

○ MAXIMISING PUBLIC BENEFITS DERIVED FROM USE OF THE SPECTRUM

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This paper comments on the role of the market and the role of the regulator and regulatory tests such as a total welfare standard in promoting an efficient allocation of spectrum. It summarises key elements of Australia's spectrum management regime, outlines why a total welfare standard is the appropriate test when assessing regulatory options in the context of spectrum management, and comments on when this sort of cost-benefit analysis is likely to be useful.

INTRODUCTION

The object of Australia's *Radiocommunications Act 1992* (the Radiocommunications Act) states, amongst other things, that spectrum should be managed to 'maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum' (Radiocommunications Act 1992, s3(a)).

This paper comments on the role of the market and the role of the regulator and regulatory tests such as a total welfare standard¹ in promoting an efficient allocation of spectrum that will maximise the benefits derived from that resource. It outlines:

- core elements of Australia's spectrum management regime by way of background;
- why a total welfare standard is the appropriate test in relation to spectrum management;
- the sort of analysis likely to be involved in evaluating the impact of alternative regulatory approaches on total welfare; and
- when this sort of cost-benefit analysis is likely to be useful.

BACKGROUND

Since radiocommunications services began around the beginning of the early 20th century, governments and operators have determined that the frequencies used by wireless services need to be regulated to prevent interference and thereby maximise benefits from new technologies.

Technical regulations to control interference were seen as the key to making spectrum more usable. Interference control was based on grouping like services into bands and assigning different channels to different users. Transmitters and receivers relied on frequency separation and guard bands to operate effectively and reduce the risk of excessive interference.

In recent decades, wireless technologies have used the ever-increasing speed and capability of microprocessors to provide a range of new and advanced services. Technology has also extended the useable spectrum into higher frequency bands and made more efficient use of the spectrum through greater tuning abilities, more precise rejection of unwanted signals, better noise suppression, greater antenna directionality and enhanced signal compression.

Despite the increases in spectral efficiency enabled by technological change, demand for spectrum for commercial applications has increased significantly and is expected to continue to increase in the years ahead. The increase in spectrum demanded for commercial applications has been accompanied by greater demands for spectrum for radio astronomy, weather and climate

information services, satellite and space services. Similarly, the communications requirements of defence, security services, police and emergency services are increasing, leading to calls for greater bandwidth and increased access to spectrum.

This has led to demand exceeding the supply of spectrum in some frequency bands and geographic areas. Technology developments may enable greater sharing of spectrum but it is far from clear that these developments will alleviate congestion of parts of the spectrum in the foreseeable future.²

Increasing the supply of spectrum that can be used by applications in highest demand is complicated by the slow but useful process of harmonising spectrum allocations internationally, and at times, by the presence of legacy technologies operating in those bands. Where Australia is a 'technology-taker' it will continue to experience greatest demand for spectrum in those bands that are in highest demand in large international markets. Competition for spectrum is most acute in the UHF and SHF bands below 5 GHz. This demand is concentrated in dense population areas. Ample spectrum is often available in less populated areas and at higher frequencies.

There is considerable recognition internationally that when excess demand exists, the outcome that is efficient and consistent with maximising public benefits is most likely to be achieved when the regulator uses market mechanisms in managing spectrum. As described by Freyens (2007), economic efficiency in this domain arises from the speed at which new applications reach consumers, contributing to enhanced production and consumption possibilities and economic growth. From a regulatory perspective, spectrum efficiency is maximised when the spectrum management regime is endowed with the flexibility to adapt spectrum access and usage to both market requirements and technological advances (Freyens, 2007, 4, fn 3).

Economists have been advocating market approaches since the 1960s, and spectrum regulators have become progressively more sophisticated in applying these approaches since the late 1980s. Technical regulation has increasingly been seen as necessary but insufficient to maximise the public benefit from use of the spectrum.

Australia has been in the forefront of developments in spectrum regulation and the use of market mechanisms to promote an efficient allocation of spectrum.³ Technologically flexible spectrum licences were introduced in the Radiocommunications Act in 1992 and the first ones were granted in 1997. Licences that confer exclusive usage rights are generally tradeable, irrespective of whether the licensee is a private sector or public sector entity. Administrative incentive pricing⁴ has been used since the 1980s. Spectrum 'commons' have also been implemented for classes of devices that are unlikely to create a significant risk of interference.

The debate over alternative approaches to spectrum management is often characterised as a three-way tug between:

- a command and control model in which the regulator controls the use of the spectrum through detailed restrictions on use;
- market approaches based on exclusive property rights; and
- a commons approach in which there are few restrictions on entry but limited protection from interference (Freyens, 2007).

Australia's spectrum management regime encompasses all three approaches. Under the Radiocommunications Act, the Australian Communication and Media Authority (ACMA) can use one of three licence regimes:

- Spectrum licences typically provide exclusive access to the licensee over a large spectrum space (frequency range and geographic area). The technical frameworks seek to provide the licensee with flexibility to change the use of the spectrum while managing interference at frequency and geographic boundaries. Spectrum licences are typically allocated at auction, although under certain circumstances prices for spectrum licences may be administratively determined;
- Apparatus licences typically specify technical conditions for the operation of a device or devices including frequency, transmit power, emission type and, importantly, geographic location. Apparatus licences are usually administratively allocated on a first-come, first-served basis although they are auctioned in some circumstances when there is expected to be excess demand for a licence.⁵ Prices for apparatus licences are set by ACMA and outlined in the Apparatus Licence Fee Schedule; and
- Class licences which are essentially a commons arrangement. Users do not need to apply to ACMA to operate in class licensed bands or pay any fees, although they must operate within the technical specifications of the class licence. To date class licences have generally been used for short-range low-powered devices that are unlikely to cause interference problems.

In all likelihood a combination of these approaches will continue to be appropriate for the foreseeable future although the proportion of spectrum accessed under each approach may change. Spectrum licences are likely to be appropriate for large networks that benefit from interference protection and that will be more efficiently managed by spectrum users with property rights and liberalised licensing frameworks. Apparatus licensing with centralised frequency co-ordination and strict rules of operation may be preferable for multiple users with narrow spectrum bands over small, specific geographic areas.⁶ For spectrum uses that have a low potential to cause interference, the commons approach provided by a class licence with minimal rules and no barriers to entry may be optimal.

Irrespective of the proportion of spectrum managed under each licensing regime, the regulator will continue to play an important role in making rules that shape the evolution of the administrative process and the market in which rights to access spectrum are acquired. Where it is not possible to be entirely technology-neutral, technical regulations instituted by the regulator will influence spectrum use and the value of certain bands to different parties.

In this context ACMA has recently articulated the framework and analytical tools that will guide its regulatory decision-making process. The regulatory debate is likely to benefit if it can operate with a common framework and language that stakeholders from a range of sectors can understand and engage with irrespective of whether their activities relate to telecommunications, broadcasting, meteorology, defense and law enforcement, aviation or any number of other key commercial and community services. The decision-framework is illustrated in Figure 1.

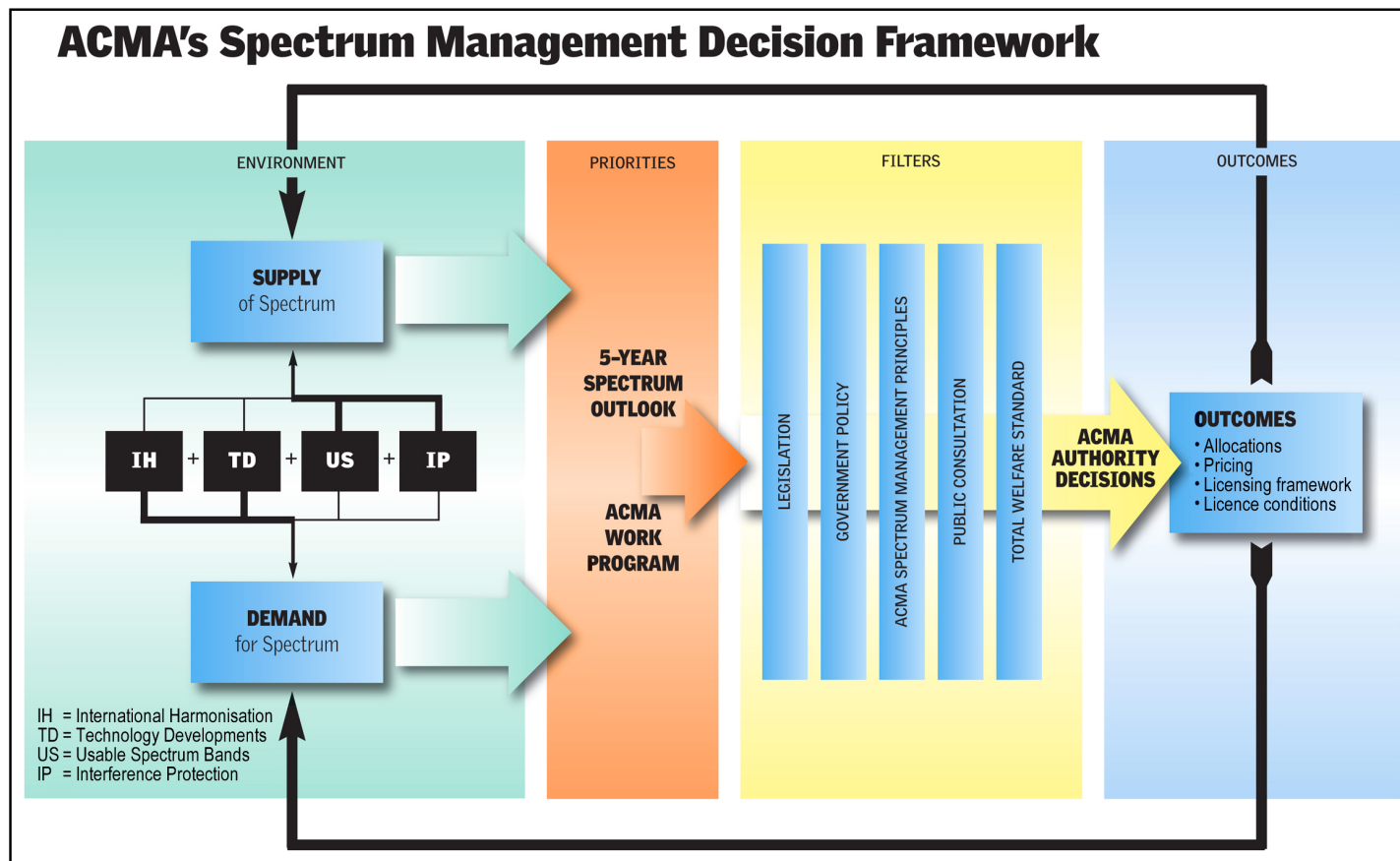


Figure 1 ACMA Spectrum Management Decision Framework

Note: 5-Year Spectrum Outlook refers to an ACMA document outlining demand pressures in various parts of the spectrum over the next five years. It is available at http://www.acma.gov.au/WEB/STANDARD/pc=PC_311105

OBLIGATIONS TO ASSESS IF A REGULATORY PROPOSAL IS LIKELY TO BE IN THE PUBLIC INTEREST: GOOD REGULATORY PRACTICE

As outlined in the diagram above, ACMA has stated that, where appropriate, it will use a total welfare standard to assess which regulatory approach is likely to be optimal. ACMA is not unique in applying a standard or test to assist in evaluating regulatory options. Such an approach was recommended in 'Rethinking Regulation: Report of the Taskforce on Reducing Regulatory Burdens on Business'⁷ and is consistent with the Office of Best Practice Regulation (OBPR) guidelines.⁸

The OBPR test has its foundations in welfare economics and principles developed in the economics literature in the 1930s (Kaldor 1939, 549–552 and Hicks 1939, 696–712). These economic foundations form the accepted basis for modern cost-benefit analysis and the basis for the 'public interest tests' used by other regulators in Australia and elsewhere in their enforcement activities.

Despite this common foundation, regulators around the world have applied different tests. The total welfare standard is a widely accepted standard for cost-benefit analysis associated with regulatory interventions. The history of anti-trust adjudication in the United States has meant that the welfare standard in competition policy in a number of countries is the consumer standard rather than the total welfare standard.

In considering applications for authorisation, the Australian Competition Tribunal has, however, been reasonably consistent in adopting a total welfare standard and articulated its position on this as early as 1976.⁹ In 2007 the ACCC stated it would apply a public benefits standard in relation to authorisation. This is similar to a total welfare standard but may differ slightly in some cases. In defining its 'public benefits standard' the ACCC notes it may have regard to what weight society considers should be attached to the public benefit and the number and identity of the proposed beneficiaries (ACCC 2007, 34).

In the US in recent years economists have been debating whether a consumer welfare standard or a total welfare standard is appropriate in an anti-trust context (Pittman 2007; Carlton, 2007; Farrell and Katz 2006). There has been a similar controversy in Canada in relation to antitrust matters (Ross and Winter 2005, 471–503) and in New Zealand on other telecommunications regulatory issues.¹⁰

Notwithstanding the OBPR's statements that support assessing the impact on total welfare (rather than consumer welfare or some other standard), given the debate over the appropriate standard in anti-trust matters and some other regulatory contexts it seems appropriate to consider what standard is appropriate in the context of spectrum management.

WHAT IS THE TOTAL WELFARE STANDARD?

A total welfare standard requires that to the extent possible:

- all significant benefits and costs arising from the regulatory proposal will be given the same weight regardless of the identity of the recipient; and
- the approach expected to generate the greatest net benefits is the preferred approach.

When a total welfare standard is applied, the impact of a regulatory proposal on the public interest is measured as the sum of the:

- direct effects on consumers (change in consumer surplus), producers (change in producer surplus), and government revenues;¹¹ and
- the broader social impacts on others in the community. Externalities (or broader social impacts) might be important and where they are they should be included in the analysis. Consistent with generally accepted practice in cost benefit analysis indirect effects, or effects in secondary markets should not be taken into account.¹²

The government sector can be treated in various ways when analysing the impact of a proposal on welfare. In some situations it may be included in the analysis in its role as a consumer or producer (as part of consumer surplus and producer surplus respectively). In others, and in particular where a regulatory proposal may affect the level of taxes or the form in which taxes are collected it may be identified as a distinct sector.

Payments that are simply transfers between government, consumers or producers are typically treated as transfers that result in no net increase or decrease in welfare. In relation to spectrum, payments for licences will generally be treated as a transfer between producers and government in a welfare analysis.

However, many forms of taxes impose economic costs by altering, for example, incentives to invest, incentives to work or the cost of goods or services. When taxes change consumption or production decisions, the impact on consumer or producer surplus should be taken into account.

WHY IS TOTAL WELFARE THE APPROPRIATE STANDARD IN SPECTRUM MANAGEMENT?

The benefits of a total welfare standard relative to other 'public interest tests' such as a consumer welfare standard can be demonstrated by using an illustrative example. At times the regulator needs to consider whether to facilitate a change in the use of parts of the radiofrequency spectrum. As a rule in Australia, ACMA as the regulator seeks to implement technical and licensing arrangements that are flexible and support a range of uses.

However, in some circumstances the regulator may need to make decisions about the technical or licensing arrangement that will affect the value of the band to current or potential users. In an extreme case it is possible that planning arrangements will prevent some potential users from operating in that part of the spectrum. When this is the case, the regulator should carefully consider which approach is in the public interest.

Changing the technical and licensing arrangements for a band may have a number of effects on welfare. For example in some cases:

1. It may impose additional costs on incumbent entities providing services using that band, and returns to those incumbent entities may fall as a result.
2. It may affect consumers of the services provided by those incumbent entities if prices rise or consumers face increased costs to access the service or a substitute services via an alternative platform.
3. It may increase the returns to parties who gain access to the band to provide new services.

4. It may increase benefits to consumers of those new services if it enables:
 - a. new valuable services to be rolled out in Australia, reduces the cost of those services being brought to market, or increases competition in the provision of services;
 - b. consumers to capture the benefits of global economies of scale in the production of equipment for utilisation in the bands; or
 - c. consumers to reap the benefits of global roaming that is possible in part because of international standardisation.

If the regulator assesses whether it is in the public interest to facilitate a change in use of the band using a total welfare standard, it would seek to take into account all significant benefits and detriments in each of points 1–4.

If the regulator used an alternative standard, for example a consumer welfare standard, it would only take into account effects 2 and 4. The impact on producers would not be considered unless it also affected outcomes for consumers.

In spectrum management it is appropriate to have regard to the possible impact on producers, consumers, government and other members of the community when assessing whether a regulation would be in the public interest. Adopting a consumer welfare standard could lead to accepting regulatory proposals that confer benefits on consumers without proper consideration of the costs on others affected by the regulation.

Consistent with the welfare-economic underpinnings of the total welfare standard it is also appropriate to give the same weight to benefits or detriments irrespective of the identity of the beneficiaries. This is not based on an assumption that we (society or regulators) are indifferent to the distribution of income between individuals. Rather, as noted in King (2006), it reflects a recognition that '... economics strongly dictates that any socially desirable redistribution is best achieved through coordinated government tax policy and not achieved through *ad hoc* intervention, for example, under competition laws' (King 2006, 38–48). Regulatory interventions focused on industry are imprecise and inappropriate policy instruments for achieving distributional objectives.

This is not to say that regulators or policy agencies should not consider as part of the analysis which members of society are better or worse off as a result of a change. Indeed, such an analysis may be part of the quantitative or qualitative assessment of the effect of the change. This analysis may influence other policy decisions, for example, the management of the transition from one regulatory approach to another.¹³ But these should generally be treated as distinct questions. In some cases they will be policy questions for government rather than matters for ACMA as the regulator.

HOW SHOULD A SPECTRUM REGULATOR USE A TOTAL WELFARE STANDARD?

The appropriate analysis will depend on the matter at hand. In some cases it may be a largely qualitative analysis, while in others quantitative analysis may be possible. A formulaic approach makes no sense given the range of spectrum management activities. The right approach will depend on factors such as:

- the regulatory options that are being considered;
- the factors relevant to understanding the impact of different approaches; and
- the information available in each case.

Having said that, there are a few general principles that should guide the regulator.

Assessments should consider the future with and without the proposed regulatory intervention. The benchmark is not the current situation, or some ideal world, but rather it is the environment expected to prevail if a regulatory proposal is implemented compared to the outcome expected if it is not.

Analysis should focus on the change in costs or benefits that will arise as a consequence of the regulatory proposal in question. Consider the spectrum example just discussed. In most cases spectrum planning decisions will affect the relative cost of delivering certain services or the price at which they services are supplied. It is an extremely rare case when a decision will affect whether the service can be delivered at all. Where the regulatory decision affects the cost of delivering services, the regulator should evaluate the implications for cost and any expected impact on price and demand for services. In these cases it will not be necessary or appropriate to determine how much society values the existence of the service.

There should be a reasonable expectation that the effects taken into account will actually result as consequence of the regulatory proposal. Regulators should seek to adopt an approach that is not naïve but that has regard to the risk associated with different outcomes, and whether effects are likely to be enduring or ephemeral.

Significant economic and broader social (or non-economic) impacts should be taken into account, and in certain circumstances may be the critical factors.

Some benefits or detriments, and in particular some broader social impacts, may not be amenable to quantification. Where it makes sense to assess some impacts in qualitative terms, they should be evaluated and supported with evidence to the extent possible and given appropriate weight in the overall evaluation. Regulators should take care not to give excessive regard to certain factors just because they can be quantified.

Effects on dynamic efficiency are difficult to capture in an analysis of the impact of a change on total welfare. Nonetheless the expected impact of a regulatory initiative on dynamic efficiency may be of prime importance and should be considered and taken into account in the overall analysis.

WHEN IS IT APPROPRIATE TO ASSESS THE EFFECT OF A REGULATORY PROPOSAL ON TOTAL WELFARE?

This sort of cost-benefit analysis is likely to be appropriate when the regulator, as opposed to the market, needs to make a decision that will affect the allocation of spectrum. That is, the regulator should analyse the impact on total welfare when it is not possible to establish technology-flexible arrangements that enable potential users of the spectrum to compete in a market to determine the highest value use of the spectrum. Spectrum regulators' responsibilities relate to dynamic and rapidly evolving sectors. In many cases market processes will reveal more information and be more likely to result in an efficient allocation of the spectrum than the regulator – irrespective of how much detailed analysis the regulator uses to inform its decision (Yarrow 2008).

In those cases, and wherever appropriate, we should focus on seeking to ensure that the market can work effectively.

It is only likely to be appropriate to commit the resources required to assess the impact of regulatory options on total welfare when the legislative framework provides the regulator with discretion regarding the tests it might apply. If the relevant legislation requires the regulator to consider different criteria, the test in the legislation is the relevant test. In general, the Radiocommunications Act supports and does not preclude ACMA from using a total welfare standard.

It is only likely to be net beneficial undertake this sort of cost-benefit analysis when a regulatory intervention is expected to have a significant impact on stakeholders. The analysis required will be time- and resource-intensive. The resources committed to the assessment of the impact of a regulatory intervention should reflect the magnitude of the issue being considered.

SUMMARY

Australia has been at the forefront of the development and implementation of flexible approaches that enable spectrum users to determine how spectrum is used. Market mechanisms such as price-based allocations, pricing administratively allocated spectrum, an ability to trade licences, and flexible technical and licensing frameworks all play an important role in this process.

However the regulator remains responsible for shaping the market rules. Regulators should continue to explore how to design market rules and technical and licensing frameworks that both promote innovation and efficient use of the spectrum and provide appropriate interference protection.

The pace of change in the operating environment makes the regulator's job more complex and increases the benefits of an informed discourse with stakeholders. When the regulator is required to make a significant regulatory decision that may affect the use of certain parts of the spectrum and benefit some existing or potential spectrum users and impose costs on others, it is likely to be appropriate to assess the merits of alternative approaches using a total welfare standard. This is one tool that can improve the regulatory discourse and the regulator's ability to determine how to proceed in a highly uncertain environment.

ENDNOTES

- ¹ ACMA held its RadComms08 conference from 30 April to 2 May 2008 and released several consultation papers beforehand. One of those papers sought comment on draft Spectrum Management Principles that ACMA proposes to use to guide its approach to achieving the spectrum management objectives outlined in the Act. In that paper and others ACMA noted that, where appropriate, it would assess the impact of regulatory proposals on total welfare to inform its decisions. The draft Spectrum Management Principles paper is available at http://www.acma.gov.au/webwr/_assets/main/lib310643/smp.doc.
- ² For a short discussion of the implications of technologies such as cognitive and software defined radio see Cave et al., 2007, chapters 2 and 10.
- ³ Some other jurisdictions that have implemented market based approaches since the 1990s include New Zealand, the United States, the United Kingdom, and Guatemala. For a review see Marcus et al., 2005.

Administrative incentive pricing is the setting of prices for licences allocated over the counter to encourage efficient use of the spectrum. ACMA does this through the tax on apparatus licences. See the Apparatus Licence Fee Schedule. http://www.acma.gov.au/WEB/STANDARD/pc=PC_1614.

For example, Low Power Open Narrowcasting (LPON) apparatus licences are auctioned when there is expected to be competing demand for a licence. LPONs allow for the provision of niche radio broadcasting services, such as tourist and racing information, or ethnic and religious programming. They are offered on a rolling quarterly program and while most are allocated with no contest, there are typically three or four auctions each year.

Academics and regulators in a number of countries including Australia have been exploring whether it may be optimal for 'band managers' other than the regulator, to manage the detailed coordination and device registration process appropriate for some uses in parts of the radiofrequency spectrum (Cave et al., 2007, ch 10).

ACMA (2006: 203–204). 'A range of feasible policy options... need to be identified and their costs and benefits... assessed within an appropriate framework'.

Australian Government (2007, p 68). 'The Government requires that [Regulatory Impact Statements] include a comprehensive assessment of the expected impact (costs and benefits) of each feasible option. The objective should be to choose the most appropriate option for resolving the identified problem and to provide readily accessible evidence to support this decision. The overall expectation is that the benefits to the community of the recommended option exceed its costs and have the greatest net benefits (benefits minus costs) to the community of all alternative approaches considered.'

Re Queensland Cooperative Milling Association Ltd, Defiance Holdings Ltd (1976), Australian Trade Practices Review 40-012 at 17,242 The Tribunal reaffirmed its approach in 2007 in – for example – the decision in *Re VFF Chicken Meat Growers* [2006] ACompT 2 at para 75.

See the papers and submissions to the NZ Commerce Commission's review of mobile termination rates.

See Boardman et al., 2006.

In taking externalities into account it is necessary to consider if other policy interventions exist or are likely to exist to address the issue. See for example, the discussion in Indepen-Aegis, 2005.

Transition measures may also generate economic costs. If transition measures are implemented it is important to ensure that the economic costs associated with those measures do not erode the benefits associated with the initial regulatory initiative.

REFERENCES

- ACCC, 2007. 'Guide to Authorisations'. p 34.
- ACMA. 2006. *Rethinking Regulation, Report of the taskforce on Reducing Regulatory Burdens on Business*. Available on line at <http://www.regulationtaskforce.gov.au/finalreport>.
- Australian Government, 2007. 'Office of Best Practice Regulation Handbook'. Available on line at <http://www.finance.gov.au/obpr/proposal/ria-guidance.html#handbook>.
- Boardman, A; Greenberg, D; Vining, A; Weiner, D. 2006. *Cost-Benefit Analysis Concepts and Practice*, 3rd edn, Prentice Hall.
- Carlton, D. 2007. 'Does Antitrust need to be modernized?' *Journal of Economic Perspectives* 21 (3).
- Cave, M; Doyle, C; Webb, W. 2007. *Essentials of Modern Spectrum Management*, Cambridge, Cambridge University Press, ch 2 and ch 10.
- Farrell, J; Katz, M. 2006. 'The Economics of Welfare Standards in Antitrust'. *Competition Policy International* 2 (2).
- Freyens, B. 2007. 'The Economics of Spectrum Management: A Review' commissioned for ACMA.

- Hicks, J. 1939. 'The foundations of welfare economics'. *Economic Journal* 49: 696–712.
- Indepen-Aegis. 2005. 'Study into the potential application of Administered Incentive Pricing to spectrum used for Terrestrial TV & Radio Broadcasting', available at <http://www.ofcom.org.uk/consult/condocs/futurepricing/aipstudy.pdf>
- Kaldor, N. 1939. 'Welfare propositions in economics and interpersonal comparisons of utility' *Economic Journal* 49: 549–552.
- King, S. 2006. 'The public benefit standard for merger authorisations'. *Australian Business Law Review* 34: 38–48.
- Marcus, J; Nett, L; Scanlan, M; Stumpf, U; Cave, M; Pogrol, G. 2005. 'Towards More Flexible Spectrum Regulation'. A study for the (German) Federal Network Agency, available at <http://www.bundesnetzagentur.de/media/archive/4745.pdf>.
- Pittman, R. 2007. 'Consumer Surplus as the Appropriate Standard for Antitrust Enforcement'. *Competition Policy International* 3 (2).
- Radiocommunications Act 1992.
- Ross, T.W; Winter, R.A. 2005. 'The Efficiency Defence in Merger Law, Economic Foundations and Recent Canadian Developments'. *Antitrust Law Journal* 72 (2) 471–503.
- Yarrow, G. 2008. 'Revisiting the Rationale for Regulation', ACCC Regulatory Conference, available at <http://www.accc.gov.au/content/item.phtml?itemId=836179&nodeId=261dc1bb4ce19dce0d38f0ab6f6312ae&fn=Goerge%20Yarrow%20Presentation.pdf>.

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