

Taking up Coase's challenge 50 years on: using spectrum markets to deliver value to society

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Introduction

The switch from analogue to digital terrestrial television in the UK is due to start in October 2007 and will result in a significant release of spectrum for new uses. The switchover process will release 112 MHz of the 368 MHz currently used for analogue terrestrial broadcasting; the remaining 268 MHz has been pre-allocated in the UK for the delivery of digital terrestrial television.

The spectrum which is to be released (the "digital dividend") is particularly valuable; it lies between 470 and 862 MHz, hence is in the spectrum "sweet spot" – the portion of the radio spectrum which combines good propagation (hence good coverage both inside buildings and in rural areas) with sufficient spectrum availability for services that require large capacity or bandwidth. The range of potential uses of this spectrum is especially wide, including standard and high definition digital terrestrial television, mobile multimedia, cellular mobile, wireless broadband, satellite communications, wireless microphones, low power applications and public safety services. There is also a high degree of uncertainty over its most efficient use now and in the future. In these conditions an auction is likely to bring significant benefits to UK consumers.

Therefore, Ofcom is consulting on a proposal to allow the market to decide on the future use of the digital dividend – see <http://www.ofcom.org.uk/consult/condocs/ddr/>. This represents a significant development in the application of market mechanisms to spectrum management, because (if the proposal is maintained) it will be one of the first times an auction has been used to determine the division of spectrum between broadcasting and non-broadcasting uses.

Spectrum regulators around the world are increasingly turning to market mechanisms to allocate spectrum, and the use of markets is at the heart of Ofcom's stated approach to spectrum management – see <http://www.ofcom.org.uk/radiocomms/sfr/>. However, deciding to use markets to allocate this spectrum has raised a number of questions about the suitability of markets, which Ofcom has addressed to verify that its preferred approach is the right one for the award of this spectrum. These questions arose out of arguments for why broadcasting uses should be considered as a separate case (arguments which have a similar resonance on both sides of the Atlantic).

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In many countries the spectrum used to deliver television and radio broadcasting has historically been used to secure public purpose objectives. For example, in the UK this spectrum has previously been allocated to broadcasters, as a quid pro quo (indirect funding) for the delivery of public service broadcasting. This approach has extended from the analogue to digital worlds. The digital terrestrial TV (DTT) platform, which has been rolled out to provide universal coverage of the UK, has been gifted 256MHz of spectrum.¹ The public service broadcasters in the UK have argued that this position should be extended to the digital dividend. In particular, these parties have provided representations to Ofcom which call for the direct allocation of the digital dividend to the DTT platform for the provision of high definition television.

The argument which is most commonly raised in the UK to justify the direct allocation of spectrum to broadcasting uses is that this use of spectrum generates sources of value which markets ignore, and hence markets cannot be used to allocate resources to broadcasting (or by implication, to any other use which also generates this source of value).

A key strand of Ofcom's work has been to critically assess this argument, to identify whether markets can secure efficient spectrum use when the potential users of spectrum have broader social goals. This assessment included the development of an analytical framework which is inclusive but rigorous, i.e. it allows broader public policy considerations, often expressed in terms of citizens as well as consumers, to be captured, but applies standard tools of economic analysis. This paper outlines this work, important elements of which are:

- The approach to welfare analysis which is required to assess whether a market approach can achieve an efficient outcome when some uses generate broader value for society, and the practical implications of this. In particular, this includes the way in which Ofcom's conceptual and empirical analysis builds upon the theory of non-use goods to capture broader social value (i.e. social value externalities) within estimates of the value of spectrum generated by competing uses, such as high definition television and wireless broadband.
- The importance of some key principles which underlie the Coasian approach, namely the opportunity cost of spectrum and the likelihood of regulatory error ("regulatory failure"), in facilitating decision making. These principles are used to analyse arguments for administrative allocations of spectrum, e.g. to public service broadcasters for high definition television, and to explain why intervention in output markets (with the aim of facilitating participation in a spectrum market by organisations that deliver broader social objectives) is both feasible and to be preferred to distortions in the spectrum market itself.

¹ However, Ofcom has recently published a statement which indicates that administered incentive pricing will be levied on this spectrum in the future. See:

<http://www.ofcom.org.uk/consult/condocs/futurepricing/statement/statement.pdf>.

Almost fifty years ago Ronald Coase in his seminal article (Coase, 1959) commented that “...the belief that broadcasting industry is unique and requires regulation of a kind which would be unthinkable in the other media of communication is now so firmly held as perhaps to be beyond the reach of critical examination.”² Ofcom’s proposal to use a market mechanism to allocate the digital dividend is an opportunity to test whether this conclusion still holds.

Section 1: What makes the digital dividend Important?

The spectrum available in the digital dividend is both particularly versatile and scarce. As set out above, the range of its potential uses is large, encompassing a number of mass market services such as cellular mobile and television broadcasting, both of which have been shown to generate significant consumer and producer value.

For example, analysis of the economic value of radio spectrum completed for Ofcom in 2006 assessed the value (consumer plus producer surplus) of these uses in aggregate to be £22bn per annum for cellular mobile and £12bn per annum for television broadcasting.³

Further work undertaken by Ofcom to illustrate the *incremental value* which may be generated through use of the digital dividend by these uses, amongst others, suggested that the aggregate incremental consumer and producer surplus which may be generated could be in region of £5bn to £10bn over a 20 year period⁴. This analysis was completed on an incremental basis as, although the digital dividend spectrum is particularly scarce, there is substitute spectrum that could be utilised by most of the candidate services. For example, mobile television can also be deployed in the 1.4GHz band (which will be auctioned by Ofcom later this year) and in the spectrum which the existing 3G cellular operators hold in the 2.1GHz band. Therefore, in considering the most efficient uses of the digital dividend spectrum, it is the incremental value that is of most interest, i.e. the value over an above use of alternative, substitute spectrum.

Ofcom’s indicative estimate of the value of the digital dividend in the UK is conservative when compared with work completed in by Hazlett and Mueller (2004) which identified that the release of 200MHz of analogue TV spectrum in the UK for cellular mobile use could result in a social welfare (consumer plus producer surplus) gains in the order of \$25bn per annum⁵.

² See Coase, 1959, p40.

³ See Europe Economics, 2006.

⁴ See Ofcom, 2006a, p 55.

⁵ It is worth noting that this assessment does not take into account that other spectrum bands could contribute towards this additional 200MHz of spectrum for cellular mobile, such as the release of the 2.6GHz band in the UK which will result in an additional 190MHz of spectrum which is suitable for this use and which will become available before the digital dividend spectrum.

The high value of the digital dividend spectrum is combined with a high degree of uncertainty over its likely future use. A number of the potential uses are nascent services in the UK, for example, high definition broadcasting and mobile television. The level of consumer demand for these uses is uncertain as is their likely spectrum requirements. Indeed, it may turn out that some of these uses do not require digital dividend spectrum at all, for example, the demand for high definition television may be satisfied through its provision on the existing DTT multiplexes or on either the cable or satellite platforms in the UK. In the presence of this level of uncertainty, the asymmetry of information between firms and the regulator means that firms are much better placed to make efficient decisions over the use of the digital dividend spectrum. Hence, taking into account the particularly high value of this spectrum, using a pricing mechanism to allocate the resource is likely to result in significant benefits for UK consumers.

However, some commentators have argued that these benefits will come at the cost of UK citizens. In their response to Ofcom's digital dividend review consultation the BBC argued that direct allocation of the digital dividend for the provision of high definition television on the DTT platform is:

*"... a public policy objective which carries social value beyond and above its private value and which will not be achieved by market mechanisms."*⁶

Therein is the key policy decision which Ofcom has been faced with in relation to the award of the digital dividend spectrum

Key policy question

- Does the presence of wider societal benefits invalidate a market-based approach to spectrum allocation?

This issue has been subject to significant debate in the UK and this paper explains how the analytical approach Ofcom developed is designed to inform this debate, and how the principles which underlie Coase's approach to spectrum management can provide a practical guide for decision making.

In so doing the paper illustrates the application of the framework with examples of how it has been applied to the suggestion that the digital dividend in the UK should be directly allocated to broadcasting use for the delivery of high definition television, because this will generate sources of value which will not be reflected in a market-based process. A summary of the results of the practical application of the framework by Ofcom to this question is set out in section 5.

⁶ See BBC, 2007, p3.

The analysis presented in this paper is limited to the analytical framework developed to help Ofcom in the preparation of its consultation on the digital dividend in 2006. Ofcom has received many responses to this consultation and these will be reflected in a statement on the digital dividend later this year. This paper does not comment on nor is it indicative of the likely response of Ofcom to points raised in consultation responses.

Section 2: An analytical approach built on the guiding principles of Coase

In his seminal article *“The Federal Communications Commission”* (Coase, 1959), Coase critiqued the approach the FCC then used to allocate frequencies for use by radio and television broadcasting. The approach he critiqued was a system whereby the Commission was authorised to issue licenses if the “public interest, necessity or convenience would be served”⁷. The key proposition in his article was that an authorisation system based on a pricing mechanism and property rights was likely to be superior.

In his article Coase charts the history of the 1927 Radio Act and a number of memorable debates over its validity. For example, Coase provides extracts from various articles written in 1951 in the course of the development of standards for colour television. These highlight how little the debate over the appropriate method of granting access to spectrum for broadcasting uses has progressed between now and then.

Coase starts by quoting from the proposals of Mr Leo Herzel, who was a proponent of the use of pricing mechanisms. Mr Herzel said:

*“The most important function of radio regulation is the allocation of a scarce factor of production – frequency channels. The FCC has to determine who will get the limited number of channels available at any one time. This is essentially an economic decision, not a policing decision”*⁸

To which Professor D W Smythe (a former chief economist at the FCC) commented:

*“Surely it is not seriously intended that the non-commercial radio users (such as the police), the non-broadcast common carriers (such as radio-telegraph) and the non-broadcast commercial users (such as the oil industry) should compete with dollar bids against the broadcast users for channel allocations”*⁹

⁷ This is the wording from the 1927, Radio Act.

⁸ See Coase, 1959, p14.

⁹ See Coase, 1959, p15.

To which Mr Herzel replied:

“It certainly is seriously suggested. Such users compete for all kinds of equipment or else they don’t get it. I should think the more interesting question is, why is it seriously suggested that they shouldn’t compete for radio frequencies”¹⁰

In his article Coase sets out a number of arguments for why a pricing mechanism alongside property rights is an alternative, and probably preferable, approach to allocating spectrum for all uses (including broadcasting). The logic which underlies these arguments has been incorporated within Ofcom’s analytical approach to addressing what, in substance, is the same question.

The starting point of Ofcom’s analytical framework is that decisions over the appropriate approach to spectrum allocation should involve explicit consideration of the costs and benefits of the different approaches. As Coase explains:

“This discussion should not be taken to imply that an administrative allocation of resources is inevitably worse than an allocation by means of the price mechanism. The operation of a market is not itself costless, and, if the costs of operating the market exceed the cost of running the agency by a sufficiently large amount, we might be willing to acquiesce in the malallocation of resources resulting from the agency’s lack of knowledge, inflexibility, and exposure to political pressure”.¹¹

Coase provides a useful guide to the factors which should be considered when making these trade-offs. Firstly he highlights two sources of regulatory error which can result when a regulator attempts to perform the function normally carried out by the pricing mechanism.

“First of all, it lacks the precise monetary measure of benefits and cost provided by the market. Second, it cannot by the nature of things, be in possession of all the relevant information possessed by managers of every business which uses or might use radio frequencies, to say nothing of the preferences of consumers for the various goods and services in the production of which radio frequencies could be used”¹²

¹⁰ See Coase, 1959, p16.

¹¹ See Coase, 1959, p18.

¹² See Coase, 1959, p18.

Secondly Coase clarifies the importance of considering the costs as well as the benefits of any policy decision.

“A government department, in making up its mind whether or not to undertake a particular activity, should weigh against the benefits this would confer, the costs which are also involved: that is, the value of the production elsewhere which would otherwise be enjoyed.”¹³

Thirdly, Coase also sets out how the presence of market failures is not in itself a justification for administrative allocation of spectrum. There are in many cases alternative approaches which can be used to resolve these issues without losing the benefits of spectrum allocation via a pricing mechanism.

“It is no doubt desirable to regulate monopolistic practices in the oil industry but to do this it is not necessary that oil companies be presented with oil fields for nothing. Control of monopoly is a separate problem.”¹⁴

It is with this general logic in mind that the analytical approach to Ofcom’s digital dividend review has been developed. This approach is set out below.

¹³ See Coase, 1959, p21.

¹⁴ See Coase, 1959, p17.

A Coasian analytical framework

- **Step 1 - assessment of the risk of market failure:** there are likely to be situations in which a market-based approach to spectrum allocation is not perfect. However, in order to make an appropriate trade-off between the benefits of this approach and its costs it is important to understand the underlying cause of the problem, its significance and likelihood.
- **Step 2 - assessment of the opportunity cost of intervention:** the opportunity cost of any intervention should be directly identified in order to allow an assessment of whether the benefit of resolving the market failure outweighs the likely opportunity cost – i.e. whether or not there is a market failure which we should seek to rectify.
- **Step 3 - identification of potential remedies:** in order to identify an appropriate solution, it is important to consider as wide a range of possible intervention options as possible. The presence of the market failure does not necessarily mean that the market must be abandoned all together.
- **Step 4 - assessment of the risk of regulatory failure:** the potential for regulatory error (or failure) should also be explicitly recognised. Even when the opportunity cost of intervention is less than the cost of the market failure occurring, the impact of regulatory failures needs to be considered before intervention can be found to be justified. In its analysis, Ofcom has categorised regulatory failures as follows:
 - *Unintended consequences* – these can be both static and dynamic and can affect both the market/users which are being regulated as well as other markets/users.
 - *Failing to achieve the desired effect* – for example, when the policy is designed to provide users with an incentive to behave in a certain way but fails to achieve this because of a lack of information or because of a failure of the policy to take account of other related effects.

The following sections of this paper discuss the key findings which result from an application of this framework to the key policy question identified in section 1, namely whether the presence of wider societal benefits invalidate a market-based approach to spectrum allocation.

Section 3: Does value to citizens result in a market failure?

At the heart of the arguments made in favour of direct allocation of the digital dividend spectrum for broadcasting uses is the contention that these uses generate value for society which a market will not recognise. Ofcom's principal duties require it to further the interests of both citizens and consumers.

Therefore, the presence of broader societal benefits which accrue to citizens are necessarily an important consideration in Ofcom's decision making.

Services which are of value to us as citizens can be thought of as services which we collectively believe should be available for all in the society. Our value from these services as citizens derives from their availability for others, rather than from our direct consumption of them. Hence, these can be thought of as goods or services which we collectively value as members of society, and from which we derive value as citizens, over and above any consumer value we derive if we decide to consume them.

In identifying what services may have value to us as citizens Ofcom identified a number of sources of broader social value; services which generated these sources of value were considered to be services which are of value to citizens. The categories of broader social value identified were¹⁵:

- Access and inclusion – value derived from universal access and facilitating access to public services.
- Quality of life – value derived from providing access to services which promote quality of life, perhaps by helping to support or promote work-life balance or family life.
- Belonging to a community – value derived from allowing people with similar interests to communicate or from participating in your local community.
- Educated citizens – value derived from services with educational content or child-orientated services.
- Cultural understanding – value derived from services which reflect and strengthen cultural identities or promote diversity and understanding of other cultures.
- Informed democracy – value from services which provide information which facilitates democratic debate.
- Social bads – this can include negative value derived under any of the headings set out above.

Building upon this identification of sources of value to citizens, this section addresses three issues which are relevant to an assessment of whether the presence of such broader societal values are a cause of market failure, and if so, whether they could be significant in relation to the award of the digital dividend.

¹⁵ See Ofcom, 2006b, p16, for a discussion of how these categories of broader social value were arrived at.

The three issues which are addressed are:

- How should these sources of value be treated in welfare analysis?
- In what situations could the presence of these sources of value result in a market failure?
- How to assess whether the potential loss in value arising from this form of market failure is significant enough to warrant action? This involves applying steps 1 and 2 of the analytical framework set out in section 2 above.

How should these sources of value be treated in welfare analysis?

Welfare analysis is the economic tool used to assess the net benefits which are generated for society from the use of resources such as spectrum. To what extent does welfare analysis capture citizen benefits?

The starting point of welfare analysis is an assessment of producer and consumer surplus. A measurement of surplus will generally capture both the direct benefits producers and consumers derive from their activities, but also any indirect effects which the activities of one agent may have upon the other, for example any positive or negative externalities which are generated.

In many respects, the presence of value to citizens has the characteristics of an externality. This value is derived indirectly from the availability of a service for society, rather than from our direct consumption of this service. In the field of environmental economics these types of goods are referred to as “non-use goods”.

The framework which underlies welfare analysis is general choice theory, which uses individual preferences over choices to derive utility functions, which can then be used to derive demand functions and hence a measure of surplus. This framework can be used to capture both the direct and indirect benefits which result from the use of a resource if individuals are able to express preferences over both of these effects. Hence, where there are services which are of value to citizens, if as individuals we are able to express preferences over the provision of these services for society, it should be possible to capture this value in an assessment of welfare.

This approach is similar to that taken in the field of environmental economics where welfare analysis is used to capture the value derived by members of society from the presence of environmental “goods” and “bads” (e.g. the endangerment of animal species)¹⁶, and to the approach taken in the economic analysis of broadcasting markets, which has commonly captured the citizenship benefits (and dis-benefits) of broadcasting under a framework of externalities.¹⁷

¹⁶ For example, see discussion in Kontoleon, Macory, and Swanson, 2002.

¹⁷ For example, see Armstrong and Weeds, 2004.

Therefore, where individuals are able to express preferences over the provision of services which benefit us as citizens rather than consumers, welfare analysis can capture this value through an assessment of citizen preferences. These preferences can be treated in the same way as consumer preferences over externalities, they can be translated into broader social value that individuals derive as citizens from the provision of a good or service even though they may not consume it directly. This is comparable to the approach taken in the field of environmental economics to the assessment of the value of non-use goods.

Therefore, if broadcasting uses of spectrum generate sources of value which accrue to us collectively as members of society, and we can individually express preferences over the provision of these services for society, this can and should be captured in a welfare assessment through the measurement of *social value externalities*.

In what situations could the presence of these sources of value result in a market failure?

Therefore, having identified that social value externalities may exist, what can we say about situations in which these may result in a market failure? From a theoretical perspective, when external effects are present markets do not work well unless these external sources of value are internalised. The impact of externalities (i.e. uninternalised external effects) upon a market allocation of spectrum between uses can be seen in the following diagrams.

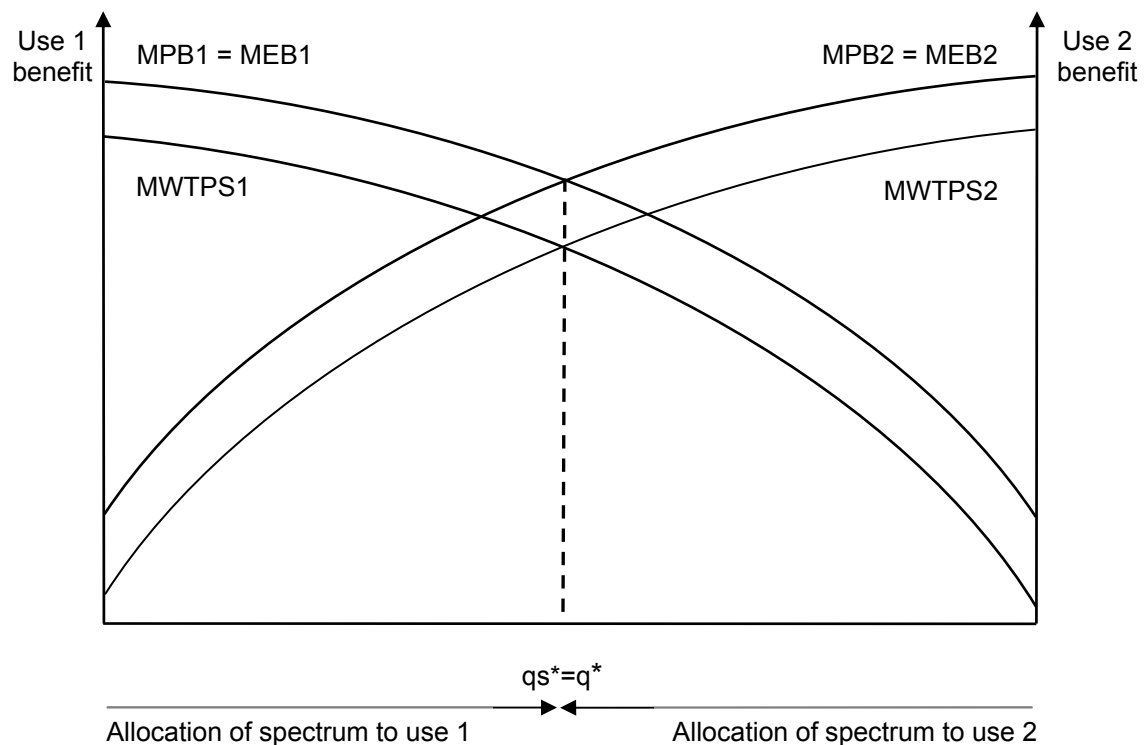


Figure 1: Efficient market allocation

Figure 1 shows an efficient market allocation of spectrum between two uses. The proportion of the available resource allocated to each of the two uses is shown on the horizontal axis (at the far left all of the spectrum is allocated to use 2, and at the far right all of the spectrum is allocated to use 1). The vertical axes represent the marginal value generated by each of the uses, with the value of use 1 shown on the left axis and the value of use 2 on the right. The curves on the diagram show the marginal willingness to pay for a unit of spectrum (MWTPS) and the marginal private benefit (MPB). The MPB curve lies above the MWTPS curve as there are benefits to consumers which are not captured by producers.

In Figure 1 there are no externalities (or other sources of market failure), hence the MPB is equal to the marginal economic benefit (MEB) generated from the use of the spectrum, and the MEB, MPB and MWTPS curves all cross at the same allocation of spectrum between the two uses. In this situation a market mechanism would be expected to result in an efficient allocation of spectrum between the two uses (q_s^*), as the allocation of spectrum based on MWTPS coincides with the socially efficient allocation (where the MEB generated by the last unit of spectrum allocated to each of the two uses is equal).

However, as shown in Figure 2 below, if there are externalities present, then the spectrum market may not result in an efficient allocation.

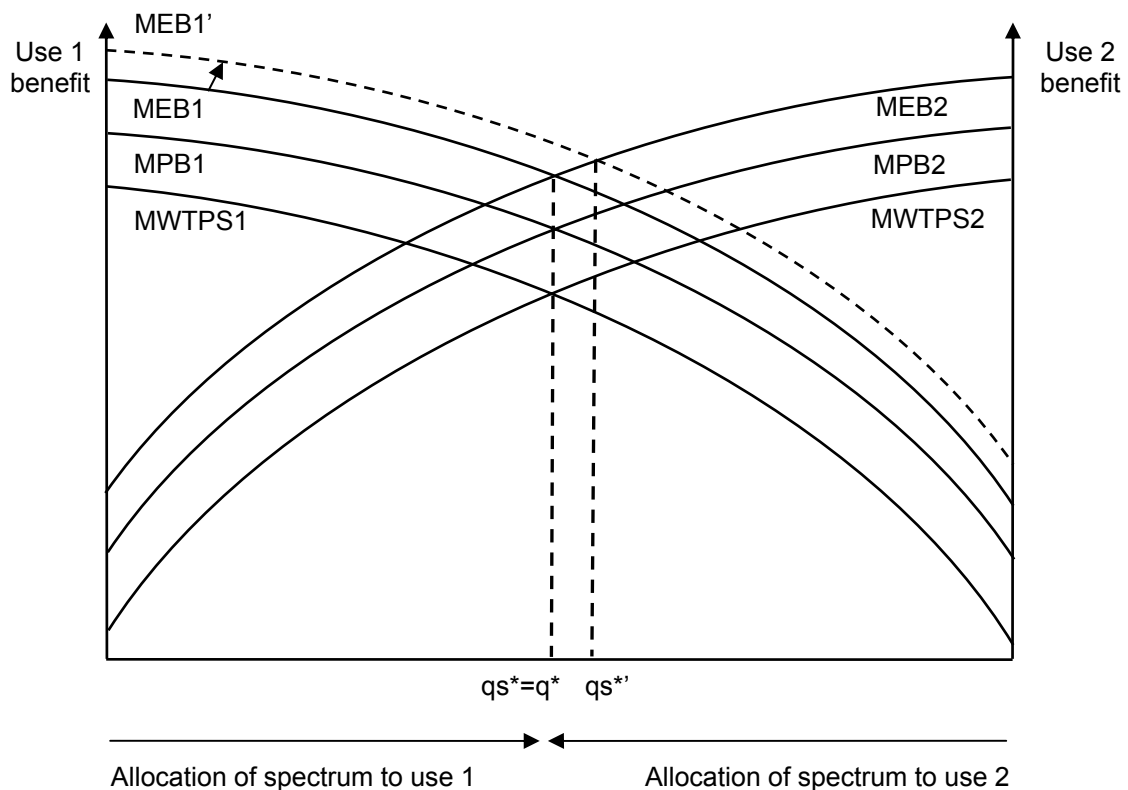


Figure 2: Market allocation with externalities

In Figure 2 both of the uses generate positive externalities (for example broader social value), as a result the MEB curve is higher than the MPB curve. The diagram shows two cases, one where the presence of the externalities results in an inefficient allocation and another where, despite the externalities, the allocation is still efficient.

In the case where the relative externality generated by the two uses is the same, the presence of the externalities is not sufficient to result in an inefficient allocation (the MEB curves still cross at the same point in spectrum allocation space as the MWTPS curves). However, if one use generates relatively more externality than the other (as with MEB1' compared to MEB2), the market no longer reaches an efficient allocation. The market outcome (q^*) allocates too little spectrum to use 1 and too much to use two, when compared to the socially efficient allocation (q_s').

Therefore, we can conclude that, when the relative level of externalities differs between uses, a market-based allocation of spectrum is likely to miss the socially efficient allocation. However, in cases where the relative levels of externality generated by the different uses are broadly comparable, a market-based allocation may still result in an outcome which is close to being efficient.

So how does the theory compare to what happens in practice? It seems likely that many uses of spectrum generate broader social value (for example, through universal access to cellular mobile services or the broadcast of public service broadcasting content) but they still engage in markets, both for spectrum and other resources. Is there evidence that these transactions are inefficient?

There are two reasons why these transactions may still work. Firstly, as indicated above, it is differences in relative levels of externality which are likely to result in inefficient outcomes. If the magnitude of the relative externality generated by all uses of spectrum is broadly similar, the market will allocate resources well, even when the externality is not internalised. When we are allocating spectrum which: i) can be used by only a limited range of uses which produce similar downstream outputs; or ii) when we are allocating additional spectrum to existing uses, it may not be unreasonable to assume that the level of (incremental) broader social value is likely to be broadly comparable across these uses.

Secondly, when a resource is not particularly scarce, most welfare enhancing opportunities are exploited, and as a result the impact of externalities on the efficiency of the allocation of the resource may be less severe. For example, if the willingness to pay for electricity by broadcasters does not fully reflect the social value externalities they generate, this does not bring with it a risk that they are unable to acquire any electricity. They may still decide to consume less of this input than they should, but they would not be expected to fail to obtain any of it. However, when goods are particularly scarce, and therefore, some welfare enhancing opportunities are not exploited, there is a risk that a use whose willingness to pay is below what it should be (as it fails to take account of externalities it

creates) will not acquire any of the resource that it should (from the perspective of economic efficiency).

Therefore, there are reasons why in the past, a failure to take account of social value externalities may not have resulted in inefficiency. Spectrum markets have generally been used to assign spectrum to users rather than to allocate to uses, hence the impact of a failure to account for externalities, such as those caused by the presence of broader social value, has been reduced. When this is combined with state provision of free spectrum as an indirect form of funding to some uses which generate broader social value, the potential for a uses which generates value to society missing out on spectrum completely has been low.

However, as demand for spectrum has increased, and it has become scarcer, the validity of this solution has been called into question. The cost of using spectrum as an indirect funding mechanism, via administrative allocation to a particular use has grown, as has the need to use markets to allocate spectrum between uses (as well as to assign it to individual users). Therefore, we may need a new solution to this problem in order to allow spectrum markets to work effectively in the future. A number of different options for solving this problem are considered in section 4 below. However, before considering these potential solutions we firstly explain the steps which can be taken to verify whether market failures resulting from the presence of social value externalities exist in relation to the award of the digital dividend in the UK, and if they do, whether they are significant enough to warrant action.

How to assess whether the potential loss in value is significant enough to warrant action?

Building on the theoretical analysis set out above, it is possible to apply the first two steps of the analytical framework to the presence of social value externalities.

The first step of the analytical framework involves an assessment of the risk of market failure occurring. The theoretical analysis set out above suggests that this source of market failure could be a real problem for the award of digital dividend spectrum in the UK, as the demand for this spectrum is significant and it is likely that a market award process will involve a number of different uses which use spectrum in widely different downstream markets competing against each other. Hence there is a realistic prospect that the uses (which include broadcasting) could generate different relative levels of social value externality. In order to identify whether the risk of this market failure is significant there are a number of well established approaches which can be used to assess whether this source of value is significant in practice. The key techniques include:

- Assessment of willingness to pay/or willingness to forgo: these involve using stated preference techniques (such as contingent valuation, choice experiments and contingent rankings) to assess citizen preferences and values.

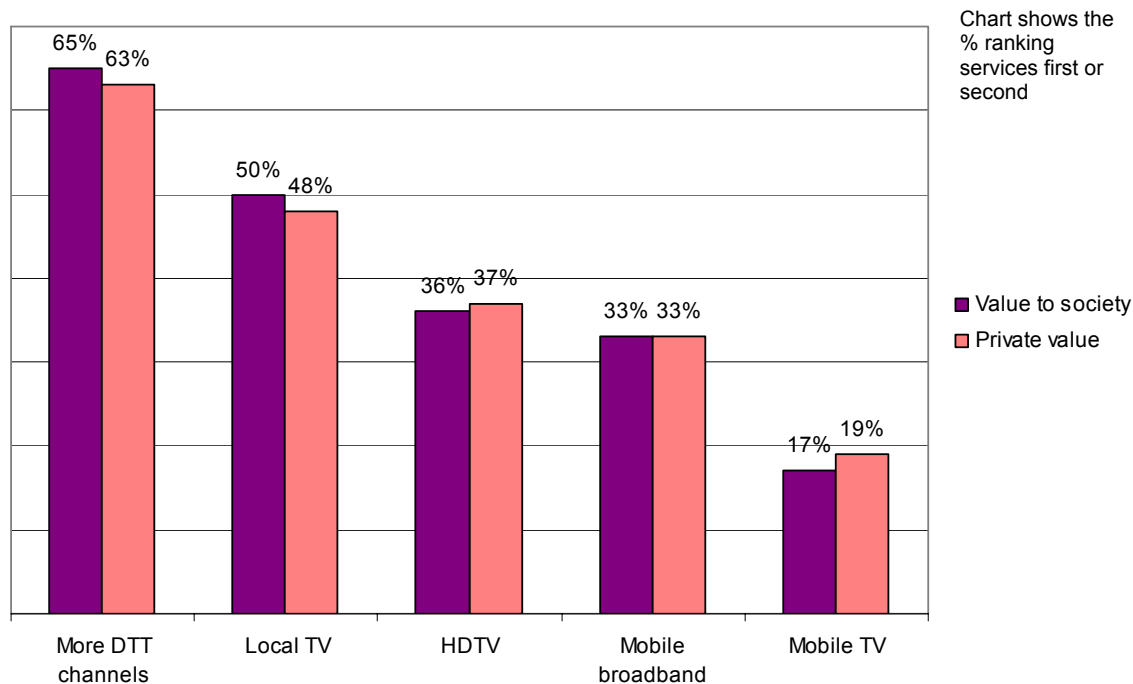
- Pricing techniques: these involve deriving citizen preferences from observable behaviour (for example, from charitable donations or from the purchases which are driven by societal rather than pure individual gain, such as purchasing ethical products).
- Deliberative approaches/citizen juries: these involve asking individuals to take part in focused discussions when they are presented with evidence and asked to collectively make trade-offs on behalf of society as a whole.
- Expert-based approaches: these involve expert panels making informed judgements about options for society.

A number of these approaches were used by Ofcom in its digital dividend review¹⁸ to assess whether the services which may use the digital dividend were likely to generate significant incremental value for society. The results of this analysis suggested that, whilst some uses generated social value externalities in aggregate, the *incremental* broader social value across the different potential uses was likely to be significantly lower, and was broadly consistent across the uses.

For example, the figure below shows the results of one of the market research techniques which involved asking respondents to rank the services which could be provided firstly in terms of their importance to the country as a whole, and secondly to them individually. The results of this particular technique suggested that the relative levels of broader social value across the uses were broadly comparable.

¹⁸ See Ofcom, 2006b, pp20-21, for a discussion of the techniques used.

Figure 3: Importance ranking for digital technologies (value to individuals vs. value to society)



Source: Holden Pearmain Research, 2006, Figure 4.6

QC2a/b: "Please rank these new services in the order of importance you think they are to the country as a whole/to you individually." Proportion ranking services 1st / 2nd
 Base: Total sample representing 89% of population, n = 1500

Therefore, the evidence collected suggested that the risk of a social value externality market failure occurring in relation to the award of the digital dividend in the UK was not significant. However, it is important to acknowledge that the techniques for assessing broader social value are likely to be subject to wide error margins. Hence, even though the evidence in relation to the risk of this type of market failure suggested it was not significant, it should not be ruled out completely at this stage. In their responses to Ofcom's consultation, respondents have presented reasons why they believe a conclusion of no significant market failure risk may not be robust.

The second step of the analytical framework is to assess the opportunity cost of intervention. In order to decide whether intervention may be required it is important to consider the magnitude of the potential market failure against the opportunity cost of intervention. In some cases market failures may be present (one use under-reflects the total value it generates) but even taking this into account, the use does not generate sufficient value to suggest that it should obtain spectrum (given the level of spectrum scarcity).

Further to this, the opportunity cost assessment fulfils two other useful roles:

- The opportunity cost provides a measure of the threshold that the benefits need to exceed for there to be a market failure. It is often easier to quantify the opportunity cost of an intervention than the benefits of resolving a social value externality. Hence, the assessment of the opportunity cost can be used as a sense check for the whether potential size of the market failure benefits is likely to be large enough to warrant intervention.
- The opportunity cost can provide a reliable indicator of the level of evidence or confidence required to make an intervention. When the opportunity cost is high, and hence the potential cost of getting the intervention wrong is significant, the level of confidence required in the evidence for the market failure is also significant.

The opportunity cost of interventions (as reflected by displaced uses of spectrum) is largely independent of the method which is used to achieve the intervention, but will be determined by the use you are intervening in favour of. Therefore, where a use of spectrum which generates social value externalities requires a relatively small amount of spectrum to deliver the socially desirable output, the opportunity cost of the intervention will be relatively less than when the use has a very large spectrum requirement.

This is particularly relevant for the question of whether to intervene in the award of the digital dividend to secure the provision of high definition television on the DTT platform. Arguments put forward suggest that if the digital dividend were used to secure this, it would be important to ensure that sufficient spectrum was available to allow the deployment of an additional multiplex with universal coverage of the UK. This is currently judged to require anything between 48MHz and 96MHz of the available 112 MHz of spectrum in the digital dividend. Therefore, given the limited evidence of significant social value externalities in relation to this use, Ofcom assessed in its digital dividend review consultation, that the case for there being a market failure which was significant enough to warrant intervention, e.g. by reserving digital dividend spectrum for high definition television, was not proven (the full results of the application of the analytical framework by Ofcom to this question is set out in summary form in section 5 below).

Summary – can citizen value result in market failure?

The use of welfare analysis to assess the value of ‘non-use goods’ shows how, where a good or service results in sources of value which do not accrue directly from its consumption, this value can still be captured within an assessment of welfare. Hence, where individuals are able to express preferences over the provision of goods and services which bring value to us as citizens, even when they do not directly consume the good or service, these sources of indirect value can and should be included within an assessment of value to society.

When a market fails to reflect these sources of value (i.e. does not internalise the external effect), there is a market failure caused by the presence of social value externalities, which could result in a spectrum market allocating spectrum inefficiently. This form of market failure has not been a big issue for spectrum markets in the past, as demand for spectrum has generally meant that spectrum markets are used to allocate spectrum between users but not between uses. However, as demand for spectrum has increased, and technological developments have provided the opportunity for different uses to share spectrum bands, this is no longer the case, and is certainly not the case for the award of the digital dividend in the UK.

Assessment of the potential for social value externalities to result in a market failure in the award of the digital dividend in the UK has so far identified that the risk of this market failure appears to be small. However, this question is still open, and respondents to Ofcom's consultation have provided reasons why they do not consider this conclusion to be robust.

Given the theoretical and empirical evidence that social value externalities can exist, it is important to consider what different intervention options may be available for resolving this form of market failure if spectrum markets are to work in the future.

Can social value externalities result in market failure?

- Social value externalities are real in both theory and practice.
- Resolving this form of externality is likely to be of increasing importance for efficient spectrum markets in the future.

Section 4: What's so wrong with free spectrum?

The Coasian approach to spectrum management clearly advocates the need to match the solution to the problem – as quoted earlier, free spectrum is not the only, or the most appropriate tool to *“regulate monopolistic practices in the oil industry... Control of monopoly is a separate problem.”*¹⁹

In this section we discuss the application of the second two steps in the analytical approach. The purpose of these is to help to identify the intervention options which may be best suited to resolving social value externalities. These two steps are:

¹⁹ See Coase, 1959, p17.

- **Step 3 – identification of potential remedies:** in order to identify an appropriate solution, it is important to consider as wide a range of possible intervention options as possible. In many cases, the presence of a market failure does not necessarily mean that a market must be abandoned.
- **Step 4 – assessment of the risk of regulatory failure:** the potential for regulatory error (or failure) should also be explicitly recognised. Sometimes the cure can be worse than the disease – just as markets are not perfect neither are regulators.

Application of step 3 - why not all interventions are equal

There are generally a wide range of intervention options which can be used to resolve market failures. The applicability of these intervention options will depend upon both the particular market failure you are seeking to remedy, and the particular characteristics of the markets in which you are intervening.

The purpose of this step in the framework is to identify the intervention options which are likely to be most effective in resolving the market failure at least cost. With this purpose in mind, intervention options can generally be helpfully distinguished by the following factors: whether they are direct or indirect solutions to the problem, and the extent to which they necessitate a deviation from market mechanisms. These two factors are good indicators of both the likely effectiveness of the intervention both in terms of the degree to which it solves the problem, and the wider impact of the intervention on the markets involved.

When considering the range of intervention options which can be used to resolve social value externalities, it is possible to identify the following broad categories of interventions (it is noted that within each of these categories there are likely to be a wide range of different implementation options).

- The provision of **direct funding**, alongside the imposition of obligations which target the socially desirable downstream output which is to be provided (i.e. the provision of universal access to high definition television). This intervention works by ensuring that a firm's willingness to pay for spectrum directly reflects the positive social value externalities it generates.
- The use of a **bidder credit** to level the playing field between users. This intervention works by adjusting upwards in the market process the amount that a firm is willing to pay for spectrum to reflect the presence of social value externalities.
- Adjusting **auction design and packaging** to indirectly level the playing field between users. Auction design and packaging can be used to make the spectrum lots relatively more or less attractive to different types of users by tailoring the packaging and design to more closely meet the needs of some. If this intervention is used to resolve the presence of social value externalities, this will generally work by making the spectrum on offer relatively less attractive

to uses which do not generate this sort of value (this could be achieved, for example, by offering packages of spectrum which are either too big or too small for these uses, necessitating these uses re-sell spectrum in the secondary market or face aggregation risks).

- Using a **market-hybrid** – combining elements of comparative selection (e.g. beauty contest) with a market-based process. This form of intervention works by effectively restricting the type of use that can compete for spectrum.²⁰ For example, this could work by imposing pre-qualification criteria which required all bidders to show how they generate broader value to society from their use of spectrum.
- Departing from a market – for example by making an **administrative allocation** of spectrum. This involves a regulator making a decision in the place of the market to allocate spectrum directly to one use and user.²¹

It is possible to distinguish three of these intervention options from the other two in terms of their directness: departing from a market, the provision of direct funding, and bidder credits, are all relatively direct solutions to the presence of social value externalities. They directly target the use which is unable to fully reflect the value it generates for society in an auction, and provide a mechanism by which this use can obtain more spectrum than it would have done otherwise. Of these three, direct funding can be thought of as the most direct form of intervention, as this intervention is based on directly targeting what you want to achieve (the socially desirable level of downstream output) rather than seeking to secure the desired output through an intervention in one particular input market.

A further distinguishing factor between these three (direct) forms of intervention is the degree to which they depart from market mechanisms. Direct funding and bidder credits both allow pricing mechanisms to be used to allocate spectrum by giving the relevant bidders a monetary amount which can be used to reflect the broader social value they generate.

²⁰ It is feasible that this form of intervention, rather than restricting the set of users that can take part, could alternatively impose additional costs on those uses that did not previously generate broader social value (for example by requiring them to extend the rollout of their service beyond the level which would be achieved based on commercial incentives alone). However, for simplicity this variant of the intervention option is not considered here.

²¹ It is possible to depart from market mechanisms for part of the decision but administratively identifying the use of the spectrum but using a market to assign the spectrum to users. However, this can be thought of as an extreme version of the market-hybrid option.

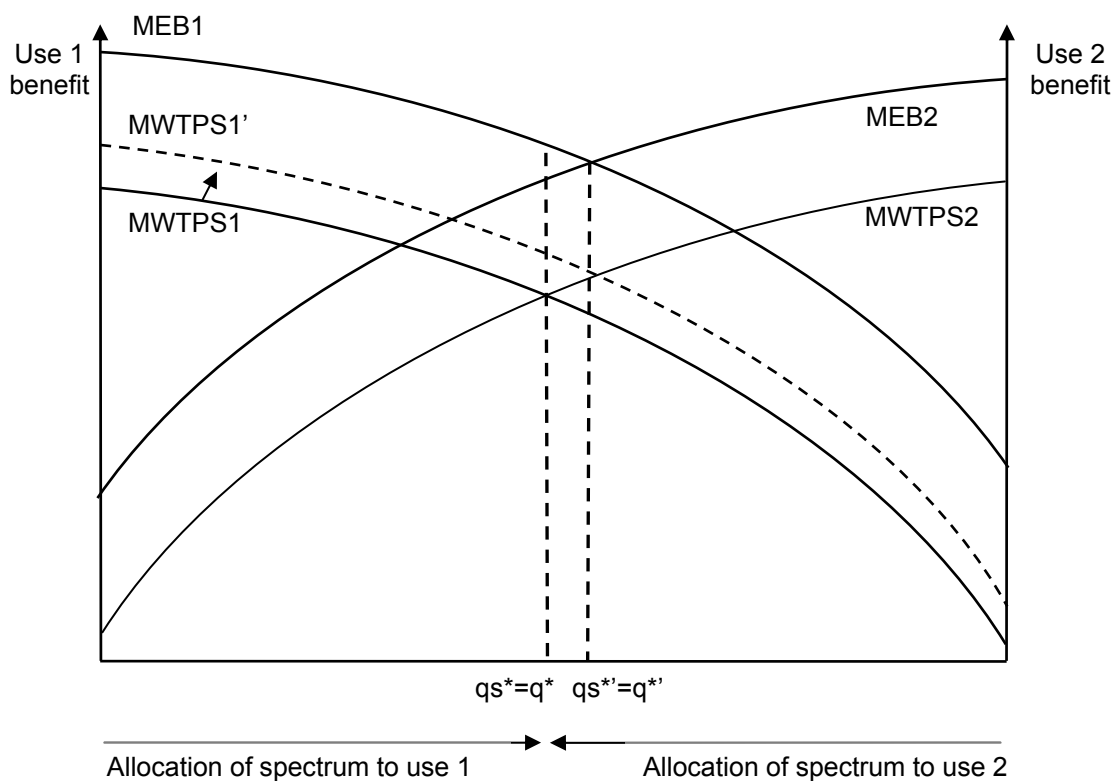


Figure 4: Resolving externalities through funding or bidder credits

Note: The marginal private benefit curves have been omitted from this diagram for ease of presentation. It should be assumed that the marginal private benefit curves intersect at the allocation q^* hence the externalities are the only source of market failure present

This monetary amount can be seen on Figure 3 – the direct funding or bidder credit would both seek to adjust the MWTPS of bidder 1 from MWTPS1 to MWTPS1', and then allow the market to trade this off against the willingness to pay for spectrum of other bidders to identify the efficient allocation q_s^* .

The departure from a market on the other hand, would involve making an administrative allocation of spectrum between the different uses. Hence the regulator would seek to determine the efficient allocation q_s^* and would then impose this division of the available resource.

Departing from a market has significant implications for the efficiency properties of the intervention. An administrative allocation of spectrum to uses is equivalent to gifting this use an input at a price which does not fully reflect the opportunity cost of its use of this resource. This would be expected to distort this use's production decisions and would result in it using relatively too much of this input.

Further to this, both an administrative allocation and a bidder credit tie the intervention to the use of spectrum, rather than to the delivery of the socially desirable level of output (e.g. the delivery of universal access to high definition television). Hence, they could both result in firms unduly favouring

the use of this input to provide the desirable output. For example, to firms in receipt of this type of intervention, the delivery of high definition television over the terrestrial platform could appear to be unduly more efficient than using alternative platforms such as cable or satellite. Therefore, the only direct intervention which fully retains the efficiency properties of using pricing mechanisms to allocate spectrum is the provision of direct funding which is tied to the delivery of the desirable output (rather than the use of spectrum as an input)²².

The other two forms of intervention identified above, adjusting auction design and packaging and using a market-hybrid, are generally less direct forms of intervention – they work by restricting the ability of other uses to compete, either by excluding some of them through pre-qualification or beauty contest criteria, or by making the spectrum which is on offer relatively less valuable to bidders who do not create social value externalities. The impact of these types of intervention on a spectrum market is to reduce the marginal willingness to pay for spectrum of users that do not generate social value externalities. This type of intervention can result in a socially efficient allocation of spectrum between uses, but is likely to have knock-on effects on the efficiency with which these uses use spectrum:

- Reducing (or excluding) the willingness to pay for spectrum of uses which do not generate broader social value will reduce the price at which spectrum is sold, and therefore, the market price will under reflect the true opportunity cost of the use of spectrum.
- Reducing the willingness to pay for spectrum of some uses will mean that these uses under-reflect the private value they generate from the use of spectrum in their decisions.

Further to this, whilst these two interventions retain some of the efficiency properties of market mechanisms, like bidder credits, they both lose the incentives to choose efficiently between spectrum and non-spectrum delivery platforms (e.g. the DTT platform versus cable and satellite).

The analysis of the effectiveness of the five intervention options is summarised in the following diagrams, which show how each of the categories of intervention measure up against the two distinguishing factors identified.

²² This is consistent with the Diamond and Mirrlees, 1971, result that in setting policy to maximise welfare in a second-best situation it is not desirable to tax (or subsidise) the use of inputs.

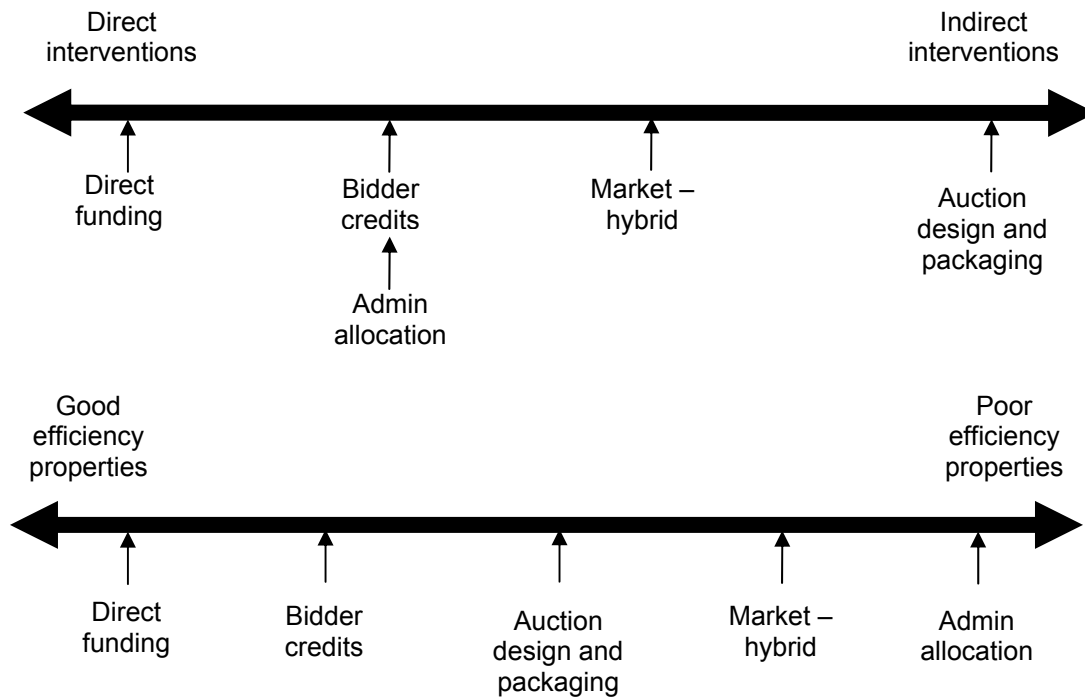


Figure 5: Intervention effectiveness

Therefore, in summary, in terms of likely effectiveness of the interventions as reflected in the degree to which the intervention solves the problem and the wider impact of the intervention on the firms involved:

- Direct funding tends to score well as an intervention option. It is the most direct form of intervention and (partly as a result of this) it retains the efficiency properties of markets both in relation to the primary market for the spectrum and in relation to the interplay between this market and other input markets.
- Bidder credits also score relatively well; they are a direct form of intervention and they retain good efficiency properties in the primary award of the spectrum.
- Auction design and packaging performs particularly badly in terms of directness but retains some of the efficiency properties of the primary award of the spectrum.
- Market-hybrids general score relatively low on both measures, whilst they are more direct than interventions based on auction design and packaging, they potentially lose even more of the efficiency properties of the primary award of the spectrum as they are likely to more severely restrict the uses which can take part in the market process.
- Administrative allocation, on the other hand, scores well in terms of its directness, but very low in relation to its efficiency properties; it loses all of the efficiency properties of both the primary market for the spectrum and in relation to the interplay between this market and other input markets.

Application of step 4 - is the cure worse than the disease?

Whilst market failures are given significant prominence in regulatory decision making (they are generally the reason why regulatory agencies exist in the first place) the presence of regulatory failures are generally given less attention. However, consideration of these issues can provide a useful guide to decision making.

As indicated earlier, Coase identified two reasons why regulatory decisions may result in error:

“... an administrative agency which attempts to perform the function normally carried out by the pricing mechanism operates under two handicaps. First of all, it lacks the precise monetary measure of benefit and cost provided by the market. Second, it cannot, by the nature of things, be in possession of all the relevant information possessed by the managers of every business which uses or might use radio frequencies, to say nothing of the preferences of consumers for the various goods and services in the production of which radio frequencies could be used.”²³

In Ofcom's analytical framework these have been translated into two general sources of regulatory failure:

- The risk of **unintended consequences** – these occur when regulatory decisions have knock-on effects which could not be accurately predicted at the time of the intervention. This can, for example, include distorting competition in downstream markets or restricting the dynamic incentives of markets to use spectrum efficiently (this is particularly likely with interventions which distort the signals which emerge from pricing mechanisms).
- Failure to achieve the **desired effect** – these occur when regulatory decisions either do not correctly identify the problem to be resolved (this is particularly likely when there is significant uncertainty and limited information) or when the intervention which is chosen does not actually solve the problem (the risk of this is particularly high for indirect forms of intervention).

The likelihood of an intervention resulting in a regulatory failure and its potential significance is generally highly dependent upon the circumstances in which the decision is being made. When decisions are being made under significant uncertainty and involve complex interactions between firms in a market or between markets, the likelihood of regulatory failures occurring is significantly higher. Therefore, in order to identify the likelihood of regulatory failures in relation to the intervention options for resolving social value externalities in the award of the digital dividend spectrum in the UK, it is important to identify the factors which are likely to make these interventions susceptible to regulatory failure. The following factors have been identified as such factors:

²³ See Coase, 1959, p18.

- Distortions of pricing signals – interventions which work by distorting the price which is paid for a resource such that it does not fully reflect the opportunity cost of its use, are likely to be subject to *unintended consequences* in the future by distorting (and in some extreme cases removing) dynamic incentives to change the use of a resource. This is in part driven by the pace of technological convergence which means that, in the future, there is likely to be a greater choice of delivery mechanisms for the delivery of any particular service.
- The certainty with which the opportunity cost is incurred – whilst the different options for intervention are not always distinguishable in terms of the size of their opportunity cost (assuming they are effective), they do differ in terms of the likelihood of this opportunity cost being incurred. Where there is some uncertainty over whether the benefit of resolving the market failure is greater than the opportunity cost, interventions which allow this trade-off to be tested through a pricing mechanisms are likely to be less prone to regulatory failure due to *a failure of the regulation to have the desired effect*.

Taking these two factors into account, it is possible to further distinguish between the different intervention options which could be used to resolve social value externality market failures.

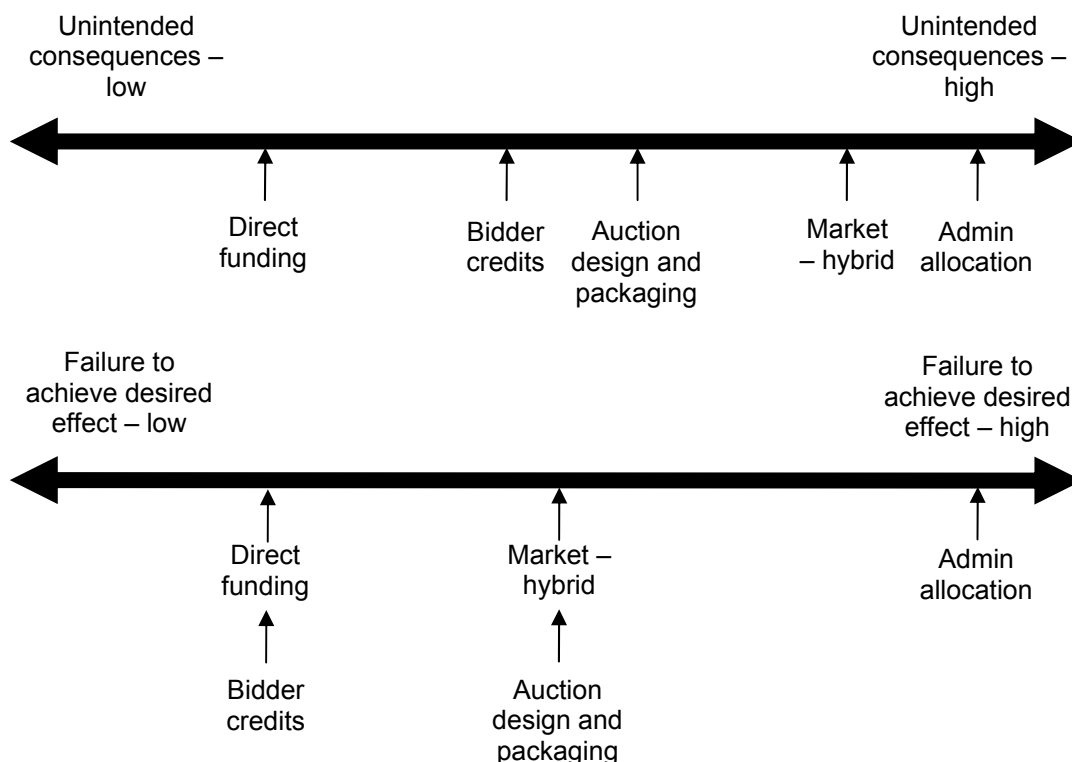


Figure 6: Regulatory failure assessment

Therefore, in summary, in terms of likely impact of regulatory failures:

- Direct funding tends to score relatively well against both forms of regulatory failure. This form of intervention directly targets the level of output in downstream markets, achieves this without distorting the pricing signals resulting from the spectrum market or other input markets, and allows the opportunity cost of the intervention to be traded-off against the benefits. However, whilst this intervention is relatively less likely to be subject to both forms of regulatory failure, the information required to set the level of direct funding accurately means that even this form of intervention may still be subject to a reasonably high risk of regulatory failure.
- Bidder credits are also relatively less likely to be subject to regulatory failure; they retain the pricing signals from the primary market for the award of the spectrum and allow the opportunity costs of the intervention to be traded-off in the market. However, as with direct funding, the level of information required to set the bidder credit accurately is significant. Hence, the overall level of regulatory risk may still be reasonably high.
- Auction design and packaging performs relatively badly in terms of both unintended consequences and failure to achieve the desired effect. It is likely to distort downward the prices which result from a pricing mechanism, and if the packaging and design significantly favour one use over others, this could have unintended impacts upon the ability of secondary markets to re-allocate spectrum in the future. In addition, whilst this intervention does allow the market to trade-off the opportunity cost of the intervention against the benefits, the benefits are non-transparent given the indirect nature of the intervention. The indirect nature of the interventions significantly increases the likelihood of this intervention failing to achieve the desired effect.
- Market-hybrids general score relatively badly against both forms of regulatory failure. This intervention is more restrictive than auction design and packaging in the use of the market to allow the opportunity cost of the intervention to be traded-off against the benefits. However, as the intervention is more transparent than auction design and packaging, these two intervention types scores broadly the same on a measure of failure to achieve the desired effect. In relation to unintended consequences, this form of intervention scores lower than auction design and packaging as it loses even more of the pricing information of the primary award of the spectrum, as it is likely to more severely restrict the uses which can take part in the market process.
- Administrative allocation scored very badly on both measures of the likely impact of regulatory failure. Its complete departure from a market mechanism means that it does not allow the opportunity cost of spectrum to be traded-off against the benefits of intervention, and the loss of any pricing information is likely to have severe implications on the future incentives for re-allocation of spectrum between uses.

Summary of assessment of intervention options and regulatory failures

The analysis of different intervention options is summarised in the table below. This appears to show a clear *a priori* hierarchy of intervention options if you are seeking to resolve market failures which result from the presence of social value externalities.

Table 1: Summary of intervention options analysis

Ranking	Direct form of intervention	Efficiency properties	Likely impact of unintended consequences	Likely impact of failure to achieve desired effect
1	Direct funding	Direct funding	Direct funding	Direct funding & Bidder credits
2	Bidder credits & Administrative allocation	Bidder credits	Bidder credits	
3		Auction design and packaging	Auction design and packaging	Auction design and packaging & Market-hybrid
4	Market-hybrid	Market-hybrid	Market-hybrid	
5	Auction design and packaging	Administrative allocation	Administrative allocation	Administrative allocation

Direct funding is likely to be the first best intervention option, followed by bidder credits. After these auction design and packaging is likely to be marginally better than a market-hybrid, and administrative allocation is the intervention option which is of last resort.

An *a priori* ranking of intervention options for resolving social value externalities:

1. Direct funding
2. Bidder credits
3. Auction design and packaging
4. Market-hybrid
5. Administrative allocation

This ranking is consistent with the ranking of intervention options arrived at by Ofcom in its digital dividend review consultation. The results of the application of the framework by Ofcom to potential social value externalities generated by the use of the digital dividend for high definition television on the DTT platform is set out in summary form in section 5 below.

Care should be taken when interpreting this hierarchy more widely. The hierarchy provides an indicative ranking of the different options but the importance of each of the driving factors used in the analysis will depend upon the particular circumstance of the proposed intervention. For example, the

key reason why direct funding tends to score more highly than bidder credits is because it ties the intervention to the desired downstream output, rather than to the use of spectrum as an input. The significance of this will depend upon the likely importance of spectrum as an input in the production of the desired downstream output both now and in the future. If spectrum is an essential input (i.e. there are no alternative delivery mechanisms) then the significance of this difference is likely to be small. However, if there are a number of viable alternatives the importance of this difference could be significant. For example, there are number of different platforms which could be used to deliver high definition television in the UK, hence, when assessing different intervention options in relation to this use it is important to consider whether some of these may allow the relative benefits of different platforms to be traded-off in the future.

The ranking of the different intervention options against the factors set out above should not be considered to be additive. The ranking of the interventions across the different factors are in many cases driven by common elements – the key reason administrative allocation scores badly is because of its departure from market mechanisms. Hence, if the ranking scores of the interventions were added together to get an implied overall ranking, there is a risk of double (or triple etc...) counting the fact that this intervention departs from a market approach. However, we do not believe this invalidates the use of the different factors set out above.

Even though there is some commonality in terms of how the interventions score across the different factors, this pattern is not universal: auction design and packaging scores relatively less well on the directness of the intervention than it does against the other factors, whilst administrative allocation scores relatively more highly against this factor. Additionally, the fact that departing from market mechanisms has a wide-ranging impact upon the likely success of an intervention is an important consideration which is evident from the assessment set out in this section and shouldn't be lost.

The assessment of the effectiveness of different intervention options and their susceptibility to regulatory failure can provide a useful guide for implementing interventions as well as for choosing between different categories of intervention. As indicated earlier, the broad intervention options set out in this section contain within them, in many cases, a plethora of implementation options. The different options for implementing each intervention are likely to impact upon its score against the different factors set out in the table above. For example, auction design and packaging could be used to favour one use to such a degree that it is equivalent to a market-hybrid which uses pre-qualification criteria to restrict the use of the spectrum to a single use. In which case, the relative preference for auction design and packaging over a market-hybrid would be lost. Therefore, not only can these factors be used to provide an indicative *a priori* ranking of the intervention options, they can also be used as a guide for how to implement an intervention in a way which minimises its bad points and accentuates its good.

Therefore, in summary, the use of a Coasian analytical approach to assess different interventions which could be used to resolve social value externalities in the award of the digital dividend in the UK has provided some general guidance for decision making:

- It has allowed the identification of an *a priori* ranking of intervention options for resolving social value externalities, which whilst not definitive, allows decision making to focus on interventions which are most likely to be successful.
- The identification of factors which are indicative of the effectiveness of intervention options and their susceptibility to regulatory failures provides a useful guide for how to implement any chosen intervention option in order to maximise the likelihood of success.

Section 5: A practical application of the framework

The preceding sections of this paper have provided a largely theoretical explanation of how Ofcom’s analytical framework was developed, its reliance on standard economic principles, and the key inferences which can be drawn from an application of the framework to the potential for market failure when some uses of spectrum generate value for society i.e. generate social value externalities. In this section we provide a summary of the results of the practical application of this framework to the question of whether Ofcom should directly allocate the digital dividend for the provision of high definition television on the DTT platform.

The table below shows the summary results from the application of the framework as published in Ofcom’s digital dividend review consultation. The detailed work underlying this summary can be found in Ofcom, 2006b. The analysis set out in this table highlights how consideration of each of the steps in the analytical framework can work in practice, how this can help to identify the nature of the problem, and provide a structured guide for decision making.

Table 2: Ofcom’s application of the analytical framework to arguments for intervention in relation to the provision of high definition television

<p>Identification of market failure argument</p>	<p>If other platforms move to HD in future, there may be a negative external value impact on consumers and citizens because of the impact of this on the attractiveness of the DTT platform if sufficient capacity is not available on the DTT platform to enable both HD and SD services to be broadcast. This impact on consumers and broader social value will not be factored into the DTT providers’ and operators’ willingness to pay for spectrum</p>	<p>If the availability of PSB content in HD becomes important for the realisation of broader social values from universal availability of PSB content, the impact of the availability of additional capacity on the ability to realise this value to society may not be adequately reflected in DTT providers’ and operators’ willingness to pay for spectrum</p>
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<p>Assessment of risk of market failure</p>	<p>Widespread or complete transition to HD is possible, although uncertain. If this transition does take place there is a range of strategies PSBs could use to deliver the main five channels in HD, including on the existing multiplexes, deploying Freesat, using cable and satellite networks, developing IPTV services and acquiring more DTT capacity. Therefore benefits of providing more DTT capacity for HD in the available UHF spectrum may be relatively limited</p>	<p>The occurrence of this market failure depends on a number of assumptions, all of which are uncertain. These include the universal requirement for PSB content in HD, the need to realise this objective via the DTT platform and the need for additional spectrum to allow the DTT platform to achieve this. It is also unclear whether or not DTT providers and operators would be able to factor this effect into their bid for additional spectrum</p>
<p>Options for intervention and opportunity cost of spectrum</p>	<p>Option 1. Direct grant of spectrum - likely to be high opportunity cost</p> <p>Option 2. Advantage DTT bidders in an auction - opportunity cost could be high depending on scale of intervention</p> <p>Option 3. Financial and institutional framework to allow acquisition of spectrum if this is best use of resources available - opportunity costs expressed through transparent process for releasing spectrum</p>	
<p>Assessment of risk of regulatory failure</p>	<p>Option 1. Direct grant of spectrum - high, given uncertainty about future development of HD</p> <p>Option 2. Advantage DTT bidders in an auction - high, given uncertainty about future development of HD</p> <p>Option 3. Financial and institutional framework to allow acquisition of spectrum if this is best use of resources available - low, regulatory intervention minimised could result in excess supply of DTT if it over-compensates for market failures that are not certain</p>	
<p>Conclusion</p>	<p>Do not intervene, but package spectrum in a way that enables potential DTT users to acquire spectrum</p>	

Source: Figure 8.10, Ofcom 2006b

Conclusion

The aim of this paper has been to demonstrate how a Coasian analytical approach to assessing market failures can be used to assess whether wider societal benefits generated by broadcasting uses of spectrum can invalidate a market-based approach to spectrum allocation. This was the key policy question Ofcom faced when developing its proposal to award the digital dividend in the UK via a market, and the analytical framework it developed to help answer this question provides a useful guide for regulatory decision making.

The key points which have emerged through the application of this framework are as follows.

- The presence of social value externalities is an issue which requires careful consideration when designing spectrum auctions. It seems clear that many uses of spectrum, including broadcasting, can generate sources of value for us as citizens (i.e. members of society) as well as value for us as consumers (i.e. value derived directly from consumption). Hence, in principle, many uses of spectrum generate positive social value externalities which may not be reflected in market mechanisms. Therefore, there may be some validity in the claim that broadcasting generates sources of value which may not be reflected in a market, but this problem is not unique to broadcasting.
- The presence of social value externalities is not a justification for departing from pricing mechanisms either in theory or in practice. The assessment of options for resolving this market failure provides a clear hierarchy of intervention options, and departing from a market entirely is the option of last resort. There are a number of other intervention options which are likely to be preferable, and which can allow a market to work when social value externalities are present. These include:
 - using direct funding, whereby users who generate broader social value are given funds to acquire resources, such as spectrum, in return for their commitment to deliver a socially desirable outcome; and
 - the provision of bidder credits, which adjust within the market process the amount some bidders have bid, to more accurately reflect the broader social value those bidders generate.
- Two steps of the analytical framework used in this paper, which were particularly helpful in arriving at this conclusion, are the assessment of the effectiveness of interventions and the likelihood of regulatory failure. These two steps show how careful assessment of the merits of different intervention options, and of the reasons why some interventions may be prone to error, can allow a regulator to design interventions which have a higher likelihood of success.

- As well as being theoretically sound, the analytical framework discussed in this paper provides a useful practical guide for regulatory decision making. The application of the framework to arguments for direct allocation of the digital dividend to the terrestrial broadcasters in the UK for the provision of high definition television has allowed Ofcom to identify clearly the strengths and weaknesses of this argument for intervention, and to reach the conclusion (as expressed in its consultation document) that a market process would be more likely to efficiently allocate this spectrum than a direct allocation of the resource by the regulator.

Overall, the results of the work discussed in this paper suggest that the contention referred to in the introduction (that *“the belief that broadcasting industry is unique and requires regulation of a kind which would be unthinkable in the other media of communication is now so firmly held as perhaps to be beyond the reach of critical examination”*²⁴) may be close to being disproved in the UK. It is hard to avoid the conclusion that the current debate over whether broadcasters can compete against other spectrum uses in a market owes more to *“the fact that the possibility of using [a market] has never been seriously faced”*²⁵ than to any fundamental failure which would preclude the use of a spectrum market.

²⁴ See Coase, 1959, p40.

²⁵ See Coase, 1959, p24.

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