Address to the 2015 Industrial Ecology Conference, Sydney

Andrew Cadogan-Cowper

11 June 2015

Gathering evidence to address environmental-economic policy problems

Abstract: Environmental-economic policy problems owe much of their complexity to the fact that they cut heavily across multiple disciplines. Assessments that need to evaluate economic, environmental and social factors still lack a broadly accepted common metric, and 'solutions' often give rise to their own set of problems.

Policy-makers, advisors and researchers who endeavour to solve such problems, or at least understand them more fully, inevitably need to be broad thinking and capable of working across traditional boundaries. Where possible, they also need data that spans those boundaries.

The work of the ABS can be broadly divided into three pillars: the economy, society and the environment. For a long time the ABS has recognised that in order to arm decision makers with the most useful data available to confront complex policy choices, as much as possible those statistical pillars should be integrated.

The advent of international statistical standards linking environmental and economic information has been of great value to the ABS, and now, the Industrial Ecology Virtual Laboratory (IELab). The IELab has tremendous potential to quantify certain inter-linkages between the environment and economy that until now have eluded measurement.

Before I begin I'd like to thank the organisers for inviting me to make this address.

In considering what I would talk about today, I thought about the work of the Industrial Ecology Virtual Laboratory – the IELab; how it connects with the work of the Australian Bureau of Statistics (ABS); and why it could be useful for policy makers.

So in my remarks today I'll cover those three points of interest, but in the opposite order. Specifically, I'll start by discussing what I believe to be some common features of complex environmental-economic policy problems; secondly I'll cover the efforts of the ABS - and for that matter many other National Statistical Organisations (NSOs) - to provide a corresponding and suitable information base; and, finally, I'll explore the information space – or gap - which I think an initiative like the IELab can fill.

Features of complex environmental-economic problems

I am not a policy-maker, but I know complex policy problems rarely have simple answers. The problems typically cut across multiple dimensions, numerous organisations, involve a range of causal factors, and challenge or defy measurement capability. 'Least-bad' solutions are often required; so-named as they may present almost as many problems as they solve.

The policy problems I'm talking about today cut across environmental and socio-economic dimensions. Issues of sustainability and complex trade-offs. Some examples that immediately come to mind in the Australian context include management of the Murray Darling Basin, slated developments in the Great Barrier Reef region and Northern Australia; and of course, climate change.

The solutions usually have problems

Now as I've just mentioned, most policy problems are complicated because the solutions lead to other problems. Take for instance development proposals for Northern Australia and the Great Barrier Reef region. These proposals have the potential to boost economic activity and create jobs, which in turn have the capacity to materially enhance people's living standards. The trade-off to be considered - as is so often the case - is the loss (or potential loss) of environmental assets and ecosystem services.

As Asian economies rise, boosting agricultural development in Northern Australia to cater for the resultant 'dining boom' will place new pressures on the environment. Creating the so-called 'Asian food bowl' is expected to require large scale land clearing and the construction of many dams.[1] The difficult recent experience of balancing environmental, social and economic considerations in 'Australia's food bowl' – the Murray Darling Basin – highlights some of the many issues that would likely come to the fore if further large scale agricultural development proceeds in Northern Australia.

---

[1]http://www.csiro.au/en/Research/Environment/Land-management/Science-Review-2009

The nexus between water, energy and climate is another interesting example. As the driest inhabited continent on earth, water security is a serious concern for Australia. In an effort to address this, desalination plants have been built in a number of states around the country. But desalination comes at a significant energy cost – around 3 kWh per 1000 litres of water (depending on distribution requirements)[2]. And energy creation, in Australia, largely comes from fossil fuel consumption, which in turn contributes to the problem of global warming.[3]

To complete the circle of interlinkages, energy creation also demands significant amounts of water – in fact the International Energy Agency estimates 15% of all global water withdrawal is for energy production. For thermal coal power plants, water is the most effective medium for removing waste heat;[4] and the same is true for concentrated solar thermal[5]. For a sunburnt country like Australia, the appeal of concentrated solar thermal is therefore tempered somewhat when many suitable sites are in remote locations with low water availability; also resulting in significant energy transmission losses associated with bringing the power to market in distant places.

Improved environmental standards in developed countries is also an interesting, albeit more global example. This can result in a shift of environmentally degrading production processes to less developed countries because they often have less stringent environmental regulations. This results in new job prospects for individuals in those countries. The problem created by, for instance - a domestic factory spewing chemical waste into a waterway - may be solved, but the solution creates an unintended environmental problem elsewhere when the factory moves its processes offshore. There may also be socio-economic costs to consider as domestic factory workers need to seek new employment.

So the first, rather obvious observation I'm making is that that the solutions to complex environmental-economic problems are rarely without trade-offs. There are very few 'free lunches'.

The lack of a common and decisive metric

A central feature of environmental-economic issues is that our understanding of the environment and its processes is generally measured in non-monetary units – for instance: tonnes; litres; kilowatts; etc., while our understanding of economic activity is primarily measured in monetary units. Trying to understand the interaction between the two – perhaps in an attempt to maximise overall utility – is hampered by the lack of a common metric.

---

[2] http://www.abc.net.au/science/expert/realexpert/desalination/02.htm

[3] Although it can be noted that many desalination plants invest in or purchase their energy from renewable power projects.

[4] http://www.worldenergyoutlook.org/resources/water-energynexus/

[5] http://www.circleofblue.org/waternews/wp-content/uploads/2010/08/Solar-Water-Use-Issues-in-Southwest.pdf

Well, finding a common unit of measure – namely dollars – is, at least initially, an appealing way to negotiate this issue. The narrative is simple; the best choice of action is the one that maximises value (or utility), expressed in dollars. The reality is of course far more difficult.

In an attempt to ascribe economic value to something, economists will usually look for behavioural trails, and these are often known as 'revealed preferences'. The most obvious type of revealed preferences are market transactions. Preferences can also be revealed by examining production costs, travel costs and hedonic pricing - but these should not be confused with market prices.

When the behavioural trail becomes faint or invisible, economists have no choice but to move to 'stated preference' methods. The lack of a behavioural trail means we are now examining respondent's 'non-use' values. These include existence values (e.g. the value placed on the existence of other species) and bequest values (e.g. passing on functional ecosystems to future generations). It is well acknowledged that *Total Economic Value (TEV)* incorporates both use and non-use values.

The most common stated preference techniques are the 'contingent valuation method' (CVM) - which involves a survey directly asking respondents to state their maximum willingness-to-pay to avoid a change, or willingness-to-accept compensation for a change; and 'choice modelling' (CM) – where respondents are asked to make a choice among a series of scenarios without directly being asked for valuation in dollars. Valuation can then be inferred from the choices or trade-offs that people choose to make.

The capacity of stated preference techniques to measure non-use values accurately is fiercely debated. The technique was famously examined during a court case for damages that followed the Exxon Valdez oil spill in Prince William Sound, Alaska, on March 24, 1989.

A panel report by the United States National Oceanic and Atmospheric Administration on contingent valuation[6] was tabled in court to provide recommendations on the suitability of that method to provide reliable information on lost existence or passive use values as a result of the spill.

The report raised a range of issues with the method, including: the absence of budget constraints; impacts of different payment methods (e.g. a tax vs. a donation); lack of respondent knowledge about what they were being asked to value; irrational or implausible responses; and the indeterminable extent of the market. I'd briefly like to discuss several of these.

With regard to the extent of the market, the panel considered the population of people that should be in scope when determining the total damages payable. This was

[6] Arrow et al. (1993)

considerably more straightforward for some ‘use’ values, e.g. losses suffered by commercial fishermen, than for ‘non-use’ values. For non-use values, should the relevant affected population be all those who live in the affected state i.e. Alaska; or perhaps all those who live in Canada and the entire United States; or further still perhaps all individuals of the world; or even further again, individuals alive today, as well as those not yet born? These are fundamental questions that could not be resolved.

Turning its attention to a stated preference literature that is thick with examples of irrational responses, the panel noted that willingness to pay often does not increase with the good being valued. This phenomenon is labelled ‘scope neglect’. In a famous study by Desvousges et al.,[7] participants indicated their willingness to pay to prevent the drowning of migratory birds. The estimated amounts that households were willing to pay were $80, $78 and $88, to save 2,000, 20,000 and 200,000 birds respectively.

This is clearly an absurd result. Nobel laureate Daniel Kahneman (2002) and others have examined this phenomenon and posit that the mind doesn’t deal well with envisioning the scope differences due to a ‘cheating’ of sorts, where the mind substitutes the difficult proposition for a more accessible mental image instead.

Another key issue with the technique is that respondents give vastly different answers depending on their knowledge of the issue. The report raised the prospect of a willingness to pay study to prevent a chemical leak into a river – and the need for the response to consider important questions such as how long the chemical would take to naturally degrade in the river, if at all; the ecological damage; the damage to human health, etc.

While most studies provide briefing material to assist respondents to understand the issues they are considering and what exactly they are being asked to value, the capacity or desire of all respondents to understand complex information is variable. This raises the prospect that perhaps valuation should be conducted by experts rather than the general population – a proposition that would itself raise further issues.

These fundamental problems have made attempts to monetise the full economic value - i.e. use and non-use values - of environmental resources highly controversial and heavily disputed. While some people advocate that any number is better than no number, because no number can be – and often is – interpreted as no value; I am not entirely persuaded by that argument.

I think it is powerful to use these methods to illustrate that broader values exist, but I believe – for the reasons outlined above - that policy makers should be very careful not to rely too heavily on the results. The ABS has avoided entering into this debate and limits its valuation of environmental resources to those that are used in the market, and therefore market prices.

[7] Desvousges et al. (1993)

So where does this leave the policy-maker? Well, in their report on measuring progress, Stiglitz, Sen and Fitoussi advocate that policy-makers use a dashboard of indicators.[8] They point out that creating a single metric in some circumstances would not even be interpretable; and use the example of the fuel gauge and speedometer on the dashboard of a car. Each measure is crucial in its own right, but if instead you were to combine the two into one indicator, what use would that be?

The ABS and its data holdings

The ABS adopts the dashboard approach in Measures of Australia's Progress[9], which was first produced in 2002. MAP is created at a very aggregate – 'awareness-raising' level, and this is very important for the general population, and to inform a conversation about where we are, and where we want to be.

In the evaluation of specific policy proposals however, it's obvious that finer scale data will be needed. Fortunately, in an integrated information system such as that used by the ABS, you have the flexibility to work at different scales. This type of information system can be visualised using the analogy of a pyramid.

At the base of the pyramid you have *'base data'*, collected by surveys and gathered from regulators. In the middle of the pyramid you have *'accounts'*, where the base data has been systematically organised for use by analysts and researchers. And, flowing from the accounts, at the point of the pyramid you have *'indicators'* – most commonly used by decision-makers and for communication with the wider public.

So if we take GDP for instance, it is simply an aggregate indicator that emerges from the System of National Accounts (SNA); that is itself compiled from raw economic data reported by industry, households and regulatory bodies. While GDP is extensively used as an indicator of economic activity, it is only one high level piece of information that emerges from the accounts; sophisticated analysts and researchers look well beyond GDP to understand the economy.

Alternatively we could consider an indicator such as Australia's total distributed water use. The ABS compiles this under the System of Environmental-Economic Accounts (SEEA); which of course draws on base data collected from industry, households and regulatory bodies.

The strength of this consistent approach to information is that you can see how data aggregates up to an indicator, as well as drill down beneath an indicator to see the supporting accounts and base data. In fact, when you have integrated standards like the SNA and SEEA governing the arrangement of the base data into accounts, researchers and policy-makers have the flexibility to create their own indicators of interest, whilst

[8] Stiglitz, J, Sen, A, and Fitoussi, J, 2009, Report by the Commission on the Measurement of Economic Performance and Social Progress, www.stiglitz-sen-fitoussi.fr.
[9] ABS Catalogue. No. 1370.0

knowing that the underlying concepts, classifications, definitions, etc., are consistent and comparable.

The SNA and SEEA

For many years now, ABS economic statistics have been united through a common framework; the SNA. The SNA is an internationally agreed standard on how to compile economic activity in accordance with strict accounting conventions and based on economic principles.

The initial motivation for the SNA was the need for accurate measures of macroeconomic activity; and it was first released under the auspices of the United Nations (UN) in 1953. Later updates to the SNA were released in 1968, 1993, and 2008. Along with the development of related standards such as the Balance of Payments Manual, the SNA became the conceptual framework for the ABS economic statistics pillar.

SEEA, on the other hand, is a much more recent development. As a result of ongoing discussion on the topic of measuring and assessing the concept of sustainable development, the UN released the first *Handbook of National Accounting: Integrated Environmental and Economic Accounting* - later known as the SEEA - in 1993.

Further work on that handbook continued with the goal of elevating it to the status of an international statistical standard. In 2012, that goal was realised with the release of the SEEA central framework. Like the SNA, the SEEA does not propose any single headline indicator. Rather it is a multi-purpose system that generates a wide range of statistics and indicators with many different potential analytical applications.

Both the SNA and SEEA use the supply-use table (SUT) framework in their accounts. In the SNA it is in monetary terms, in the SEEA it is in physical and monetary terms. Because both systems align their concepts – e.g. production and ownership; and classifications – e.g. industries and products; data from one system is easily related to another. Before I move to discussing some of the applications however, I'd like to say a bit about how the economic data, in particular, is created.

Creating SUTs and IOTs

Economic SUTs are a framework for recording the supply and use of products in an economy, and observing the structure of interrelationships between industries. An SUT also provides a balanced estimate of GDP. GDP is conceptually the same whether it is measured by the income, expenditure or production method; but in practice, due to variable data quality, they will not be equal until SUT balancing has been completed.

Compilation of the SUT begins with the receipt of data from our annual economic activity survey (EAS). This data is combined with an extensive range of other data sources that become available at various intervals – such as trade, household expenditure, and government finance – to produce a SUT. ABS SUTs are balanced at the level of 67 industries and 301 products, and are used as benchmarks for quarterly and annual estimates of economic activity.

SUTs are also further disaggregated to a 115 industry by 1296 product asymmetric input-output table (IOT), and a symmetric 115 by 115 IOT. Unlike the SUTs, the IOTs are published. Therefore IOTs are used extensively in both economic, and more recently, environmental-economic modelling. As such, they are the foundational data for the IELab.

With the release of the 2012-13 IOTs in 2015, the ABS will have published 26 IOTs for Australia. Previous ABS tables range back to 1958–59; but before the ABS adopted this field of work, Cameron had published 3 sets of Australian IOTs, for reference years 1946-47, 1953-54 and 1955-56.[10]

As the official statistical office for Australia, the ABS is bound to certain principles of '*official statistics'* as defined by the United Nations (UN). These principles ensure that the ABS manages risk very carefully, and it should. This ensures high trust in the community.

Compiling and publishing IOTs as official statistics is not without risk. Inevitably, there are many data gaps, and judgements are needed. For the ABS, the compilation challenges are, broadly:

1. Stretching *industry* survey data across *products* in the supply matrix.
2. Stretching *industry* survey data across *products* in the intermediate use matrix.
3. Aggregate balancing decisions.
4. The fixed sales structure assumption used to create the II SIOT.

Overcoming these challenges requires a significant number of assumptions and imputations. While the need to fill data gaps is not ideal, that is also the stark reality of producing statistics. It's easily forgotten that ABS statistics are still only estimates.

The key question then, is how good does an estimate need to be to be worthy of publication? And that answer depends on how the estimate will be used – in particular, we must ask 'is the estimate fit for purpose'?

In the case of IOTs the ABS is aware of many highly credible and important uses where the estimates are fit for purpose. We will no doubt see examples of this over the course of this conference. In other cases however, the estimates are either not fit for purpose, or are used to construct multipliers which are then misapplied.

The frequent misuse of I-O multipliers to bolster claims for industry assistance in particular, has been deeply concerning to the ABS and many of its users. In 2001, the

[10] See Cameron (1957), (1958) and (1960).

ABS ceased publishing I-O multipliers, and also began to include commentary explicitly highlighting their inherent shortcomings within its Concepts, Sources and Methods (CSM) publication (ABS 2013).

I won't say any more on that as it is a topic worthy of its own focused discussion, except that I would refer anyone who is interested to a paper titled *'On input-output tables: uses and abuses* by Paul Gretton of the Productivity Commission for further reading.

How can this data be put to work?

As I mentioned earlier, the IOTs have been used extensively in economic modelling for a long time. They were central to models used for evaluating the impacts of the introduction of the Goods and Services Tax (GST) in 2000; the multitude of microeconomic reforms undertaken as part of the National Competition Policy (NCP) and the COAG National Reform Agendas; and very recently, the review of automotive industry assistance in Australia.

ABS economic data captured in IOTs has been combined with environmental data to produce a range of environmental accounts on a SEEA basis since the 1990's. These include water, energy, greenhouse gas (GHG) emissions, waste, and land accounts.

All of these accounts link economic activity with environmental impacts, and therefore help to inform policy-makers looking at environmental-economic policy problems. The water accounts for instance were used in the preparation of the Murray Darling Basin plan; while the land accounts for the Great Barrier Reef region have helped inform on the relationship between fertiliser runoffs into the marine park and nearby agricultural activity.

Estimates of the 'coupling' between economic activity and the environment are a key piece of information. For instance the accounts allow us to look at the relationship between individual industries and their resource requirements like water, energy and emissions. We can look for evidence of 'decoupling' in either the absolute form – whereby resource use actually declines while economic activity grows – or in its relative form – whereby resource use increases but at a lesser rate than economic activity. Furthermore, and essentially, because these estimates are compiled under the standards I referred to earlier, they exist as a time-series; so the impact of policy interventions or otherwise varied circumstances can be traced.

Looking at resource use by industry gives us a 'production' perspective. Another valid and important analysis is known as the 'consumption' perspective – and this is a real feature of combining data to form environmental-economic IOTs. With respect to GHG emissions the *production approach* measures emissions that are physically produced by industries and households within an economic territory. The *consumption approach* assigns the territorial emissions to categories of final consumption, adds emissions embodied in imports, and subtracts emissions embodied in exports. In aggregate the difference between the two approaches will therefore equal the net trade balance of emissions. We can then go on to examine the emissions induced by different categories of final demand – for instance the emissions induced by household demand for manufactured food products.

When looking at country-level comparisons, the consumption and production approaches can generate significantly different results, and therefore represent a significant area of debate within international negotiations on climate change. Major developing economies that undertake emissions intensive production - for instance China - herald the consumption-based approach as a better gauge of responsibilities for current emissions.

Notably, in the UK a 2012 parliamentary report revealed that despite the UK's production-based emissions falling, the UK's consumption-based emissions had been increasing.[11] It went on to suggest that the off-shoring of emissions-intensive manufacturing activities, coupled with increasing consumption were principal factors - a phenomenon mirrored in many high income countries.

In my mind, neither a production nor consumption based view on its own tells the complete story - inferring responsibility for emissions singularly on the basis of either method would be a mistake. Instead, both perspectives are valuable. While consumers often have some choice in their consumption decisions, at times they may lack the necessary constituency to alter producer decisions. Producers may have control over their production methods, but where incentives to move to less environmentally harmful practices do not exist, may be slow to change. As a result, it is well acknowledged that Governments must play a central role in managing these types of issues.

These are just some examples of how integrated environmental economic information is assisting policy-makers to be more informed. So how can the IELab add further value?

The information gap and the Industrial Ecology Virtual Laboratory

Well, I believe the IELab can add value in several ways; firstly, by improving the spatial resolution of the data. For policy-makers, one of the key dimensions missing from the ABS data is a regional disaggregation. Numerous groups and researchers have therefore applied their own methods to achieve the desired spatial resolution. One common technique is to apply regional economic indicators and survey information to national estimates.

[11] http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenergy/1646/1646.pdf

The attraction of regional IOTs is undeniable – real-world policy and investment decisions are made at varying geographical scales; and so for many purposes a national IOT is a relatively blunt instrument. However, in 2002 there was an historical shift that reduced the ABS capacity to produce regional IOTs. Prior to 2002, the ABS economic unit model was based on a production unit known as an 'establishment'. Establishments were location-based units. The business register from which survey frames were taken was maintained by the ABS, using ABS data to update the information relating to businesses, and information from the Australian Taxation Office (ATO) to identify new and deceased businesses.

With the introduction of a new tax system in Australia in 2000, the ATO created a whole-of-government register of businesses, the Australian Business Register (ABR). When the ABS adopted the ABR and coupled it with an ABS maintained component, the statistical units model changed to align better with taxation reporting requirements. As a result, the production unit became a 'type of activity unit' (TAU), defined according to an activity concept, in contrast to the former location based 'establishment' model.

Although many TAUs will still be performing activity within a single I-O industry and at a single location, for regional IOTs, the loss of a geographic dimension in the statistical unit has been unhelpful. More recently the ATO has begun to collect and compile location based information for its business register. The ABS is investigating the potential for this to aid in the development of regional IOTs.

The second way in which I see the IELab improving the information landscape is through harnessing expertise in environmentally extended input-output table construction and analysis. This type of work is not viewed as core ABS statistical territory – primarily for reasons of expertise and cost.

By providing a single, flexible platform for all industrial ecology researchers - much like the ABS coordinates statistical effort amongst Australian Government - the IELab significantly reduces the potential for duplication and wasted effort. Specifically, by using a 'root-base-branch' approach, the IELab allows researchers to tailor the multi-regional input-output (MRIO) table construction to address their own particular research needs. This means that rather than numerous institutions building duplicate research infrastructure - with the attendant costs - instead, a single core research infrastructure can be used by all.

Finally, I think the IELab adds value by engaging with risk on a different level to what we can at the ABS. The ABS necessarily occupies a different place in the information landscape than the researchers and university groups represented here today.

Official statistics work only with the most well established and accepted concepts. They are heavily governed by standards and practices. Accordingly, the ABS – like other NSOs

– can't, and shouldn't, engage with risk in the same way as research groups. That means we will generally be more conservative in what we will venture to measure. We have a different contract with the general public.

By contrast, research work is inherently a frontier, exploratory field. Therefore you will be at the cutting edge - often required to define your own concepts, and measurement will have to make do with the 'best available' data, coupled with the most reasonable assumptions you can muster to fill the gaps. Where official statistics will generally occupy a 'safe' space, I think for researchers there has to be more room to move; more flexibility.

I think for complex problems like the ones we've been talking about, our combined endeavours are essential. As I see it, our job at the ABS is to support your work with the best information we can gather. And in that respect, the integration of environmental and economic statistics is a particularly big step forward for your work, as the problem of misaligned data should have reduced.

Concluding remarks

In my remarks today I've addressed three broad points. The first explored some common features of policy problems that span economic and environmental dimensions. The second examined some of the data holdings that the ABS has compiled to assist analysis of these multi-dimensional policy problems. And finally, the third was the information space I think the IELab can fill.

The IELab has tremendous potential to quantify inter-linkages between the environment and economy that until now have eluded measurement. In other words, the IELab can add crucial information to the dashboard of indicators that policy-makers will use to navigate complex environmental economic policy problems.

As we will soon hear, there are many practitioners around Australia now using the IELab, and the success of the concept is recognised in efforts to create a Global IELab. I look forward to learning much more about the novel applications of this infrastructure over the course of the next two days.

Thank you.

References

ABS (2013), *Australian System of National Accounts: Concepts, Sources and Methods Australia*. Cat. No. 5216.0, ABS, Canberra

ABS (2012), Hao, S., Legoff, G., Mahadeva, K., Chia, N. and Cadogan-Cowper, A. *Australian Greenhouse Gas Emissions: Experimental Consumption-Based Estimates Via Input-Output Analysis*, 20th International Input-Output Association conference (IIOA) 2012, Bratislava, 24-29 June 2012.

ABS (1995), *Information Paper: Australian National Accounts: Introduction to Input-Output Multipliers, 1989-90,* Cat. No. 5246.0, ABS, Canberra

Arrow et al. (1993) *Report of the NOAA Panel on Contingent Valuation,* January 11, 1993

Australian Public Service Commission (2007), *Tackling Wicked Problems: A Public Policy Perspective*, Canberra.

Baker, R. and Ruting, B. 2014, *Environmental Policy Analysis: A Guide to Non-Market Valuation*, Productivity Commission Staff Working Paper, Canberra.

Cameron, B (1957), '*The 1946-47 transactions table'*, Economic Record, vol. 33, pp. 353-60.

Cameron, B (1958), '*New aspects of Australia's industry structure'*, Economic Record, vol. 34, pp. 362-74.

Cameron, B (1960), 'Inter-sector accounts 1955-56', Economic Record, vol. 36, pp. 269-71.

Denniss, R (2012), *The use and abuse of economic modelling in Australia,* The Australia Institute

Desvousges et al. (1993). Measuring natural resource damages with contingent valuation: Tests of validity and reliability. In J. A. Hausman (Ed.), *Contingent valuation: A critical assessment* (pp. 91–159). Amsterdam: North Holland.

Henry, K. (2007), *Treasury's effectiveness in the current environment*, Address to staff at the Hyatt Canberra, 14 March 2007.

Henry, K. (2014), *Public Policy Resilience and the Reform Narrative*, Address to the Crawford School of Public Policy, 16 September 2014.

Kahneman, D. (2002), '*Maps of bounded rationality: A perspective on intuitive judgement and choice'*, Nobel Prize Lecture, December 8, 2002

Mogas et. Al. (2002), *A Comparison of Contingent Valuation and Choice Modelling: estimating the environmental values of Catalonian Forests,* Australian National University, Canberra, December 2002.

PC (2013), Gretton, P, *On input-output tables: uses and abuses*, Productivity Commission Staff Research Note, September 2013.

United Nations (2014), *Fundamental Principles of Official Statistics,* Available at: http://unstats.un.org/unsd/dnss/gp/FP-New-E.pdf (accessed 27-03-15).