified Cabinet in Confidence) to Melbourne's water supply during recent drought years resulted in extraction of rural water from the Goulburn river and construction of a desalination plant. However, simulations by Leroux and Crase (2010)[10] suggest that the sale and purchase of water options might be a viable, market-based alternative strategy that also has the potential to reduce social conflict over water between town and country users.

An issue that is important to future evaluation practices but has not gained significant prominence to date is that of discount rates. There is a risk that government agencies will adopt by default some of the arguments advanced in the case of mitigation of climate change, whether or not they are appropriate for appraisal of adaptation measures.

Finally, the recommendations on p. 79 of the draft report are not entirely clear. The first dot point seems to refer to "reform" of barriers to adaptation, but the second dot point refers to "measures" although the two points appear to be intended as contrasts in terms of relative costs and benefits. Some clarification may be warranted here.

Thank you for the opportunity to comment. I am happy to discuss any relevant issues with the Commission.

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[10] 'Advancing Water Trade: A Preliminary Investigation of Urban-Irrigation Options Contracts in the Ovens Basin, Victoria, Australia', *Economic Papers*, 29(3): 251-266. http://onlinelibrary.wiley.com/doi/10.1111/j.1759-3441.2010.00070.x/abstract