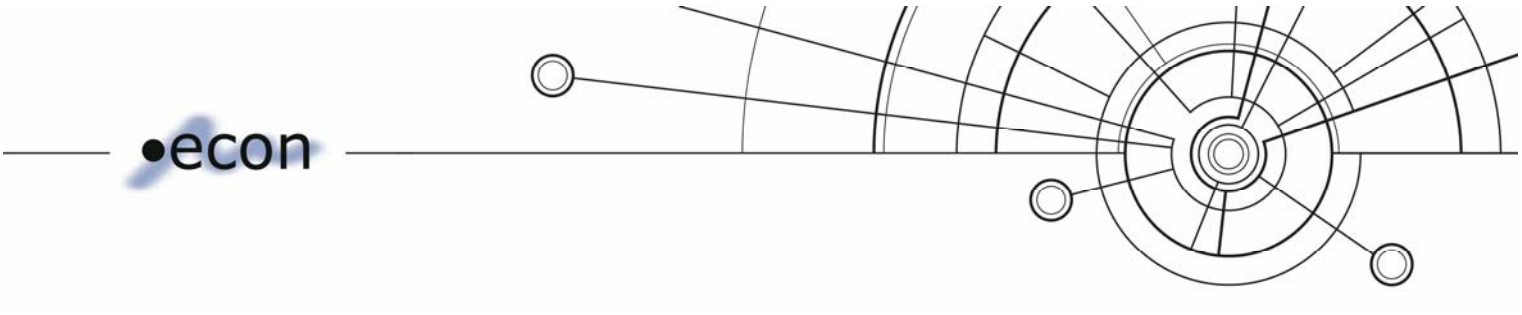

Spectrum charging and public service broadcasting

April 2006

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Tables & Figures

Executive Summary

This paper explores the economic rationale for applying spectrum charging to the BBC and Channel 4	Ofcom is expected to consult in the near future on the application of spectrum charges to the broadcasting sector for the period after digital switchover. In anticipation of this consultation, this paper explores the economic rationale for introducing spectrum charging to not-for-profit public service broadcasters (PSBs), such as the BBC and Channel 4. We find that provided – as is already happening - trading in DTT[1] capacity functions effectively, and the amount of spectrum awarded to PSBs is commensurate with their public service obligations, then spectrum charging will not create any additional incentives for efficient use of spectrum. It would, however, significantly affect the funding of PSBs, potentially disrupting their ability to fulfil their public service obligations.
Spectrum charging is a key tool of market-based spectrum management and its use for spectrum used by broadcasters has been recommended.	Spectrum charging is one of the main tools of the more market-based approach to spectrum management pursued by Ofcom over recent years. The Cave Review[2] recommended that charging should be applied to most categories of spectrum user who have not been awarded spectrum through an auction. This would include extending charges to spectrum used by not-for-profit PSBs, such as the BBC and Channel 4, and revising the payments made by commercial broadcasters with public service obligations, such as the ITV licensees and Channel 5 (whose Broadcasting Act licences already include an implicit charge for access to scarce analogue spectrum).

[1] Digital terrestrial television

[2] Review of Radio Spectrum Management for the DTI and HM Treasury, March 2002.

No charges are likely to be made for analogue spectrum but Ofcom is considering whether and how to introduce charges for digital spectrum post-switchover

The Government has in principle accepted this recommendation. However, it has committed not to introduce spectrum charges for analogue spectrum before 2006 and not to charge for digital spectrum prior to the expiry of the current multiplex licences. Ofcom's view is that charges should not be applied to analogue spectrum provided that broadcasters conform to the planned timetable for digital switchover.[3] It has not yet made a formal policy decision on applying charges to digital spectrum but is expected to consult on this shortly. These commitments are in part intended to provide incentives for broadcasters to support and promote digital switchover.

The main objectives of spectrum charging are to promote efficiency of spectrum use...

Together with the use of auctions and introduction of secondary trading (supported by liberalisation of spectrum use), spectrum pricing is seen to promote efficiency in spectrum use by exposing users to the opportunity cost they cause, i.e. the highest value that could be generated from the spectrum in the best alternative use. Facing spectrum users with these costs in the form of charges (or prices emerging from auctions or trading) is expected to lead to efficiency because users have an incentive to reduce the amount of spectrum they use, move to less congested frequency bands, and provide those services that generate the highest value.

... and, when used alongside trading, to realise the scarcity value of spectrum for society as a whole rather than allowing spectrum users to realise windfall gains.

Spectrum charges may also be applied alongside spectrum trading (where users have not obtained spectrum through a competitive auction). Given that effective spectrum trading already exposes users to the opportunity cost of their use, the contribution of spectrum charging to improving efficiency is likely to be very small (although Ofcom believes that some users are more likely to respond to charges rather than the opportunity to gain from selling spectrum to others). The main role of spectrum charging in this case, as acknowledged in the Cave Review, is to ensure that society as a whole benefits from the scarcity value of spectrum by extracting this value which would otherwise lead to windfall gains for spectrum users.

[3] Ofcom, Spectrum Pricing – A consultation on proposals for setting wireless telegraphy act licence fees, September 2004, Section 8.

When considering the application of spectrum charges to broadcasters (and in particular PSBs), it is important to acknowledge that their scope for changing spectrum use is limited …

The main mechanisms by which spectrum users can respond to charges to improve the efficiency of their spectrum use are to release unused spectrum, implement more spectrally efficient technologies, use less congested bands, or use spectrum for the provision of higher-value services. However, the scope for PSBs to pursue these strategies is limited, given that they need to maintain compatibility with an existing base of receivers (digital TV sets or set-top boxes), and are under strict obligations regarding their coverage – unlike other spectrum users such as the MoD or the emergency services, they do not control both the sending and the receiving end of transmissions within closed user groups, and thus cannot simply 'switch' to another platform. Such behaviour may anyway be undesirable from a public policy perspective, as this would undermine the attractiveness of the DTT platform, jeopardise the success of digital switchover or – if it were to happen after switchover – leave consumers who have invested in upgrading to DTT stranded. Indeed, there are restrictions on the use of spectrum allocated to broadcasters and multiplex operators to ensure that DTT is, and remains, an attractive platform to assist digital switchover.

… and that trading in DTT capacity already provides strong incentives for efficient use.

More importantly, the efficiency gains from introducing spectrum charges are likely to be very limited because strong incentives for efficient use already exist as a result of DTT slots being traded. Broadcasters have strong incentives to maximise the efficiency of their spectrum use in order not to have to buy additional capacity from commercial multiplex operators (or to gain from offering DTT slots on their multiplexes). These incentives exist regardless of whether broadcasters pursue commercial objectives, or are not-for-profit organisations such as the BBC and Channel 4 pursuing public service objectives. Given that both broadcasters compete for viewers in order to deliver PSB impact (and, Channel 4 also competes for advertising revenue), they need to make the most of the spectrum they have been awarded by using it to offer attractive programming, or to generate revenues that can be ploughed back into programming. Indeed, the BBC and Channel 4 are already participants in the market for DTT capacity notwithstanding the current absence of spectrum charging.

Thus, spectrum charges would mainly extract the scarcity value of broadcasting spectrum (i.e. perform the same function as payments made by ITV and five under their Broadcasting Act licences).

Therefore, the main role of applying spectrum charging to broadcasters will be to realise the economic value of spectrum for the government rather than providing (potentially large) windfall gains to spectrum users. As such, spectrum charges would perform the same function as the payments (made up of a fixed amount and a charge set on the basis of qualifying revenue) that have to be made at present by commercial broadcasters under their Broadcasting Act licences (or similar payments by multiplex operators which are provided for, but currently not used under the terms of their multiplex licences). Indeed, these payments are generally acknowledged to include a fee for the use of scarce spectrum, and would, in Ofcom's view, have to be reduced if charges for the use of analogue spectrum were introduced.

This scarcity value supports the BBC and Channel 4 in their public service roles - applying spectrum charges to those broadcasters would reduce or remove this support.

By contrast, the BBC and Channel 4 are at present allowed to benefit from the scarcity value of spectrum in support of their public service role. Rather than extracting a windfall gain, applying spectrum charges to such broadcasters would simply reduce their funding. Making these broadcasters pay for their spectrum use would reduce or, in the case of Channel 4, almost entirely remove the support they currently receive, and would therefore undermine their ability to fulfil their public service remit.

Spectrum charges might amount to up to 10-11% of the BBC's and Channel 4's programme spend.

Indicative calculations of the likely value of spectrum charges suggest that applying such charges to the BBC or Channel 4 - who would not benefit from a reduction in other licence payments and have little flexibility to reduce the amount of spectrum they use – would be significant in relation to their programming budgets. For example, such charges might amount to up to 11% of the BBC's spend on programming transmitted on its public service television channels, and to around 10% of Channel 4's programming budget.

In order to allow PSBs to continue in their role additional funding from elsewhere would need to be provided.

Unlike ITV or Channel 5, the BBC and Channel 4 cannot simply return their PSB obligations and avoid spectrum charges in this way. With practically no alternative to paying, facing spectrum charges would reduce the amount of money available for programming. Public service broadcasters would not be able to continue fulfilling their obligations without additional funding from elsewhere (e.g. a higher licence fee in the case of the BBC or direct subsidies in the case of Channel 4). The need for such compensation that would arise from the application of spectrum charges to public service broadcasters such as the BBC and Channel 4 is generally acknowledged, and already mentioned in the Cave Review. The social benefit associated with PSB obligations implies that a corrective mechanism is needed in order to avoid under-provision that might arise in a purely market-based environment.

Comparing a situation in which PSBs are charged for spectrum, but compensated for their higher cost with a situation in which they receive free access to spectrum shows that gifting spectrum is the better option.

Thus, unless one accepts a likely reduction in the scope of public service broadcasting as a result of spectrum charges, the relevant question is whether it is better to make PSBs pay for spectrum and provide the necessary funds, or to continue with gifting spectrum in support of their PSB role. A comparison of these two options shows that gifting the amount of spectrum that is considered to be commensurate with the public service obligations under which broadcasters operate (which in turn should be properly defined in the political process through mechanisms such as the BBC Charter Review and an equivalent process for Channel 4) is a better solution because it avoids the need to predict the likely future value of spectrum and avoids the risk that PSBs might be unable to fulfil their remit. Provided that such broadcasters can trade DTT capacity at the margin (and are free to lease unused capacity), gifting this amount of spectrum does not undermine incentives for efficient use. Gifting spectrum would not distort competition relative to providing financial support, and would be equally transparent.

Support to PSBs through spectrum grants is entirely consistent with the core objective of the Cave Review and Ofcom's objectives for spectrum management.

We therefore believe that free access to the spectrum that public service broadcasters are considered to need in order to discharge their obligations should continue to be provided in support of the BBC and Channel 4's roles. Provided that broadcasters have flexibility to trade spectrum and DTT capacity, and that the value of gifted spectrum is transparent, this recommendation should be entirely consistent with the core objective of Ofcom, the Cave Review and Government policy in this area, which is to maximise incentives for efficient use of spectrum.

1 Introduction and background

1. The last decade has seen a fundamental shift in the way in which radio spectrum – a key, and often scarce, input in the provision of many services – is managed. The old command-and-control approach to spectrum management is gradually being replaced by a more market-based approach, relying on price signals (in combination with liberalisation of spectrum use) in order to determine:

   - for what purposes spectrum should be used (allocation); and
   - who should be using it (assignment).[4]

2. The underlying rationale is that prices (whether in the form of spectrum charges set by the regulator, competitive bids in spectrum auctions, or emerging from secondary trading) are an effective instrument for signalling to each (prospective) spectrum user the opportunity cost of its use. Responses to these price signals will then promote the efficient use of spectrum. Administered Incentive Pricing (AIP), under which the fees paid by spectrum licensees are not set with reference to the administrative cost incurred in managing it, but rather at a level that reflects the economic value of the spectrum they use, plays a key role within this framework.

3. In order to maximise the efficiency gains that can be expected from such a market-based approach spectrum pricing may be applied across all spectrum uses and spectrum users, including broadcasting. This was one of the recommendations coming out of Professor Martin Cave's 'Review of Radio Spectrum Management' in March 2002 (the Cave Review). At present only commercial terrestrial broadcasters (namely the ITV licensees and Channel 5) pay for access to scarce analogue spectrum through the Additional Payments for which they are liable under their Broadcasting Act licences. Channel 4 and the BBC, by contrast, do not make any payments for their use of spectrum, but rather enjoy free access to spectrum as an in-kind contribution towards the funding of their public service remit.

4. The government, in its response to the Cave Review, agreed "*that spectrum pricing is a tool which should be applied to all broadcasters to promote the most efficient use of spectrum*."[5] It also acknowledged that the key issue in relation to the application of pricing to spectrum used for television services was the successful migration to digital TV broadcasting, which would in itself

[4] The distinction between allocation and assignment is the same as used in the Review of Radio Spectrum Management for the DTI and HM Treasury, March 2002 (the Cave Review), where allocation is defined as "reserving frequency bands for one or more broad service categories" and "[o]verlaying this service allocation … a further reservation of spectrum to particular users", and assignment refers to "granting use of specific frequencies for transmission within a given location to a particular user, consistent with the allocated service" (p 45).

[5] Government Response to the Review of Radio Spectrum Management, October 2002, p35.

bring considerable efficiency gains. It was therefore considered desirable that AIP should provide incentives for broadcasters to promote digital switchover. At the same time, proposals for AIP should take account of the ability of TV broadcasters to meet their public service obligations, and other extant regulatory arrangements. Overall, this means that at present there will be no specific charges for the use of analogue spectrum (provided that broadcasters cease to use such spectrum in line with the plans for digital switchover)[6], and there is a commitment not to apply AIP to spectrum used for digital terrestrial television (DTT) until expiry of the current multiplex licences.

5. More specifically, Ofcom has consulted on the application of AIP to analogue television broadcasting[7], and presented four options, namely:

- not to introduce AIP for analogue TV spectrum (Option 1);
- a full application of AIP from 2006 (Option 2a);
- a phased application of AIP to analogue spectrum in line with the plan for digital switchover (i.e. fees would apply on a regional basis from the date on which switchover in the region is due to be completed – Option 2b); and
- an application of AIP in full from the date when switchover is due to be completed nationwide (Option 2c).

6. Based on its impact assessment for each of these options (taking account of obligations to create conditions for switchover on the BBC and on commercial PSBs under the terms of their digital replacement licences), Ofcom rejected Options 1 and 2a, and identified Option 2b as its preferred one. No firm decision has been made, however, and the issues raised in Ofcom's consultation document, perhaps with further issues related to digital television spectrum, will be part of a further consultation.

7. In its consultation, Ofcom explicitly considered the impact of spectrum charging on broadcasters who are currently making payments for their access to analogue spectrum through Additional Payments under the Broadcasting Act licences, and how a situation could be prevented in which such broadcasters were paying twice. Ofcom failed, however, to consider the implications of spectrum charging for broadcasters who are not making such payments (i.e. Channel 4 and the BBC) but whose public service role is supported (wholly or in part) through free access to spectrum. Although such broadcasters would not face the risk of double payments, they might find themselves in a situation in which their funding is significantly reduced,

[6] Other than those included in the Additional Payments made by commercial broadcasters under the terms of their Broadcasting Act licences, which would in any case be reduced to the extent that spectrum charges for analogue spectrum were to be levied.

[7] See Ofcom, Spectrum Pricing – A consultation on proposals for setting wireless telegraphy act licence fees, September 2004, Section 8.

and in which they might therefore be unable to continue discharging their public service remit.

8. The implications of analogue spectrum charging for broadcasters, and in particular public service broadcasters who are not liable for Additional Payments, are of limited relevance given that under Ofcom's preferred option broadcasters would not pay (additional) spectrum fees for their use of analogue spectrum, provided they cease using such spectrum in line with the digital switchover plan. However, the impact of spectrum charging on public service broadcasters will take centre stage in any consideration of spectrum charging for DTT spectrum following the expiry of the current multiplex licences, and a key question is whether, and in what form, public service broadcasters should pay for access to spectrum.

9. We have been asked by the BBC and Channel 4 to provide an economic assessment of the case for and against applying spectrum charging to public service broadcasters, considering alternative forms of support and the potential impact of gifting spectrum on efficiency. Overall, we find that there is a robust economic case for continuing to support public service broadcasters by providing free access to the spectrum they are considered to require in order to fulfil their public service remit.

10. The reminder of this document is structured as follows. In Section 2, we review the rationale for AIP, and consider the role of AIP alongside other mechanisms that would expose spectrum users to price signals. In Section 3, we explain why trading opportunities alone provide adequate incentives for public service broadcasters to use spectrum efficiently, and show that the BBC and Channel 4 have responded to these incentives. Section 4 addresses the likely impact of spectrum charging on broadcasters and shows that such charges would have a significant effect on the ability of the BBC and Channel 4 to discharge their public service obligations. Section 5 considers the relative merits of providing support to PSBs in the form of free access to spectrum in comparison with increased (or explicit) funding in order to compensate them for the cost increase suffered by PSBs as a result of spectrum charging.

11. Having demonstrated why it would be inappropriate to apply AIP to the core spectrum assigned to public service broadcasters, we present our conclusions in Section 6. We find that continuing with gifting spectrum to the BBC and Channel 4 is an appropriate form of support. The value of such support will obviously need to be considered in defining – through an appropriate political process - the scope of the public service obligations for which broadcast spectrum should be set aside. This may require a periodic review of the amount and value of spectrum gifted to the public service broadcasters in the same way that other forms of funding would be reviewed. For the BBC, this review could form part of Charter Review, with an equivalent process for Channel 4. Provided that the BBC and Channel 4 retain the commercial flexibility to buy, sell and lease spectrum, this will ensure that they face the full opportunity cost of their spectrum at the margin, which is both necessary and sufficient for achieving efficiency (subject to the constraints defined by the decision to have specific public service obligations fulfilled through the use of broadcast spectrum).

2 Spectrum charging and efficiency

12. With the move from a command-and-control approach to spectrum management to a more market-based way of allocating and assigning access to frequencies, spectrum charges have become an important instrument for spectrum managers. Together with spectrum trading (accompanied by spectrum liberalisation) and the use of auctions for the primary allocation of spectrum, administered incentive pricing (AIP) is aimed at achieving an outcome in which spectrum is used for those purposes, and by those users, that generate the greatest benefit for the economy and society.

2.1 AIP and efficiency

13. The Wireless Telegraphy Act 1998 (WT Act) enables prices for spectrum licences to be set above the administrative costs incurred in managing them in order to encourage efficient use of spectrum and reflect other spectrum management objectives. This facility, known as Administered Incentive Pricing, provides for the use of prices as a tool for spectrum management.

14. In order to promote efficiency, spectrum charges based on AIP should expose users of radio spectrum to the opportunity cost of their use. Opportunity costs reflect the highest value that could be generated from the spectrum in question by other users, or in other uses. When faced with a price set at opportunity cost, a prospective user will decide to use spectrum if and only if its own valuation exceeds the value placed upon the spectrum by the highest alternative user. Otherwise, the prospective user would prefer to use less spectrum, spectrum in a different frequency band (where there is less competing demand and thus opportunity costs are lower), or not to use spectrum at all.

15. Provided that spectrum charges correctly reflect opportunity costs, and that each prospective spectrum user's willingness to pay correctly reflects the benefits from its use to society, spectrum will end up being used by those who generate the most benefits. Spectrum charges based on AIP have the same effect as prices generated in a competitive market in terms of producing an economically efficient outcome. As noted by Ofcom[8], pricing can:

- promote allocative efficiency[9] by rationing demand "*so that only those who value an additional unit of spectrum more highly than the price charged for it will demand more spectrum*", thus producing an outcome

[8] See Ofcom, Spectrum Pricing – A consultation on proposals for setting wireless telegraphy act licence fees, September 2004, p 15 f.

[9] Allocative efficiency is achieved when output is expanded up to the point where the value placed upon an additional unit is equal to the cost of producing this additional unit, and is consumed by those who value it most highly.

in which "*it would not be possible to increase the total value generated from the spectrum by reallocating spectrum from one use to another*" or, indeed, from one user to another;

- achieve productive efficiency[10] by reflecting "*its value at the margin in terms of the cost of other inputs saved by using spectrum*", which means that spectrum will only be used if it allows its user to produce output at a lower cost than using alternative inputs; and
- promote dynamic efficiency[11], through regular adjustments to prices in light of changes in technology and consumer preferences.

16. In the absence of market benchmarks (such as prices observed in a competitive auction), regulators do not have direct information about the highest value that an alternative user would place on the spectrum. Instead, Ofcom's predecessor, the Radiocommunications Agency (RA), used a proxy methodology developed in 1996 by NERA and Smith Systems.[12] The NERA Smith approach calculates AIP as the least cost alternative to using spectrum that would enable the same output to be produced. This could be achieved via an alternative technology such as fibre cables in the case of fixed wireless links, or it could imply moving to a less congested spectrum band. This is the maximum amount that a marginal user would be willing to pay for the spectrum – which in a competitive market in which there were many similar prospective spectrum users, should be equal to the opportunity cost of spectrum use.

17. AIP has gradually been rolled out to most spectrum licences where usage fees are charged but fee levels have historically been set very cautiously (they were initially limited to 50% of the levels recommended by NERA Smith). In part, this reflected concern that setting prices is an inexact science, and setting them too high could unnecessarily choke off efficient use. However, in 2002, the Cave Review recommended that greater use should be made of auctions and pricing. In particular, in relation to spectrum charging, it recommended that:

- AIP should be applied at more realistic levels and more comprehensively across spectrum uses; and

[10] Productive efficiency is achieved when a given quantity of output is produced at the lowest possible cost, i.e. by the cheapest supplier using the most cost effective production technology, given input prices that are competitively determined, or otherwise set so as to reflect the value foregone by using a resource such as spectrum in the provision of one particular service rather than the next best alternative.

[11] The notion of dynamic efficiency relates to productive and allocative efficiency being maintained over time. Dynamic efficiency implies that product and process innovation takes place whenever the value generated by new products or the cost savings obtained from better processes exceeds the cost of innovating.

[12] 'Study into the Use of Spectrum Pricing', NERA and Smith System Engineering Limited, April 1996.

- where AIP is already implemented and there is evidence of spectrum shortage, prices should be set at full opportunity cost level.

The Government broadly agreed with the findings of the Cave Review and charged the new Communications regulator, Ofcom, with the task of reviewing the methodology for valuing spectrum and for setting fees.

18. In 2003, Ofcom commissioned a review of AIP by a consortium of Indepen, Aegis and Warwick Business School. Indepen largely confirmed the validity of the original NERA Smith approach but widened the opportunity cost methodology by recommending that the value of spectrum be based on alternative uses in addition to the existing use in the spectrum band. The report also recommended the application of AIP to an increasing range of spectrum uses, including broadcasting, and provided a new set of illustrative values for setting AIP based prices. These developments were in line with Ofcom's parallel shift to a more holistic approach to spectrum management, in which different frequencies are opened up to a variety of uses on a liberalised basis.

19. Subsequently, Ofcom has introduced proposals for spectrum pricing reform for a variety of spectrum bands[13], such as fixed links and private business radio, with revisions in part based on Indepen's recommendations. The first changes were introduced in 2005. However, no decision has yet been made on applying AIP to broadcasting. As discussed in Section 1, Ofcom has put forward a possible plan for applying charges to analogue spectrum but has not yet made any proposals for charges for DTT spectrum, which anyway would not be introduced until after the expiry of the current multiplex licences from 2010 onwards.

20. In general, widening the approach to calculating AIP to take account of alternative uses as well as users should make it more likely that AIP will reflect the true opportunity cost of spectrum use, and thus encourage more efficient spectrum use. However, this is by no means straightforward:

- The introduction of liberalisation, along with trading and revisions to spectrum charges, promises a transformation in spectrum supply conditions. Increased spectrum availability for high value uses could diminish opportunity cost, as demand for these uses is satisfied, although this may be offset by new sources of demand. Therefore, as Indepen has acknowledged, AIP calculations based on the current status quo may quickly become out of date and will need to be regularly reviewed.
- Consideration of alternative uses in spectrum charging is only relevant to the extent that change of use is permitted by Ofcom. In practice,

[13] Ofcom, Spectrum Pricing – A consultation on proposals for setting wireless telegraphy act licence fees, September 2004; and Ofcom, Spectrum Pricing - A statement on proposals for setting Wireless Telegraphy Act licence fees, February 2005.

even in an environment of increasing spectrum liberalisation, there are usage regulations in many bands which either explicitly or de facto prevent particular uses. Thus, the opportunity cost of blocking alternative uses may be incurred at the regulatory level rather than the individual user, in which case it should not be a relevant consideration for spectrum charging. This reality is implicitly recognised in many of the methodologies developed by Indepen and Ofcom on a band-by-band basis but appears to be underplayed in broader policy discussions of spectrum pricing. This issue is particularly relevant to public service broadcasting, where the end user has relatively little discretion over actual use of its spectrum (see the discussion in Section 3).

- Historic decisions to allocate spectrum to particular uses sometimes reflected implicit recognition that a purely market-based approach might not allocate sufficient spectrum to that use. Such 'market failure' might result if a particular use – such as broadcasting – produces significant social benefits not reflected in end users' willingness to pay. For these types of spectrum use, calculating AIP solely on the basis of private values and excluding externalities could result in market failure in their provision. As the Cave Review acknowledges, *"spectrum pricing could potentially result in inefficient outcomes since it could result in too little of the socially beneficial activity being provided*".[14] However, both the Cave Review and Indepen Report argue that market failure issues should be addressed through alternate policy tools, such as subsidies, rather than through intervention in spectrum allocation. without considering whether such other tools can practically be implemented nor the implications for the justification of spectrum charges in case that other mechanisms ensure efficiency.

21. In sum, AIP – provided that it reflects real opportunity cost - can promote efficient use of spectrum. However, in a liberalised spectrum environment, considerable caution is required in setting AIP to ensure that only appropriate alternative uses are considered and that prices are not set too high such that they may deter efficient use over time.

22. One argument that Ofcom has put forward for maintaining AIP alongside trading is that some spectrum users may not be profit driven, and therefore may be insufficiently responsive to opportunities for gains from trades. However, there are usually good reasons why particular types of spectrum user have been developed as non-profit makers. Typically, it is because society has recognised the need to establish organisations with a wider remit that can consider social benefits alongside concepts of market efficiency. Hence, for example, the emergency services and defence enjoy privileged access to spectrum. Similarly, public service broadcasters have historically been granted particular spectrum as an implicit contribution towards the funding of their public service obligations, which, in turn, results from the

[14] Cave Review, p.124.

political decision that broadcast spectrum should be used for the fulfilment of public service objectives.

23. Both the Cave and Indepen reports advocate addressing market failure concerns through policy instruments applied to final service markets (e.g. price regulation in telecom markets, universal service obligations and content regulation of broadcasters or direct grants or subsidies to FWA for rural areas) rather than through changes to the pricing of an input such as spectrum.[15] However, they do not consider the practicalities of such interventions and whether on a case-by-case basis they would really allow for AIP to be imposed on such users without causing inefficiencies in provision. As we discuss in Section 5, there are real practical difficulties with devising a funding mechanism that would allow public service broadcasters to meet their obligations in the event that AIP was extended to all broadcasting spectrum.

24. In advocating AIP, Ofcom also highlights the need to take a cautious approach in setting spectrum charges so as to be sure they do not exceed opportunity cost. Even with only private values, this may be challenging, as the NERA-Smith methodology necessarily rests on many assumptions. Where there are also significant externalities, ensuring AIP is below the *real* opportunity cost of denying an existing use becomes much more difficult. In particular, unless Ofcom can be entirely satisfied that adequate policy instruments in final service markets are in place to address externalities, then there will be a significant risk of AIP contributing to the underprovision of socially beneficial services.

2.2 AIP and other market-based tools

25. AIP is only one of a number of tools that can be applied by spectrum managers to expose users to the opportunity cost of their usage. The other tools are primary auctions and secondary trading. Where applicable, these market-based approaches are generally preferable to the inexact science of setting administrative spectrum charges. Ofcom does not apply AIP to spectrum licences that have been auctioned. However, in the case of licences that have not been auctioned but are tradable, Ofcom argues that AIP can play a complementary role to trading in promoting efficient use. In practice, as we explain below, AIP offers only modest benefits over and above those that can be realised from trading.

2.2.1 AIP and auctions

26. Auctions are Ofcom's preferred approach for assigning newly available spectrum or existing licences that have expired. Where auctions are used, users are typically charged a one-off price determined by bidding in the auction which covers the full licence term. Provided the auction is

[15] Indepen et al., February 2004, An Economic Study to Review Spectrum Pricing, p.45; and the Cave Review, p.123-25 and p.171.

competitive, the final price should be at least equal to the opportunity cost of denying the highest value potential user that fails to win a licence.[16] Therefore, there is no need for any further charges to promote efficient use during the licence period. Indeed, the possibility of applying charges during the licence period (unless fixed in advance) would create uncertainty for bidders in the auction and might undermine the efficiency of the process. For these reasons, Ofcom does not impose AIP on spectrum licences that have been auctioned.[17]

27. Auctions can also provide benchmark prices for spectrum not assigned by auction. Consider the case of two adjacent bands which can be used to provide similar services, one of which has had licences assigned administratively and the other by auction. In this case, the auction outcome should provide a good indication of the value of the administratively assigned licences. This should provide a useful cross-check or potentially superior methodology to the NERA-Smith approach to calculating opportunity cost.

2.2.2 AIP and trading

28. Introducing secondary trading of spectrum should expose existing users to the full opportunity cost of their use and thus provide adequate incentives for efficient use of spectrum. Whenever there is an alternative user that values spectrum more highly than an existing one, both parties should have an incentive to trade. Thus, in a fully competitive spectrum market with secondary trading, there should be no need for AIP. Nevertheless, Ofcom has decided to maintain AIP for non-auctioned but tradable spectrum, arguing that spectrum charges are complementary to trading. This is a somewhat controversial position that has excited much comment in consultation responses to Ofcom.[18]

29. As we will demonstrate below, some of the same incentive properties that are associated with the possibility of trading spectrum arise in the case where spectrum users can trade capacity. In the case of spectrum that is being used, and should continue to be used for the provision of DTT broadcasting services, the trade in DTT slots provides the same incentives for improving spectral efficiency and ensuring that scarce transmission

[16] In a typical spectrum band, with scope for multiple users, an efficient auction should normally produce a price per MHz that lies between the willingness to pay of the lowest value winning bidder and highest value losing bidder.

[17] In this regard, the spectrum charges that are included in the Additional Payments for which commercial broadcasters are liable can be said to have been determined in a competitive auction, given that these licences were initially offered through a tender and that the financial terms upon their review are determined on the basis of what bids would be in a hypothetical auction. Clearly, the payments are not linked to spectrum use in the sense that a broadcaster would pay less if it used less spectrum – but given that the broadcaster has practically no discretion over the spectrum use, this would seem to be of limited relevance.

[18] Ofcom, A Statement on Spectrum Trading, August 2004, p42-44.

capacity is available for the highest-value user that would emerge if the underlying spectrum were traded.

30. In its statement on spectrum trading, Ofcom put forward a number of arguments in favour of maintaining AIP alongside trading, none of which are particularly compelling:

- *"the volume of trading may initially be low in some markets … and therefore will not fully promote efficiency"*. There may be a variety of reasons why trading volumes are low in any particular band, for example because the number of licences is modest, most spectrum is already assigned to the highest value user or there is little excess demand. It does not necessarily follow that AIP would increase turnover, nor that it would provide a stronger incentive for marginal users to surrender spectrum. Further, this argument is not obviously relevant to DTT capacity, where there is already a relatively active market for slots, with the last three available slots on Freeview changing hands for £8million-10million each. This contrasts with the embryonic markets for tradable spectrum licences, where Ofcom has only approved one set of trades (other than simple internal transfers) as of March 2006.[19]
- *"the ability to trade may not be sufficient to promote efficiency because it does not impose an economic cost, whereas AIP does"*. Trading creates a 'carrot' for inefficient spectrum users to surrender spectrum, whereas AIP provides a 'stick'. In principle, a firm pursuing efficiency should respond equally to either price signal. Nevertheless, it seems plausible that the 'stick' of AIP may sometimes be more effective in encouraging action by inefficiently run firms.
- *"if the value of spectrum is appreciating, licensees may hold unused spectrum, in the expectation of future gains*." AIP imposes an upfront cost on 'hoarding' spectrum. However, there are also legitimate reasons why firms may wish to hold on to underused spectrum in the medium term which may be penalised by AIP. For example, with AIP, it may be more difficult for firms to keep spectrum for future expansion, even though this may ultimately be the most efficient use.
- *"some spectrum users are not driven by profits, therefore an opportunity to make a financial gain will not provide a strong incentive to their efficient use of the spectrum*." This is essentially the same argument as the second bullet above, i.e. that some firms do not behave efficiently and so would require the 'stick' of AIP rather than the 'carrot' of trading opportunities. The argument can also be found in the Cave Review which said that "*[t]he review judges that [the BBC and Channel 4] are more likely to respond to the explicit price signal*

[19] 'First spectrum trade agreed' (19/02/06), Policy Tracker, see http://www.policytracker.com.

resulting from a direct charge for spectrum than they are to an implicit revenue signal resulting from a potential spectrum leasing arrangement."[20] Nevertheless, it is far from clear that just because an organisation is not motivated by profit, it should necessarily be less responsive to gains from spectrum trading. Notably, as we discuss in Section 3, the BBC and Channel 4 both face strong pressures to make most efficient use of their limited resources, including spectrum, to maximise the value of services for the public and compete with commercial rivals for viewers.

- *"AIP is complementary to trading if it is set conservatively, in that it will not harm trading if it is set somewhat below the market clearing level.*" This is less an argument for trading but rather a counter-argument to concerns that setting AIP too high could prevent efficient spectrum use.

31. There is, however, a further argument that can be made in favour of using AIP with trading, namely that spectrum charging in this case is a mechanism for clawing back windfall gains in the event that existing spectrum licences are converted to tradable and liberalised usage rights of indefinite duration. Although Ofcom omits this argument from its reasons for using spectrum pricing with trading (perhaps owing to concerns that it might be unfairly be portrayed as targeting higher revenues), it is arguably more compelling than any of the others. As with spectrum auction revenues, 'taxation' of windfall gains provides a largely non-distortionary way of raising public finance.[21] Indeed, the issue of addressing "*windfall gains*" is specifically picked out by Cave as a reason for maintaining spectrum pricing "*in the short to medium term*".

32. On balance, there appears to be a general public policy case for Ofcom to maintain the option of applying AIP to tradable spectrum in terms of realising the scarcity value of spectrum for society rather than leaving it as windfall gains to spectrum users. Nevertheless, it is apparent that spectrum charging is a much less important tool than trading and adds only modest additional efficiency benefits. As the Cave Review highlighted: "*whilst incentive pricing has benefits, its use should be focused on those areas where other tools are not, in themselves, sufficient to ensure efficient use of spectrum. … Where spectrum becomes tradable, spectrum pricing may be necessary in the short to medium term while the market is nascent or where there are concerns about windfall gains, but would not be necessary in the longer term*."[22] Given this assessment, it is important that any decision to apply AIP is taken on a case-by-case basis, and not simply applied as a blanket policy.

[20] Cave Review, p.167.

[21] Wolfstetter E., *The Swiss UMTS Spectrum Auction Flop: Bad Luck or Bad Design?*, Institut f. Wirtschaftstheorie I, Humboldt Universität zu Berlin (2001), p.6.

[22] Cave Review, p.125.

3 Efficiency and the trading of DTT slots

33. In the previous section, we discussed the policy objective underpinning the use of spectrum charging, namely to provide incentives to spectrum users to use radio spectrum efficiently. In the words of the Cave Review, exposing spectrum users to the opportunity cost of their use should provide "*greater incentives for them to:*

- *examine spectrum needs, and release unused spectrum;*
- *use spectrum to provide alternative services;*
- *use less congested parts of the spectrum; and*
- *implement more spectrally efficient technologies*."[23]

34. AIP can serve as an instrument for achieving efficiency provided spectrum users can reduce the amount they have to pay for spectrum by reducing the amount of spectrum they use (by using more spectrally efficient technologies, or reducing the number of services they provide); or moving to 'cheaper' bands. Where spectrum users cannot respond to charges in these ways, where their ability to respond to spectrum charges is limited, or where they already have incentives to economise on their use of spectrum, spectrum charging will not provide incentives for improved efficiency, but simply extract the value that is generated by the spectrum user.

35. In this section, we discuss why the efficiency effects of AIP are limited with regard to the use of DTT spectrum, particularly by PSBs. This is because the existence of a market for DTT slots already provides strong incentives for broadcasters to increase the efficiency of their spectrum use (given the constraints they are facing), and to re-allocate capacity at the margin. Put differently, the existence of trading opportunities in DTT capacity, in which potential buyers and sellers can easily be identified and a market price is readily apparent (currently around £8-10million per Freeview slot), means that the opportunity cost of spectrum use is transparent, regardless of whether AIP is applied. For the avoidance of doubt, we should emphasise that efficiency considerations are related to the marginal costs and benefits of varying spectrum use, and that therefore efficiency is achieved by exposing spectrum users to opportunity costs at the margin. Charges for uses that are inframarginal – i.e. uses that would never respond to these charges – simply amount to a transfer from spectrum users to the public.

36. We begin by briefly describing the current situation with regard to the allocation of DTT spectrum, and discuss what decisions relating to the efficiency of spectrum use are available to broadcasters and multiplex operators. We then discuss the implications of the trade in DTT slots on the incentives faced by broadcasters, and the consequent impact of AIP on

[23] Cave Review, p.163

efficiency. Finally, we show why these arguments apply just as strongly to the BBC and Channel 4 as they do to commercial broadcasters.

3.1 Efficient spectrum use on DTT

37. In order to be able to receive television broadcast services, viewers require equipment that is capable of picking up (and, in some cases, de-scrambling) the broadcast signal (we will refer to such equipment as 'receivers'[24]). Receivers are designed to be used with a particular broadcasting technology, and for a specific broadcasting medium, and one can distinguish between different broadcasting platforms, defined with reference to the technology used for broadcasting and receiving the service. With regard to digital television, the DTI distinguishes four platforms[25], namely:

- satellite, which requires a set-top box that can be used with existing TV sets, or a digital TV set designed to receive digital satellite signals, plus a satellite dish for receiving the signals transmitted from the broadcasting satellite;
- cable, which requires a cable connection and a set-top box
- terrestrial, which requires an integrated digital television set or a digital adapter (set-top boxes) and a standard aerial; and
- broadband DSL, which requires a DSL connection and an appropriate decoder.

38. Broadcasting platforms are subject to strong network effects: a platform is more attractive to a broadcaster the larger the number of viewers it can reach. Similarly, a platform is more attractive to viewers the more and the better the broadcast services provided on it. The benefits from such network effects are maximised when platforms are open and standardised.[26]

39. From the perspective of viewers, different platforms are distinguished by the range and characteristics of services they offer (e.g. the number and type of television channels that are distributed over the platform; whether the platform supports interactive services; whether the platform provides additional services such as telephony or broadband internet access), and the cost of joining and using the platform. Each platform requires dedicated receivers, the cost of which is normally borne by the viewer (either in the form of an up-front purchase price, a rental charge or, in the case where the broadcaster has subsidised the purchase of the equipment, through

[24] The term 'receiver' is here used in its widest sense, and includes for example, TV sets, set-top-boxes and the aerials or satellite dishes required to pick up the broadcast signal, or any other terminal capable of receiving and displaying television broadcasts.

[25] See http://www.digitaltelevision.gov.uk/getting_digtial/platforms.html

[26] Note that this does not require that a standard is defined explicitly – it may simply emerge, as was the case, for example, with the VHS standard for video tapes.

subscription charges that are higher than would otherwise be the case).[27] In particular, the incentive for viewers to join a platform is greatest when they expect their investment in doing so (the cost of acquiring the necessary receivers) to provide the greatest benefits.

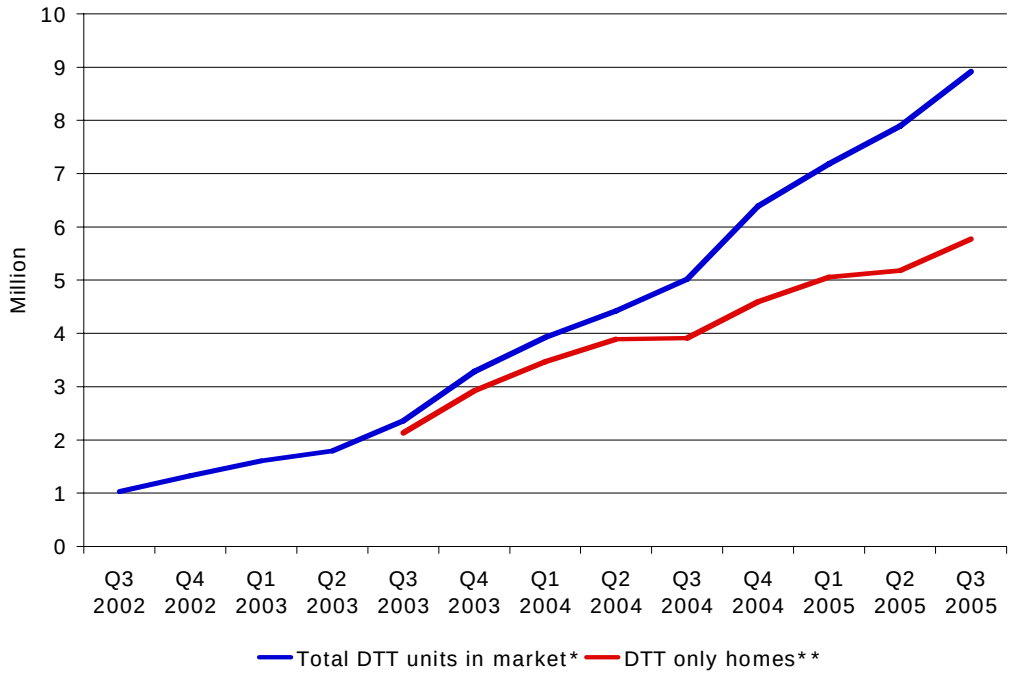
DTT as a driver of digital take-up

40. In the case of DTT, the evolution of the Freeview platform – based on a digital television set or a simple digital set-top box using the open DVB-T standard, and giving free access to a large number of channels – clearly demonstrates the strength of such effects. As illustrated in Figure 1, the audience size has grown rapidly, with the number of DTT receivers in use increasing from just 1 million to over 9 million in the three years since Freeview was launched in October 2002. At the same time, the number of DTT-only households has risen to around 6 million. Moreover, audience ratings for new digital channels are better in Freeview homes than in households that use Sky Digital.[28]

[27] We note that the ability of a broadcaster to recover receiver subsidies over the customer lifetime depends on its ability to prevent other broadcasters from gaining access to the customer through the subsidised receiver without sharing the cost of the subsidy. This means that platforms with subsidised receivers will have to be proprietary, and that competition between broadcasters over these platforms is limited by comparison with open platforms. The initial costs of the subsidy can than be recovered either through higher subscription charges, or from charges made to other broadcasters for access to the platform.

[28] For example, in April 2005, "*ITV2 achieved its best ever football ratings with more than 2 million tuning in to UEFA cup action between Newcastle and Sporting Lisbon.*" Media Guardian, 21 April 2005, 'New slots up for grabs on Freeview'.

Figure 1: Take-up of DTT since launch of Freeview†



Notes: †Free-to-view DTT only – excludes free-to-view DTH (satellite), of which there were 545,000 as of Q3 2005; *Based on number of DTT set-top boxes and integrated digital televisions in active use; **Discounted total excluding DTT boxes bought for second TVs in same household.

Sources: ITC Multichannel Reports and Ofcom Digital Television Updates, from Q3 2002 to Q3 2005.

41. Being able to reach a significant viewer base is clearly very valuable for broadcasters. This is reflected in the growth in channels and the increasing prices paid for multiplex capacity:

- Freeview currently has 35 channels and 24 radio stations, up from 24 television channels and 11 radio stations at the time of launch.[29] An indication of its success is the decision of Channel 4 to change its E4 service from a pay service – available only through cable, DTH satellite or the DTT pay platform Top-Up TV – to a free-to-air service in May 2005. Channel 4 made clear at the time that with the growth of Freeview, it expected increased ratings and advertising revenues to

[29] Actual number of channels available may vary between regions.

exceed lost subscription revenues.[30] Similarly, UK satellite operator SKY recently introduced a new mass entertainment channel, Sky three, on Freeview, replacing the niche Sky travel service.[31]

- The recent plan to offer FilmFour as a free service on the Freeview DTT platform provides further confirmation for the strength of the network effect: the decision is expected to both increase the reach of FilmFour and strengthen Channel 4's public service presence, and make the Freeview platform more attractive.[32]
- When Freeview launched in October 2002, slots were available for about £3m[33] and some commercial channel capacity went unused until April 2004. However, by April 2005, when engineering changes by Crown Castle facilitated the release of two more slots, there was strong competition for new capacity. The slots were bought for an estimated price of £5-7million per annum each by ITV and Channel 4, with Five, Disney and Turner Broadcasting all rumoured to have made bids.[34] According to media reports, Channel 4 again beat off competition from Five, when – in November 2005 – it acquired an additional channel from National Grid Wireless, agreeing to pay a purported £10million per annum.[35]

42. Moreover, the growth in the number of DTT households has been the main source of the increase in the overall level number of households who receive

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[30] Andy Duncan, Channel 4's Chief Executive said: "*E4's launch on Freeview will make one of digital TV's 'must-have' channels available to eight million new viewers. Freeview is still growing fast and we're forecasting an uplift in ratings and advertising revenues, which we expect to exceed lost subscription revenues. Alongside the launch of More4, taking E4 free-to-air is key to our strategy of extending our presence in multi-channel with a view to funding and strengthening our public service contribution in a fully digital world, across all platforms." Dan Brooke, Controller of Digital Strategy at Channel 4, added: "We've always said we would take E4 free-to-air when this represented the best opportunity for its future development and growth....*" Channel 4 press statement, 'Channel 4 to Launch E4 on Freeview, Press release', 26th April 2005.

[31] BBC news, 22 September 2005, 'SKY launches new Freeview channel', http://news.bbc.co.uk/1/hi/entertainment/tv_and_radio/4271060.stm.

[32] Channel 4 Chief Executive Andy Duncan said: "*This change will significantly extend our presence in multi-channel homes in advance of digital switchover. It will also strengthen our public service contribution by offering regular showcases for British and European movies, including films financed by Channel 4 itself through its £10m annual production fund. Our plans to launch FilmFour On Demand, available on broadband platforms, will enhance viewer choice further and complement the free-to-air offering."* Channel 4 press statement, 'FilmFour to relaunch as UK's only major free-to-air film channel', 8th February 2006.

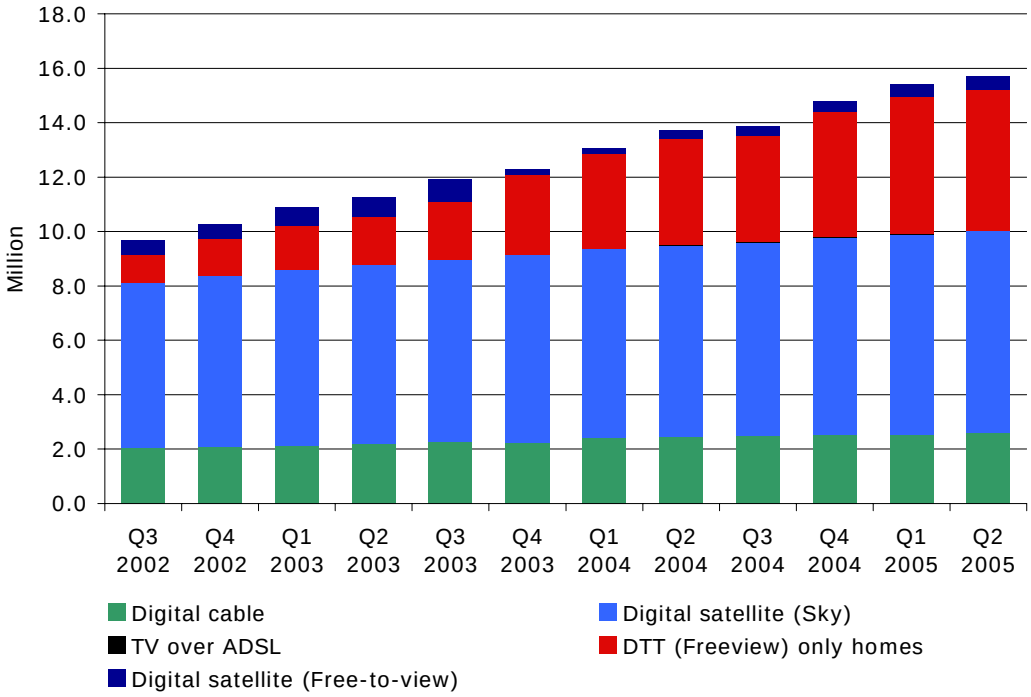
[33] Media Guardian, 21 April 2005, 'New slots up for grabs on Freeview'.

[34] Ibid.

[35] The Guardian, 29 November 2005, 'Channel 4 buys sixth slot on Freeview for £10m'.

digital television services, as shown in Figure 2. Overall, DTT only households (Freeview) account for almost 70% of the 6 million increase in the number of digital households between Q3 2002 and Q3 2005. By contrast, the contribution of free-to-view satellite services has been limited, and the services currently on offer from Sky are intended to provide a "*single call instant upgrade path to Sky packages*"[36] rather than a separate and self-standing free-to-air proposition.[37]

Figure 2: Growth in different digital platforms



Sources: ITC Multichannel Reports and Ofcom Digital Television Updates, from Q3 2002 to Q3 2005.

43. As such, DTT will perform an essential role in the process of digital switchover. DTT is an essential part of achieving an increase in the reach of

[36] BSkyB 054/05 interim results presentation.

[37] We understand that the large drop in the number of free satellite homes in Q4 2003 was due to Sky swapping out all its smart cards (in an attempt to reduce piracy/ subscription avoidance). Sky provided all subscribers with new smart cards, however, it did not provide new smart cards to ex-subscribers still using their satellite equipment to pick up free channels (which are classified as "free satellite" homes). Following the smart card switchout these homes were no longer able to receive all of the free-to-air terrestrial channels, some of which are encrypted on the satellite platform unless they purchased a new smart card for about £15. Only a proportion of previous subscribes to the pay package who were estimated to use their satellite equipment to receive free satellite services did so. This suggests that take-up of free satellite is to a significant extent driven by previous pay customers 'trading down' to free services, which does not increase overall digital viewership.

digital television to a level that it becomes possible to switch off the analogue signal without depriving millions of viewers of access to television services. As stated by Ofcom, "*[t]he majority of television viewers in the UK receive their television channels over the terrestrial transmission network. In a few years time, analogue transmission over this network will be phased out and replaced with digital transmissions. Already over 5 million viewers watch digital terrestrial television.*"[38] Moreover, DTT will be the major plank in upgrading those households (including an estimated 10% of primary television sets) that have not voluntarily converted at the time of the planned switch-off of analogue transmission.[39] DTT has been chosen by the Government as the platform for driving switchover, and PSBs have been given coverage obligations to achieve this objective. This quite naturally implies that, even after switchover, DTT will remain an essential part of the future television landscape.[40]

Obligations on DTT broadcasters and multiplex operators

44. In order to ensure that DTT provides an attractive platform, the multiplex licences contain a number of requirements in order to maintain technical standards, compatibility with the established base of receivers, and the supply of a broad range of programming.

45. Digital terrestrial television services are provided in the UK at present over six multiplexes. Multiplex 1 has been awarded to the BBC on terms agreed with the DCMS in 1996. Multiplexes 2, A, B, C and D are licensed pursuant to the Broadcasting Act by Ofcom. More specifically:

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[38] Ofcom, Pay TV channels on multiplexes B, C and D, Consultation on proposals to remove the 'free-to-air only' requirement, October 2005, paragraph 1.1.

[39] The modelling of the cost implications of digital switchover undertaken by Scientific Generics for Ofcom is based on the assumption that the majority of conversion will be made using DTT: "*Existing research shows that the choice of platform is dominated by cost and that (for subsequent sets) the selected platform may differ from that installed on the primary set. For the purposes of the cost model, it is therefore assumed that all non-voluntary set conversions will make use of the lowest cost route to conversion available. In most areas this will be via a low cost DTT STB. Should DTT not be available due to coverage limitations, free to view (FTV) satellite has been assumed*" (Scientific Generics, Cost and power consumption implications of digital switchover, Report prepared for Ofcom, November 2005, p 8 f.)

[40] This implies that the choice of the method by which broadcasting services are delivered may actually be rather limited. The (sunk) investments that have been made by broadcasters and viewers, in particular with regard to DTT, imply that some options are no longer available, especially where broadcasters also need to achieve universal coverage. Thus, the fact that, as Professor Cave has pointed out before the House of Lords Select Committee on the BBC Charter Review, technologically "*the importance of spectrum for broadcasting has diminished to some degree*" and that "*there are some services which have to be provided using spectrum, like mobile communications*" but "*[t]here are many services like broadcasting where you actually have a choice*" may be of limited relevance (see Select Committee on the BBC Charter Review, 11 January 2006 (uncorrected transcript), answer to Q1723).

- Multiplex 2 is operated by Digital 3&4 Ltd, a joint venture of Channel 3 and Channel 4. The capacity on this multiplex is split between Channel 3 (48.5%), Channel 4 (48.5%) and the Public Teletext service (3%).
- Multiplex A is operated by SDN Ltd (controlled by ITV plc), and 50% of the capacity on this multiplex is reserved for Channel 5 and (in Wales) S4C.
- Multiplex B is operated by BBC Free to View Ltd (BBC FTV).
- Multiplexes C and D are operated by National Grid Wireless Ltd (NGW) (until recently called Crown Castle UK Ltd).

46. The agreement for the use of Multiplex 1 does not expire. The multiplex licences have been awarded for a 12 year period, and expire between 2009 (Multiplex 2) and 2014 (Multiplexes B, C and D). However, we understand that the Government is committed to maintain the underlying frequencies for DTT use.

47. Indeed, allowing other uses to displace DTT broadcasting over these frequencies would seem to be inappropriate for public policy reasons, given the role played by DTT in terms of achieving digital switchover. Even a partial displacement of DTT broadcasting by other uses, with the resultant reduction in the range or quality of services available over DTT would devalue the DTT platform, and the mere threat of such an outcome might significantly undermine the willingness of viewers to invest in upgrading their receivers to DTT.

48. Table 1 provides an overview of the obligations contained in the Multiplex licences. Obligations to reserve capacity and co-ordinate with other multiplex operators, to seek to extend coverage and to comply with common standards (set out in the form of technical requirements) are clearly aimed at ensuring that DTT provides a stable and predictable broadcasting platform for the benefit of viewers. To the extent that these obligations specify actions that the multiplex operators would not otherwise wish to take in pursuit of their commercial objectives, they also protect the interests of broadcasters by ensuring that positive network effects are not lost as a result of individual licensees' actions. In any case, the spectrum associated with the respective multiplexes was gifted to PSBs in order to provide core channels and other digital services to support their wider PSB remit.

Table 1: Obligations on multiplex licensees

Multiplex	Obligations
All	• To ensure that at least 90% of digital capacity awarded by the licence is available for digital broadcasting services • To furnish the Commission with information both specified in the licence agreement and any other information the Commission may request • To protect fair competition and the obligation to publish a list of its tariffs

Multiplex	Obligations
2	• Extensive technical requirements regarding transmission standards are detailed in Article 6 of the Multiplex Licence
	• To ensure Channel 3 licensees, Channel 4 and Public Teletext Providers' qualifying services are broadcast over its frequencies
	• Not to charge viewers for the reception of the services it broadcasts
	• To ensure that broadcasters on its multiplex make sufficient investment to provide programming over the licensee's frequencies
	• To conform to detailed timetable to commence digital broadcasts at all sites previously used for analogue broadcasting as listed in the Licence Agreement
A	• To broadcast in Gaelic for a given amount of time on channels that are wholly or partially broadcasted in Scotland
	• Extensive technical requirements regarding transmission standards are detailed in Article 6 of the Multiplex Licence, including conformance with UK international obligations
	• To devote capacity to Independent Analogue Broadcasters (currently Channel 5 and Welsh television) in exchange for payments from the broadcasters where level of capacity is controlled by the Commission (now Ofcom, who have set this at 50%) and payment are at the discretion of the Commission if agreement cannot be reached between both parties
	• Not to charge viewers for the reception of services provided by Independent Analogue Broadcasters
B, C and D	• To seek to increase coverage of services and to implement power increases at broadcasting stations
	• To commence broadcasting at sites listed in the Licence Agreement
	• To provide subtitling for digital programme services by 31 December 2002
	• To promote digital television broadcasting in the UK, including a minimum marketing expenditure on promoting take-up of digital television and an obligation to measure and report its impact on take-up of said services
	• Extensive technical requirements regarding transmission standards are detailed in Article 6 of the Multiplex Licence, including conformance with UK international obligations and published technical standards regarding EPG and co-operation with Multiplex C and D operators to enable the reinstatement of a Centralised Service Information System
	• Not to provide capacity to pay TV services without prior consent from Ofcom*
A, B, C and D	• To conform to clauses governing agreements with other multiplex operators or broadcasters, particularly regarding capacity allocation, and obligations not to discriminate towards certain services and against others

* Ofcom is currently reviewing whether this obligation should be removed (see Ofcom, Pay TV channels on multiplexes B, C and D – Proposal to remove the 'free to air only' requirement, Consultation, October 2005)

Source: Multiplex licences (http://www.ofcom.org.uktv/ifi/tvlicensing/muxlicensees/)

49. In terms of coverage[41], commercial multiplex operators should be able to determine their own coverage in light of their commercial objectives, "*provided that they do not allow the coverage of any multiplexes to fall below its current level (i.e. 73 per cent of households should continue to receive coverage of all six DTT multiplexes)*."[42] Ofcom believes that, in pursuit of their objectives, commercial multiplex operators should achieve similar levels of coverage, but that the maximum coverage that commercial multiplex operators can be expected to achieve is around 90%.[43] This could be achieved by broadcasting from around 200 sites.[44]

50. Public service broadcasters are in addition required to provide services to the population at large, which is reflected in the current requirement (under the terms of their Digital Replacement Licences) of making broadcasting services available to 98.5% of households in the UK. Analogue broadcasting achieves this objective by transmitting signals from 1,154 sites.[45] The coverage requirement on switchover for the three multiplexes that are designated for public service broadcasting remains the same, i.e. DTT reception of PSB services must be available to 98.5% of UK households. This requires the PSB multiplexes to transmit from the 1,154 transmitters currently used to broadcast analogue, while using specific combinations of transmission mode and power level (and possibly to transmit from additional sites).

51. The difference in the number of sites from which commercial multiplex operators and PSB multiplexes will have to broadcast in order to meet their obligations illustrates the extent to which PSBs will have to exceed commercially optimal coverage. Multiplexes 1, 2 and B are designated as PSB multiplexes and will be required to achieve near universal coverage.[46]

Implications for spectrum use

52. Given the need to maintain compatibility of the broadcast signal with the established base of receivers, and the obligations imposed on spectrum users as part of their licences, there is:

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[41] Coverage is defined with regard to the number of households that are capable of receiving all services (core coverage) or a particular service (served coverage) through a fixed roof-top aerial in a way that meets internationally agreed standards of picture quality and reliability. Marginal coverage extends this notion by including households that can receive services that are adequate, though below these standards (see Ofcom, 'Planning Options for Digital Switchover' Consultation Document, February 2005, p 7).

[42] Ofcom, Statement on 'Planning Options for Digital Switchover', June 2005, p.2.

[43] Ibid.

[44] Ofcom, Consultation on 'Planning Options for Digital Switchover', February 2005, p9.

[45] Ofcom, February 2005, Consultation on 'Planning Options for Digital Switchover', February 2005.

[46] Ibid.

- very limited scope for public service broadcasters and multiplex licensees to return unused spectrum or change spectrum use;
- limited scope for increasing the spectral efficiency; and
- for broadcasters with certain coverage obligations, limited scope to release spectrum on a regional basis in areas where roll-out is unlikely to be commercially sensible.

53. The standardisation that makes a platform particularly attractive to viewers and broadcasters, and that maximises the benefits from positive network effects, at the same time limits the ability of broadcasters to change the way in which they use spectrum.[47] Assuming that the broadcaster would wish to continue serving the majority (and ideally all) of the viewers on a particular platform, changes to spectrum use are limited to those that maintain compatibility of broadcasting technology with the standards incorporated in most, if not all, the receivers.

54. For example, a DTT broadcaster may be able to change its transmission mode[48], following consultation with Ofcom, from 16QAM to 64QAM, resulting in an increase in bitrate, and thus capacity, of about one third(albeit at the cost of losing coverage without an increase in transmission power), because the DVB-T standard supports both transmission modes. A broadcaster may be willing to incur the cost of losing some coverage in exchange for the greater capacity available. By contrast, moving from MPEG2 to MPEG4 compression technology[49], which would increase by around 50% the channel capacity available on a multiplex by reducing the bitrate required for transmitting a television channel, would imply that the broadcaster loses access to almost all viewers, as new boxes would be required. Even though this move would bring significant improvements in the efficiency of spectrum use, it would seem to be unavailable to a broadcaster in the short-to-

[47] In this regard, it is worth noting that multiplex operators have set up an industry body ("The Digital Network", TDN) to facilitate co-ordination of technical changes on the platform (such as, for example, channel numbering).

[48] Quadrature Amplitude Modulation (QAM) refers to a modulation scheme in which data are conveyed by changing the amplitude of two carrier waves which are out of phase with each other by 90 degrees. The demodulator must correctly detect both phase and amplitude in order to retrieve the signal. Moving to a higher-order constellation (i.e. from 16QAM to 64QAM) allows transmitting more bits per symbol, but at the same time increases susceptibility to noise and thus decreases signal robustness. Thus, without an increase in transmission power, coverage decreases. 16QAM provides 18Mb/sec while maximising DTT coverage. 64QAM increases the bitrate to 24Mb/sec, but at the cost of reduced coverage (or higher transmission power to retain coverage). It is also generally accepted that 64QAM is the maximum transmission mode possible while ensuring quality of broadcasting terrestrially.

[49] MPEG2 is a compression technology developed for video applications, supporting high quality video streams. MPEG4 is a compression technology aimed at supporting lower bandwidths, developed initially for internet streaming. MPEG4 is regarded as providing acceptable quality for video streaming at bitrates down to 1 Mb/sec. At comparable levels of quality, MPEG4 requires half the bitrate needed under MPEG2.

medium term.[50] Similarly, the possibility of using less congested parts of the spectrum for broadcasting is precluded because set-top boxes are not guaranteed to be capable of picking up signals outside the range planned for DTT broadcasting, and viewers might need to invest in new aerials.

55. Although a broadcaster may, in principle, consider changes in its spectrum use which would require upgrading or replacing a significant proportion (or all) of the established receivers, it is unlikely that any individual broadcaster would have sufficient 'pull' to provide an incentive for viewers to adopt what in essence would be a different platform. The challenge of achieving digital switchover, i.e. providing an incentive for a sufficiently large proportion of analogue television viewers to upgrade to the digital platform is a strong case in point.

56. Scientific Generics, in a report for Ofcom, estimate that *"[a]t the time of switchover … around 10 percent of primary sets, 16 percent of subsequent sets and 10 percent of VCRs will need to be converted non-voluntarily due to the policy of switching over from analogue television to digital television according to the Government's announced timetable.* Even so, the "*total cost to UK households over the period of switchover of non-voluntary conversions driven by switchover policy is estimated to be £572m. This represents around 2% of all UK consumer spend on brown goods over the same period, which is forecast to be approximately £30bn."*[51]

57. Of course, this does not imply that broadcast technology cannot change over time, but ensuring (wherever possible) backward compatibility with existing receivers is often an important requirement. We note that the requirement of backward compatibility might even result in lower spectral efficiency than could be achieved at any given point in time, owing to path-dependency of technological development and the sunk investment embodied in an established base of receivers.

58. In principle, broadcasters may decide to pursue a strategy of limited geographic coverage, and lease unused capacity to other uses. In addition,

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[50] Similar issues arise in the context of moving from the 2k to the 8k format. Using a larger number of sub-carriers (8192 rather than 2048) for broadcasting the signal would allow the use of a single frequency network, where fill-in transmitters could use the same frequencies as the main transmitter, which in turn would improve coverage in areas where no alternative frequencies are available. However, some of the set-top boxes currently in use, as well as some early integrated digital TV sets, do not support the 8k format.

[51] Scientific Generics, Cost and power consumption implications of digital switchover, Report prepared for Ofcom, November 2005, p 1. Scientific Generics further note that "[a]*ctual cost to individual households of switchover driven non-voluntary conversion of sets and VCRs is estimated to range from £26 - £153 depending on the equipment in the home and the status of voluntary conversion at the time of switchover. Where necessary, replacement of aerials is predicted to cost an additional £20 to £165 depending on whether there is a need to replace the roof aerial and on the number of new set top aerials required. However, as only around 2% of households are expected to require new roof aerials, the range of aerial costs for most households is likely to be from £20 to £40."*

they may be able to lease access to particular frequencies in areas where they are not used (owing to the geographic reuse pattern where multiple frequency blocks are used to support a single multiplex). However, the scope for doing so is limited because of the sensitivity of television receivers, which means that alternative uses will typically be limited either to very small geographic areas, e.g. local TV for a single town or city, or low-power services, such as PMSE. Furthermore, coverage obligations on public service broadcasters limit the scope for reduced geographic coverage in the interest of maintaining an attractive platform.

59. In any case, to the extent that broadcasters do have some flexibility to alter their spectrum use (e.g. leasing unused night-time capacity, or leasing capacity in areas which a commercial broadcaster, who is free to determine its coverage target, does not wish to serve), it is not necessary to impose AIP to ensure that this happens. Provided that operators are allowed to reinvest the revenues from such transactions, they have strong commercial incentives to explore such opportunities. More generally, as we will demonstrate next, the incentives for achieving efficiencies are not linked to broadcasters facing AIP charges, but arise from the fact that capacity on DTT multiplexes – which is what broadcasters are ultimately interested in – is being traded.

Specific considerations with regard to public service broadcasters

60. In addition to these general considerations, specific issues arise for broadcasters such as the BBC and Channel 4, for whom universal availability and public service commitments are not a matter of choice, but their core purpose:

- As noted above, PSBs are required to achieve near universal coverage on DTT. Commercial public service broadcasters (ITV and Five) may decide no longer to accept PSB obligations (i.e. seek licences on a commercial multiplex without public service obligations and associated rights), and reduce the cost of spectrum use by reducing coverage, or abandon the DTT platform altogether. Such options are not available to the BBC or Channel 4 which exist as public service broadcasters[52].
- Neither of these two broadcasters can abandon DTT altogether. Although digital satellite would theoretically offer the required coverage, abandoning DTT in favour of DSAT would imply a platform switch, which would be undesirable and politically unacceptable, given the investments that have been made by viewers and broadcasters in DTT), and the higher overall cost of equipment required for DSAT reception.

[52]Commercial broadcasters may well be prepared to forgo incremental coverage if the revenue loss from doing so is smaller than the associated cost savings in terms of lower spectrum charges and no PSB obligations.

- Both broadcasters are bound by their public service remit, and cannot use spectrum for purposes other than meeting this remit, even if this provided higher revenues.
- For the same reason, they may be unable to reduce the amount of spectrum they use by reducing the range and scope of services they provide, given that they have been awarded spectrum in order to meet specific obligations.[53]

61. This means that the relevant question with regard to efficiency has to focus on whether PSBs make the most of the spectrum they have been awarded, rather than whether they could provide fewer or different services – taking account of the fact that the design of the broadcast network is driven largely by politically determined coverage requirements rather than the broadcaster's attempt to minimise the amount they pay for spectrum.[54]

3.2 Trading of DTT capacity and efficiency

62. As discussed in Section 2, allowing spectrum users to trade usage rights exposes them to the opportunity cost of holding and using spectrum, either in the form of the cost of using more spectrum, or the potential gains available from using less spectrum and selling usage rights to others. In the case of trading, the case for AIP becomes relatively weak – and from an economic perspective one of the main justifications for charging spectrum users is that such charges ensure that the scarcity value of spectrum flows into the public purse rather than creating windfall gains for spectrum users.

63. The fact that multiplex capacity is tradable (in combination with the fact that there is limited flexibility with regard to the use to which this spectrum is being put) ensures that there is an incentive to use DTT spectrum efficiently. This means that incentives for increasing the spectral efficiency of broadcaster's use of DTT spectrum do not come from the prospective reduction in AIP payments, but rather from the additional revenues that can be generated by increasing the channel capacity of the multiplexes. Provided that broadcasters are free to use this additional capacity for their

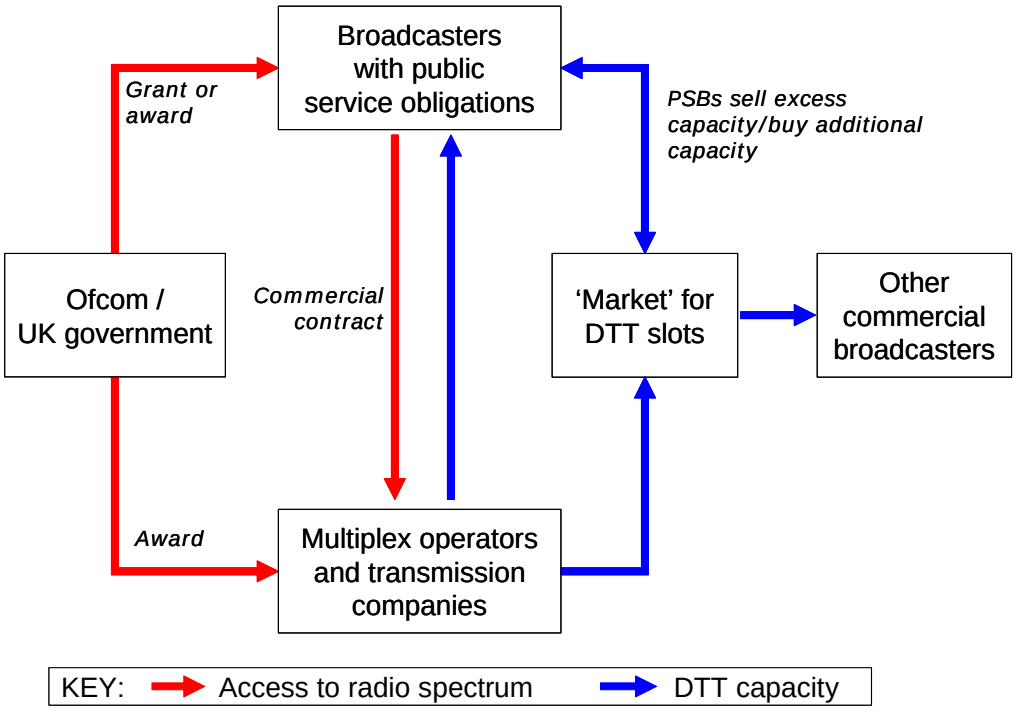
[53] Of course, this argument points towards a potentially deeper problem with use of spectrum charges for defining the scope of public service broadcasting: once public service obligations have been defined, it may not even be desirable for PSBs to respond to charges for spectrum by reducing the scope of these services.

[54] For example, Ofcom's Chairman, Lord Currie of Marylebone, argued in front of the House of Lords Select Committee on the BBC Charter Review that "*there is a case … for spectrum pricing in order to encourage efficient use of spectrum. For example, if one was rolling out a new broadcast network, a system of masts and so on, with spectrum being priced you would arrive at a very different configuration of masts than if there was no charge*." (House of Lords, Minutes of Evidence taken before the Select Committee on the BBC Charter Review, 14 December 2005 (uncorrected transcript), answer to Q1440) Whether this indeed applies to network design of broadcasters who have to meet a near universal coverage target, and who correspondingly have the location and aerial height of their transmitters written into their licences, is rather questionable.

own services, or sell it on to others, these incentives exist irrespective of whether or not broadcasters are exposed to AIP charges.

64. DTT spectrum is licensed to broadcasters (such as the BBC), who then engage transmission companies (such as NGW) to transmit broadcasts, or directly to multiplex operators (such as SDN) who offer capacity to broadcasters.[55] Multiplex operators may be under an obligation to offer capacity to particular broadcasters (such as SDN, which is required to offer 50% of the capacity on Multiplex A to Channel 5 and S4C in Wales). Figure 3 summarises the general relationship between the various players.

Figure 3: Spectrum rights and DTT capacity



65. In order to examine the impact of AIP charging for DTT spectrum on efficiency incentives and costs, it is important to recognise that such charges would exist alongside the trading of DTT capacity in the form of multiplex slots being bought and sold. Prices for such slots are determined by the interaction of supply – which is essentially determined by:

- the amount of spectrum available for DTT multiplexes;
- technical characteristics such as transmission mode and compression technology, which together with transmission power level determine the

[55] NGW is both a multiplex operator and a transmission company. SDN, which is now owned by ITV, is a multiplex operator, which uses Arqiva (formerly NTL broadcast) to transmit its broadcasts.

number of television and radio channels that can be transmitted at any given time, their quality and their reach; and

- constraints on these technical parameters imposed by Ofcom in order to ensure acceptable quality of services and guarantee certain coverage levels.

66. The price of a slot defines the opportunity cost of spectrum use by a broadcaster – it is the price that would have to be paid for obtaining additional capacity, as well as the price that would be saved, or could be obtained, if a broadcaster bought fewer slots, or released some of the slots that it has been allocated to the market.

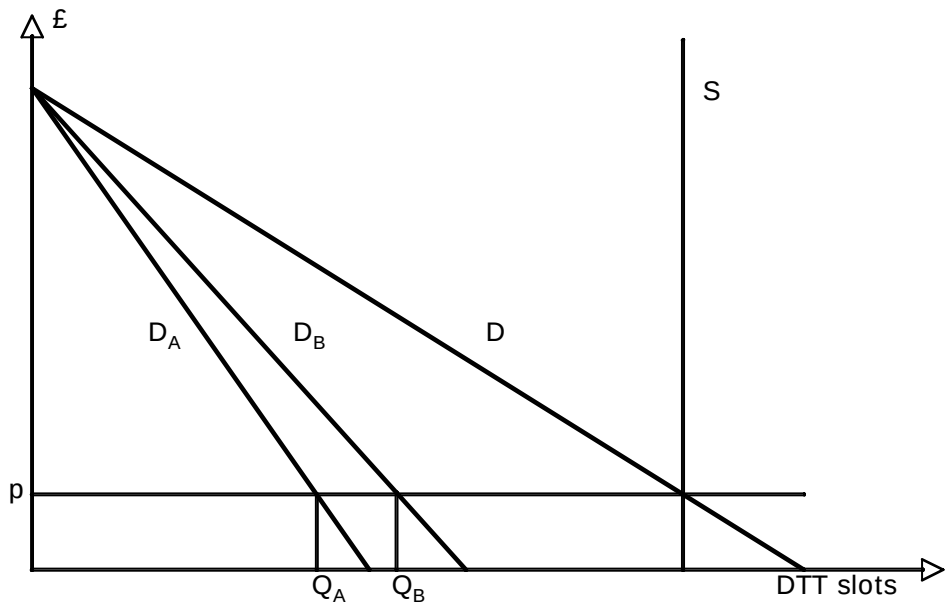
67. Thus, the users of DTT spectrum are faced with opportunity cost of their use regardless of the existence and level of spectrum charges based on AIP. Spectrum charges do not generate an added incentive for efficient use of spectrum. AIP does, however, extract the scarcity value of DTT spectrum which would otherwise be enjoyed as windfall gain by the users (assuming, as is currently the case, that multiplex licences have been awarded administratively rather than by competitive auction). Therefore, there is a good public policy reason for applying AIP to commercial DTT users, albeit one that Ofcom appears reluctant to acknowledge.

68. The role of AIP in terms of achieving efficiency and extracting value can be shown in a simple graphical analysis.[56]

69. Consider that there are two broadcasters, A and B, and that their demand for DTT slots is reflected in downward sloping demand curves D_A and D_B. These demand curves represent the broadcaster's willingness to pay for additional channels, which in the case of a commercial broadcaster simply captures the additional profits they can generate from offering additional services. Total demand for DTT slots is given by D, and the supply of DTT slots, S, is given exogenously and determined by the amount of spectrum available for DTT multiplexes and the most efficient broadcasting technology. Figure 4 shows how this capacity should be used by the two broadcasters, with broadcaster A using Q_A and broadcaster B using Q_B. This is achieved by means of a price per slot of p, which equates total demand and total supply.

[56] We note that in practice DTT capacity is not homogenous in the sense that multiplexes may differ with regard to their coverage (e.g. PSB multiplexes will ultimately achieve a greater coverage than the commercial multiplexes) and as a result of restrictions (e.g. currently multiplexes B, C and D cannot offer capacity to pay TV services without prior consent from Ofcom, although this requirement is under review at present). However, these differences are not relevant for the general argument developed below, namely that trading of capacity exposes multiplex operators to the opportunity cost of their spectrum use, and thus provides strong incentives for efficiency.

Figure 4: Efficient use of DTT slots by two broadcasters – a stylised example



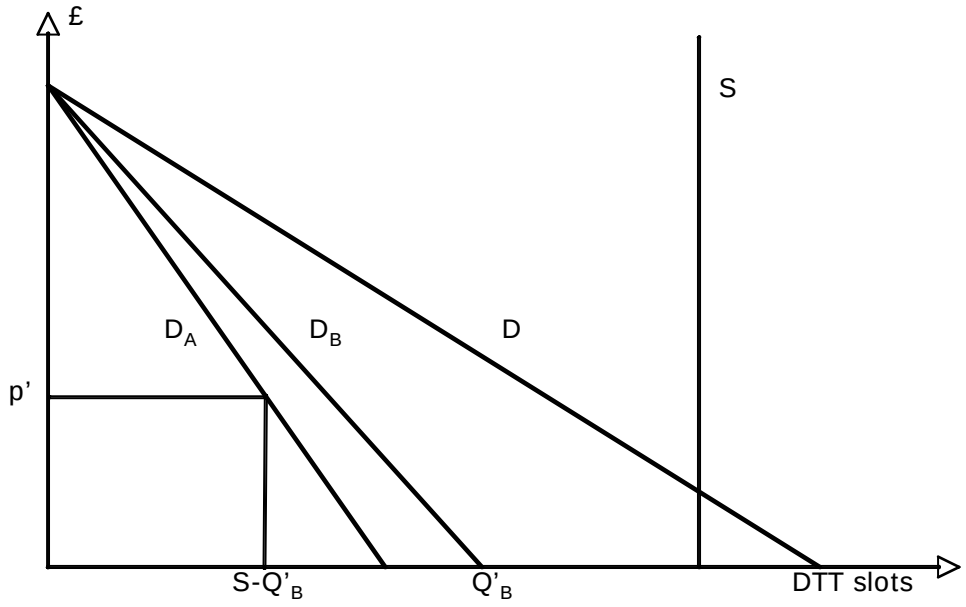
70. If spectrum charges were set at p, then it would indeed be the case that each broadcaster would demand as much spectrum as is required in order to provide the corresponding slot capacities Q_A and Q_B using the most efficient technology. However, AIP is not required to produce such an outcome – simply allowing trading in slots, which generate a price p will do that.

71. In order to see this, consider a situation in which all spectrum was initially allocated to broadcaster B for free, as illustrated in Figure 5. Does this imply that broadcaster B would have an incentive to use spectrum inefficiently, employing a broadcasting technology that only generates sufficient capacity to satisfy all of its own capacity needs (i.e. no more than Q'_B slots)? There is no reason to expect such behaviour, as the broadcaster could gain by adopting more efficient technology to increase overall capacity, and sell slots to broadcaster A. Would broadcaster B have an incentive to retain Q'_B slots for its own use, leaving broadcaster A with less than Q'_A $(S - Q'_B)$ slots? Again, there is no reason to expect such an outcome, as broadcaster A would be prepared to pay p' for additional slots while the marginal value of these slots to broadcaster B is less than p'; therefore broadcaster B would gain by reducing its own use of slots and selling released capacity to broadcaster A.[57] Such gains from trade are only exhausted when the marginal value of slots is the same for both

[57] Of course, this assumes that there are no competition concerns in the market for slots or the downstream broadcasting market(s). Otherwise, broadcaster B might have an incentive to limit broadcaster A's access to slots for anti-competitive reasons.

broadcasters – i.e. in a situation in which broadcaster A uses Q_A slots, and broadcaster B uses Q_B slots. Trade in slots will produce an efficient outcome even in the case where spectrum was initially allocated exclusively to one broadcaster for no payment whatsoever. Indeed, any allocation of spectrum will ultimately lead to the efficient outcome, provided that slots can be bought and sold.

Figure 5: Inefficient use of DTT slots



72. It is the case, however, that in the above example broadcaster B would enjoy all the benefits associated with the fact that spectrum is scarce, i.e. that demand for DTT slots exceeds supply. In particular, it would earn profits of Q_A times p from selling slots to broadcaster A, and would have obtained for free spectrum worth Q_B times p. Setting an AIP charge equal to p would extract this value. Setting such a charge could replace trade of spectrum slots amongst broadcasters if broadcaster B, in order to reduce its payments under AIP, returned all the spectrum in excess of what it requires to provide Q_B slots, and this spectrum would then be awarded to broadcaster A (who would be willing to take exactly the returned amount).[58] This outcome would not be different, in terms of efficiency of spectrum use, from the situation in which broadcaster B held on to its spectrum endowment and

[58] It should be immediately obvious that setting charges above p would inefficiently choke off demand, which would lead to spectrum set aside for DTT use not being utilised. It should also be obvious that, in the case where AIP charges are set below p, there would be no incentive for broadcaster B to return spectrum, because it would achieve a price of p per slot, of which only a part would have to be passed on to in the form of spectrum charges.

sold capacity to broadcaster A (who would thereby contribute to the AIP payments in proportion to its spectrum use).

73. In this regard, spectrum charges for DTT spectrum would perform the same role that broadcasting licence fees play in the case of analogue television spectrum. Under the terms of their licence, commercial broadcasters (namely the ITV licensees and Channel 5) pay for their use of spectrum in the form of an annual fee composed of a fixed payment and a percentage of qualifying revenue (which is essentially the same as net advertising revenue).[59] Although not explicitly classified as a spectrum charge, these payments are intended to extract (some of) the scarcity value associated with analogue television spectrum.[60] In its statement on the methodology to be used for reviews of the financial terms associated with these licences, Ofcom states that its "*objectives for these reviews of financial terms are to determine a fair and reasonable value for each licence, and to set new financial terms according to a fair and objective process. This is necessary in order to ensure that the taxpayer gets a proper return for these licences and, in particular, the right to use scarce spectrum.*"[61]

74. The additional payments based on qualifying multiplex revenues - as provided for in the current multiplex licences, but suspended for the initial licence period (i.e. the 12 years from the award of the licence) - would perform a similar function: they would extract (some of) the value generated by the scarcity of DTT capacity that is currently accruing to multiplex operators. Again, these payments would not be explicitly labelled as spectrum charges – but they would presumably have to be adjusted in light of any spectrum fees payable by multiplex operators in the future.

75. In this regard it is worth pointing out that the decision not to levy those charges for the initial licence period obviously has not had any impact on the prices charged for DTT slots. The administrative charges initially fixed in the multiplex licences (though subject to review by Ofcom) clearly have had no

[59] These payments have initially been determined as part of the licence bids. Ofcom has developed a methodology for setting the cash bid and the percentage of qualifying revenue based on what these had been if the licence had been awarded afresh through a first-price sealed bid auction (for details see Ofcom, Methodology for reviews of financial terms for Channel 3, Channel 5 and public teletext licences, Statement, October 2004.

[60] See Ofcom, Spectrum Pricing Consultation, paragraph 8.10.1: "*Channel 3 and Channel 5 licensees, and the Teletext licensee, differ from other analogue television broadcasters in that they are liable to make Additional Payments for their Broadcasting Act licences. These already include an implicit payment for access to scarce analogue spectrum.*"

[61] Ofcom, Methodology for reviews of financial terms for Channel 3, Channel 5 and public teletext licences, Statement, October 2004, p 10. It is worth pointing out that the licence also gives the licensee a right to broadcast on DTT through guaranteed access to multiplex capacity, and that the value of this right forms part of the licence valuation. One might therefore argue that, but for the setting of fees based on analogue revenues in order to encourage promotion of digital switchover, these payments also include a fee for access to DTT spectrum.

impact on the price of DTT slots (which are fetching up to £10 million each). Indeed, the only way in which such charges could affect the price of DTT slots is if they were set at a level at which demand would be reduced below the level of current capacity – i.e. inefficiently choked off.

3.3 Public service broadcasting and incentives for efficiency

76. As discussed above, the scope for DTT broadcasters to improve efficiency of spectrum use is limited, and PSBs face additional constraints. However, there is clear evidence that PSBs have, subject to these constraints, aimed to maximise efficiency of their use of spectrum.

77. Public service broadcasters, like their commercial counterparts, face strong incentives to use spectrum and DTT capacity efficiently, as a result of trading. It has often been argued that public bodies because they are not-for-profit may have insufficient incentive to respond to trading opportunities. However, as we argue below, there is little reason to believe that this argument applies to public service broadcasters, given that they compete with commercial rivals for viewers in order to achieve PSB impact, and in the case of Channel 4 also for advertising revenues, and therefore have every incentive to make the most of the spectrum they have been awarded. Moreover, although public service obligations impose constraints on the BBC and Channel 4's demand for spectrum which do not apply to commercial broadcasters, they nevertheless face the same incentives to increase capacity or lease under-utilised spectrum at the margin.

78. The incentive effects arising from trading of DTT capacity are not dependent on broadcasters pursuing a profit objective. Both Cave and Ofcom allege that public bodies lack incentives to behave efficiently because they are not-for-profit, and would respond more strongly to explicit cost signals in the form of charges for spectrum use rather than opportunity costs in the form or forgone gains from trade.[62] We note that this argument is not particularly well developed or supported. Nevertheless, even if one assumed it to be true for some types of public bodies that are spectrum users, such as the Ministry of Defence (MoD) and the emergency services, it seems unlikely that it would apply to public service broadcasters, for three reasons:

- *PSBs operate in a competitive environment*. Unlike most other public users, such as the MoD, PSBs compete with commercial rivals in a downstream market. Although PSBs do not pursue profits, they do compete with other broadcasters for viewers in order to maximise PSB impact and, in the case of Channel 4, for advertising revenues. This creates very strong incentives to manage all their resources (including spectrum) efficiently. Looking forward, one would expect PSBs to regularly review their digital channel portfolios, and that the costs of expanding or contracting their DTT capacity (and thus spectrum use)

[62] See the Cave Review, p.166-169 and Ofcom, Statement on Spectrum Trading, August 2004, p42-44.

through trading will be an integral part of this. Indeed, PSBs are already involved in purchasing multiplex capacity – both Channel 4 and the BBC have bought additional capacity (and even though the BBC might not be required to continue doing so following switchover as a result of the increase of capacity on its multiplexes from moving to 64QAM, it is considering the release of any unused capacity into the market).

- *The market for DTT capacity is likely to more liquid and transparent than many other spectrum bands*. For trading to work effectively as an incentive for efficient use, it is important that existing spectrum users are sufficiently aware of the potential gains from trade. This is clearly the case for PSBs, as there is already a market for DTT capacity: recent sales of slots on the Freeview platform have demonstrated that there is excess demand; and the approximate sale price of slots and identity of bidders has been widely reported in the press. By contrast, the MoD may be much less aware of opportunities, as its spectrum has not hitherto been available for commercial exploitation and many prospective users may not even have considered the possibility of access. Arguably, spectrum pricing might encourage the MoD to absorb the transactions costs of seeking out sellers. Such a stick would clearly be redundant for PSBs, as selling opportunities are already readily identifiable.
- *PSBs are limited in terms of their control over their use of spectrum*. As we have discussed elsewhere, PSBs have very limited influence over how spectrum is used for broadcasting. In order to fulfil their public service remit, it is imperative that they broadcast on the DTT platform using UHF spectrum. As viewers buy and install their own equipment which is tied to this platform and spectrum, they could not by themselves organise a switch to alternative platforms or spectrum in response to price signals. This contrasts with both the MoD and emergency services, which control both the send and receive equipment base within a closed user group, and therefore potentially have the ability to shift systems deployment in response to spectrum price signals.

79. Public service broadcasters are also less able to adjust their spectrum demand than commercial broadcasters, as they are subject to additional constraints in terms of coverage and their service obligations. For example, assume that it would be efficient for a commercial multiplex operator to limit the geographic coverage of DTT services, and sublease spectrum access in those regions where it does not transmit to alternative uses (say PMR). The cost savings from not rolling out a ubiquitous transmitter network, together with the revenues from subleasing spectrum in areas without DTT coverage can be expected to be reflected in lower cost for a DTT slot on a commercial multiplex. While a commercial broadcaster would have an incentive to move to such a multiplex, given the cost savings it would enjoy, a public service broadcaster required to achieve near universal coverage would not have the opportunity, say, to purchase capacity on a commercial multiplex and return spectrum in order to avoid charges. Similarly, a PSB would not be able to

move to another platform, completely abandoning DTT and returning unused spectrum in order to save spectrum charges.

80. Nevertheless, subject to the constraints identified above, public service broadcasters have the same incentives as commercial broadcasters to buy, sell and lease capacity. This is illustrated by the recent behaviour of Channel 4 and the BBC which, along with ITV, have been active participants in the market for DTT transmission capacity. Further, in the case of the BBC's Multiplex B, a requirement to sell or lease unused spectrum is written into its licence. Where leasing capacity improves the ability of the PSB to meet its obligations (e.g. in the case where ploughing back the additional revenues gained from other users into programming allows the PSB better to fulfil its public service remit), doing so is both efficient and in the interest of the PSB.

81. Channel 4 has been active in both leasing spare capacity and, most recently, leasing new capacity for its own growing channel portfolio. For instance, following the collapse of ITV Digital, Channel 4 sub-let the capacity on Multiplex 2 that was previously used by FilmFour, using the proceeds to offset the cost of running the multiplex. Meanwhile, Channel 4 and ITV have made substantial investments in the compression technology of Multiplex 2 to increase capacity from the originally envisaged six to a total of eight television channels by using dual pass encoding MPEG-2 technology at a cost of £2.2m. Four of these are allocated to Channel 4, and used for the transmission of Channel 4, E4, More4 and QuizCall.

82. Channel 4 currently offers two channels in addition to those carried on Multiplex 2 (namely E4+1 and More4+1), and has purchased additional capacity from multiplex operators. E4+1 is carried on multiplex C, and More4+1 is broadcast on multiplex D.[63] Thus, Channel 4 clearly experiences the opportunity cost of increased spectrum use at the margin in the form of payments it has to make for such additional capacity, irrespective of the fact that it is currently not paying for the use of spectrum on Multiplex 2. Therefore, it is difficult to envisage how spectrum charging could increase efficiency within Channel 4.

83. Similarly, the BBC is exposed to opportunity costs at the margin, as demonstrated by its recent decisions on managing access to multiplex capacity:

- The BBC was gifted multiplex 1 under the terms of the 1996 Broadcasting Act, and was broadcasting its services using 64QAM. However, it also purchased additional capacity at that time on the open market (from SDN) to carry additional services such as BBC Knowledge.
- As part of the Freeview bid, the BBC was granted a licence by Ofcom for a second multiplex (multiplex B). The additional multiplex capacity

[63] In addition, Channel 4 is currently launching another channel, E4 Music, using the E4 slot during the times that E4 is not being broadcast.

allowed the BBC to move from 64QAM to 16QAM, which reduced available capacity. However, rather than being a reduction in the efficiency of spectrum use, this move (which was approved by Ofcom) was designed to increase the robustness of the signal and thus (coupled with power increases at many of the DTT transmitters) resulted in a 5% increase in core coverage.

- Upon permanent migration to the DTT platform alone, both the BBC's multiplexes will achieve near universal coverage through transmitter power increases, allowing a return to the 64QAM, but in the meantime the BBC continues to purchase additional capacity on Multiplex A for the transmission of its radio services (BBC Radios 1-4).[64] Following switchover, the BBC will benefit from an increase in the capacity of its multiplexes, but it has committed to offering capacity to S4C (in Wales) and Channel 5; both broadcasters will need to move to one of the PSB multiplexes in order to meet the coverage targets associated with their public service obligations. We understand that the BBC is currently evaluating whether any capacity will become available for the open market.

84. In sum, the BBC and Channel 4's sale and purchase of capacity and the BBC's commitment to use increased capacity post-switchover to carry other PSB channels show that both organisations face the opportunity cost of their spectrum use regardless of whether it will become liable for AIP payments.

85. In addition, given that both the BBC and Channel 4 are paying the (significant) costs of building out the DTT network, they have a clear incentive to use spectrum as efficiently as possible for its designated purpose (subject to the obligations under which they operate and the frequency planning constraints in their licences).

[64] As part of this switchover plan, Ofcom has proposed that those multiplexes currently operating at 16QAM should move to 64QAM. This will improve the efficiency of the bandwidth used for those multiplexes currently at 16QAM, however, for those multiplexes already operating at 64QAM (including multiplex 2) there will be no additional efficiency improvement. Channel 4's multiplex, multiplex 2, is currently operating at 64QAM.

4 The impact of spectrum charging on PSBs

86. In the previous section, we have shown that the options for broadcasters and multiplex operators to increase the efficiency of spectrum use are very limited, and that the tradability of DTT capacity by itself provides strong incentives for exploiting those efficiencies to the maximum extent possible. Given this, the main function of AIP charges would be to extract the scarcity value of DTT spectrum for the benefit of the public purse. Thus, spectrum charges would perform the same function (and in the case of the case of the ITV licensees and Channel 5 explicitly replace) the Additional Payments that such broadcasters make under their Broadcasting Act licences.

87. As part of its spectrum pricing consultation, Ofcom acknowledges that exposing such broadcasters to charges for analogue spectrum – the only form of AIP so far considered by Ofcom - could lead to double payments even under its preferred options (namely in the case where such broadcasters continue to use analogue spectrum after the date for switchover included in their digital replacement licences, and the reasons for the delay in ceasing to broadcast an analogue service are within the control of the broadcaster). In this case, Ofcom would propose to deduct payments under AIP from payments based on qualifying revenues.[65] Moreover, it is worth pointing out that reducing Additional Payments is only one way of compensating such broadcasters for the increase in their cost base that might result from the introduction of spectrum charges. An alternative form of compensation is a reduction in the obligations imposed on the broadcaster, such as, for example, a reduction in the proportion of originated programming that the broadcaster is required to provide. Relaxing such an obligation would allow the broadcaster to save costs by replacing originated programming with bought in content (taking account, of course, of the impact of such a decision on audience share and revenues).[66]

88. Thus, it should be obvious that levying AIP charges on public service broadcasters who at present receive spectrum without having to make Additional Payments (i.e. Channel 4 and the BBC) will simply increase their cost base. For example, the BBC could face new costs equivalent to up to 11% of its expenditure on programmes transmitted on its public service television channels (see calculations below). Similarly Channel 4 could face charges up to 10% of its programming budget. Unless these organisations received new funds to compensate for these increased costs, they would necessarily need to cut back their expenditure in other areas. Thus, the

[65] See paragraph 8.10.10 of the spectrum pricing consultation. We note that it is far from clear why similar considerations would not apply to fixed payments.

[66] Note that relaxing any constraint that affects the broadcaster's behaviour in practice will by definition either reduce the broadcaster's costs, or increase its revenues, and thus raise overall profits. Otherwise, the broadcaster would have had an incentive to behave in the way required by the licence conditions anyway, and the condition would not have had any practical effect.

effect of spectrum charging would – as we will show – more likely lead to cuts in non-spectrum related activities, rather than any change in spectrum use.

89. Table 2 below provides some possible benchmarks for calculating AIP for DTT spectrum. One approach would be to use the Indepen least-cost alternative methodology, which valued a DTT multiplex at between £48m (for a commercial multiplex) and £57m (for a PSB multiplex).[67] However, this approach rests on a number of questionable assumptions about the costs of take-up of alternative delivery platforms.[68] Moreover, it presents a static view of opportunity cost that does not reflect the scarcity of DTT spectrum nor the increase in its value as take-up of Freeview boxes and thus the addressable audience has risen.

90. An alternative approach would be to consider the commercial value of DTT spectrum, based on recent trades. The willingness to pay of broadcasters for commercial DTT spectrum is arguably a more realistic indicator of the true opportunity cost of reserving spectrum for PSBs than considering alternative deployment strategies. Although there is no official data on trades, media reports suggest that the price of a single TV channel on an 8-channel multiplex has risen over the last three years from around £3million to £10million per annum.[69] This implies that the opportunity cost of reserving an entire multiplex for PSB might have risen from around £25million to £80million since the launch of Freeview in 2002. It is worth noting that the last three commercial TV slots to become available have been bought by ITV and Channel 4, both of which are public service providers that already have reserved spectrum.

91. In a liberalised spectrum world, it may also be relevant to consider alternative uses of spectrum other than DTT. Table 2 includes a number of

[67] The difference arises from the fact that six 8MHz blocks are required for nationwide coverage, whereas the coverage that a commercial operator would aim for requires only five blocks.

[68] For example, in its review of public service television broadcasting (phase 2), Ofcom pointed out that "the launch of Free Sat would affect the Indepen calculation, which is based on the cost of connecting customers to satellite (as an alternative to DTT) and assumes a smart card is needed. If this is no longer the case then the charge […] would fall to £670,000 per MHz per annum. 6*8*£670,000 = £32m." It is also worth pointing out that the methodology assumes that the willingness to pay of broadcasters *in general* is determined by the cost of using alternative technologies in order to maintain universal coverage. This is unjustified, as commercial broadcasters may well be prepared to forgo incremental coverage if the revenue loss from doing so is smaller than the associated cost savings (in terms of a smaller transmission network). This means that the opportunity cost would have to be determined by the *lower* of the cost of using alternative technology in order to maintain coverage, and the reduction in profits from a reduction in coverage; only public service broadcasters who are *required* to maintain coverage would have to incur the former cost.

[69] Media Guardian, 21 April, 2005 and 29 November, 2005. Note that these fees also cover the cost of transmission services provided by the multiplex owner, so strictly should not be considered entirely as scarcity value.

benchmarks for alternative uses. These benchmarks are potentially relevant when considering the broader opportunity cost of reserving spectrum for DTT use. However, for the purposes of calculating AIP, they are only relevant to the extent that it is possible for these services to co-exist with DTT, given that the government has already committed to making this spectrum available to DTT use. Of the uses presented, only PMSE falls into this category – and its value appears rather lower than that of additional commercial TV. Of the other uses presented, particular care should be taken in interpreting the cellular mobile data, as this is based on awards of spectrum in bands officially allocated for mobile, not UHF spectrum.

Table 2: Possible benchmarks for calculating AIP for DTT spectrum

Methodology	Price per MHz per annum	Cost of TV slot on Freeview†	Cost of a mutiplex†
Least cost alternative:			
Indepen original [a]	£1.20m	£6.0m	£48.0m
Ofcom revised [b]	£0.67m	£3.4m	£26.8m
Value of alternative use:			
Commercial TV [c]	£2.00m	£10.0m	£80.0m
PMSE / PMR [a]	£0.64m	£3.2m	£25.6m
FWA [d]	£0.60m	£3.0m	£24.0m
Cellular mobile [d]	£54.00m	£270.0m	£2,160.0m

Notes: †Based on typical deployment profile for a commercial multiplex using five 8MHz broadcast channels and providing a capacity of 8 simultaneous 24hour TV slots on Freeview.

Data sources: [a] Indepen, Spectrum pricing report for Ofcom (2004); [b] Ofcom, Review of public service television broadcasting – phase 2 (2004); [c] Media Guardian (Nov 2005) – based on estimate of annual fee to be paid by Channel 4 for access to an addition Freeview TV slot on the commercial National Grid Wireless multiplex; [d] Analysys (2005) – estimates of the 'intrinsic' value of spectrum for FWA and cellular mobile based on international price benchmarks from 1998-2004.

92. The benchmarks presented in Table 2 are based on commercial multiplexes using five 8MHz spectrum blocks. They may therefore underestimate the 'opportunity cost' of PSB use, as these multiplexes are expected to use six blocks in order to achieve greater national coverage. Currently, the BBC is reserved two multiplexes, while ITV and Channel 4 share one reserved multiplex. Using the Indepen and Freeview slot data and adjusting for the additional spectrum use of PSB multiplexes, this might imply annual AIP charges of £114-192million for the BBC and £27-48million each for ITV and

Channel 4.[70] In the case of the BBC, such charges would be equivalent to 8–11% of the corporation's total spend on programmes transmitted on all of its public service TV channels (£1.7bn in 2004/05). In the case of Channel 4, the cost would be between 6-10% of programming spend (£485m in 2004/05).

93. The magnitude of these payments is not out of line with the Additional Payments currently made by Channel 3. ITV plc (including GMTV) announced that it would pay £80 million in 2005 (which implied a reduction of £135 million from 2004 payments of £215m). Of these, only £4m would be fixed payments, with the remainder being related to qualifying advertising revenue.[71] Although as a result of the 'digital dividend'[72] these payments would fall to zero by the time of digital switchover, commercial broadcasters would not be worse off than at present if they had to pay spectrum charges of that magnitude: the payment of such charges would obviously be reflected in bids made for the licence, and thus in any licence fee set by Ofcom on renewal of the Broadcasting Act licence. Put differently, any licence fee set in the future for licences that contain rights and obligations comparable to those found in the current licences would be reduced by the amount the licensee would have to pay for the spectrum associated with reserved capacity, as the increase in cost faced by the licensee would flow through to a commensurately lower bid in a (hypothetical) auction.

94. By contrast, the introduction of such large charges would clearly have significant funding implications for BBC and Channel 4 . In order to maintain their current levels of service, they would require compensation to offset these increased costs. Without compensation, they could respond in a number of ways:

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[70] These amounts have been calculated by taking the amount of spectrum currently reserved for the BBC and ITV/Channel 4 and multiplying that by the spectrum value implied by the Indepen approach and the commercial transactions for DTT slots on Freeview.

[71] 'Ofcom determination of financial terms for Channel 3 licences ITV plc response', ITV press release, 29/06/2005. Channel 5 pays a fixed sum of £4.4 million (in 2004 prices), and 8% of qualifying revenue (see 'ITC announce terms for renewal of Channel 5 licence', ITC news release, 26/32/2003).

With Ofcom estimating total TV advertising for 2004 to be standing at £3.5bn (see http://www.ofcom.org.uk/research/cm/overview05/finance/), Channel 5's share being 8.3% (see http://www.five.tv/aboutfive/corporate/businessreview/sales/), and assuming that half of advertising revenues are 'analogue', Channel 5's PQR payments would be around 11.6 million – also in excess of what spectrum charges would be under the above assumptions.

[72] The 'digital dividend' refers to the fact that PQR payments are linked to analogue advertising revenue, and will thus fall as digital take-up increases. This reduction in payments provides a strong incentive for commercial broadcasters to promote take-up of digital television, and thus to support digital switchover.

- they could sell or lease some spectrum to commercial broadcasters, thus offsetting a proportion of their spectrum charges – but the scope for this is very limited give coverage constraints and their public service remits;
- they could cut investment in programming which accounts for the largest proportion of expenditure by public service broadcasters;
- they could try and increase revenues in order to compensate for higher costs – however, given that prices for secondary programming rights, or advertising space are determined competitively, it is doubtful that a previously unexploited opportunity to increase charges exists. Moreover, the argument that all DTT broadcasters face an increase in their cost base, which will eventually have to be passed through to their customers (advertisers, purchasers of programming or, in the case of pay TV providers, subscribers) ignores the fact that (a) marginal costs are unchanged because broadcasters are exposed to opportunity costs of spectrum use even in the absence of AIP charges, and (b) for commercial broadcasters who are currently paying for spectrum, total costs would not change as spectrum payments would be accompanied by corresponding reductions in Additional Payments under their Broadcasting Act licences.

95. Thus, it seems most likely that (unless they are adequately compensated for AIP charges) PSBs like Channel 4 and the BBC would have to respond by cutting investment in other areas, such as programming, rather than by reducing their spectrum use (e.g. by reducing coverage to the level of commercial multiplexes, thus freeing one UHF channel). Unlike ITV and Five the BBC and Channel 4 do not have the option of abandoning their position as public service broadcasters and reducing their coverage, or ceasing to broadcast on the DTT platform altogether. The ability of the PSBs to cut back on spectrum use is very limited, as this would mean that they cannot longer meet their public service obligations

96. PSBs already lease capacity on the commercial multiplexes in addition to the DTT spectrum reserved for their use (and could release any unused capacity that they hold). Thus, they are already exposed to the opportunity cost of their use at the margin. Thus, imposing AIP on PSB spectrum would be unlikely to affect their preferences for using spectrum except in the case that it creates hard budget constraints.

97. Regardless of whether PSBs actually change their spectrum use in response to the introduction of AIP, it is clear that such charges (if not offset by some form of compensation) will significantly increase the broadcasters' cost base. requiring them to cut spending on other activities. This would jeopardise the PSBs' ability to discharge their public service obligation in terms of providing distinct and original programming.

5 Suspending spectrum charges as support for PSBs

98. Gifting spectrum is one particular form of support for public service broadcasting. At present, public service broadcasting is financed by "*a patchwork of direct and indirect public subsidies alongside a similarly wide variety of obligations on the main terrestrial TV channels*."[73]

- The BBC is funded by a licence fee payable by everyone (with some exceptions) owning a television set, and is given free spectrum in return for special and wide-ranging public service obligations. The BBC also receives direct funds from central Government in respect of free licences for those over the age of 75 and for the World Service.
- Channel 4, although financed by advertising, is a not-for-profit organisation[74] and guided by its public service remit, which includes obligations to innovate, to experiment, to be creative, to appeal to the tastes of a culturally diverse society, to be distinctive and to make a significant number of programmes of an educational nature. Like the BBC, it is given free spectrum and other privileges (such as must-carry status on cable systems or the right to prominence on electronic programme guides).
- The commercial broadcasters, ITV1 and Five, are granted access to scarce analogue spectrum and other privileges, in return for commitments to fulfil certain programming obligations. They originally won their Broadcasting Act licences in a competitive auction, and pay an ongoing price on renewal of their licences. These payments include an implicit sum for spectrum, but also reflect the benefits obtained through privileges such as 'must carry' status on cable systems, as well as the cost arising from the public service obligations included in their licences.
- S4C receives funding from the Department for Culture, Media and Sport (DCMS) to finance its operations.

99. Table 3 provides an overview, showing that the provision of free or subsidised spectrum (together with a range of privileges related to EPG position and must-carry status) is a common form of support for public service broadcasters.

[73] Ofcom, Review of Public Service Broadcasting, Phase 2 – Meeting the digital challenge, paragraph 3.1

[74] Channel 4 is not required to pay a dividend to the Government, its sole shareholder.

Table 3: Support for PSBs

Form of subsidy	BBC	ITV1	Channel 4	Channel 5	S4C
TV licence	✓				
Free spectrum	✓		✓		✓
Subsidised spectrum		✓		✓	
Appropriate prominence on EPG	✓	✓	✓	✓	✓
Reserved capacity on DTT	✓	✓	✓	✓	✓
Must-carry on cable	✓	✓	✓	✓	✓
Central government funding	✓				✓
Dividend waived			✓		

Source: Ofcom, PSB Review, Phase 2, Table 3.1

100. In order to maintain the level of funding for PSBs, spectrum charges would obviously need to be reflected in reduced payments by broadcasters who at present receive subsidised spectrum access, and this is what Ofcom has proposed in its spectrum pricing consultation. By implication, where part of the support is provided in the form of free access to spectrum, spectrum charges would need to be accompanied by a corresponding increasing in funding (in the case of the BBC) or an explicit subsidy (in the case of Channel 4).[75] Indeed, the need to provide funding in order to neutralise the impact of spectrum charges has been acknowledged in the Cave Review:

> "*One argument which was put forward was that broadcasters effectively pay for their spectrum through the public service broadcasting commitments they make. The review acknowledges that spectrum pricing can potentially result in inefficient outcomes if the private or commercial value of spectrum usage differs from its wider social value. But the review considers that the same principle should apply to broadcasters as to other public services, i.e. the goal of overall economic efficiency is best served if broadcasters are given incentives to use spectrum efficiently. The*

[75] For the sake of completeness, it is worth pointing out that also under Ofcom's preferred model of a so-called public service publisher, for which competitive bids are received, the increased cost of spectrum access as a result of spectrum charges would be reflected in the level of the bids in the sense that for any given level of funding, the range and quality of programming services offered by bidders would be reduced. Thus, in order to achieve a certain level of public service, the level of funding would have to be increased by the amount of the cost increase through spectrum charging – or free spectrum access would have to be included in the package.

> *Government can then make available any funds it finds necessary to compensate public sector broadcasters for any charge for spectrum, with the compensation mechanism designed to be consistent with other objectives such as independence of broadcasters from Government*."[76]

101. However, in the previous section, we have argued that AIP is unlikely to provide any incentives for efficient use of spectrum above and beyond those that arise from the fact that DTT capacity is scarce and is traded. Therefore, an obvious question is why it would be better to apply spectrum charging to PSBs, and compensate them for the increased costs through appropriate increases in funding rather than continue with a policy of gifting spectrum. Indeed, closer examination suggests that continuing to provide support in the form of free spectrum access is a superior solution.

102. This is mainly because a solution in which public service broadcasters pay for spectrum but then receive compensation for the increase in their costs requires more information and poses a greater risk with regard to the broadcaster's ability to discharge their public service obligation than a direct grant of free access to a given amount of spectrum. The latter does not have any distortive effects (other than those that the funding of public service broadcasters is intended to achieve regardless of the way in which it is being provided, namely to maintain the provision of programming and an overall broadcasting environment that fulfils the policy objectives underpinning the idea of public service broadcasting).

5.1 Informational requirements associated with charges and compensation

103. In order to provide support through the grant of free access to spectrum, it is necessary to know how much spectrum a PSB would require in order to fulfil its obligations. Determining the spectrum endowment that is commensurate with a given set of public service obligations may be difficult in practice – but it is necessary regardless of whether support is to be provided in-kind, or in the form of explicit (additional) funding.

104. This is because the amount of funding that is required needs to be linked to the cost of spectrum required for the discharge of the broadcaster's public service remit, rather than the amount of spectrum the broadcaster actually uses. If a broadcaster were simply reimbursed for whatever amount it actually pays for spectrum (or DTT capacity), this would result in a distortion of incentives: the opportunity cost of spectrum used by the broadcaster would be zero, and the broadcaster would therefore have an incentive inefficiently to expand its spectrum use. Therefore, an appropriate level of

[76] Cave Review, p171. This point was reiterated by Professor Cave in front of the House of Lords Select Committee on the BBC Charter Review (see Select Committee on the BBC Charter Review, 11 January 2006 (uncorrected transcript), answer to Q1747).

compensation would have to be set in advance on the basis of the cost that a broadcaster is expected to have to incur in getting access to the amount of spectrum (or capacity) required in order to discharge its obligations.

105. This not only requires one to determine the amount of spectrum (or capacity) that a public service broadcaster requires in order to be able to fulfil its role, but also to calculate the likely payments that such a broadcaster would have to make for spectrum over the period of time for which funding is provided. In other words, additional information is required in order to set an appropriate level of compensation compared to providing support in-kind through gifting spectrum. Any uncertainty over the likely level of charges (in the case where Ofcom sets spectrum charges, but another branch of government is responsible for providing the funding necessary to pay such charges), or the price of capacity in the open market will create a risk that PSBs may not be able to fulfil their public service remit (or are over-compensated). By comparison, the traditional idea of gifting spectrum to PSBs in order to compensate them for their obligations clearly acknowledged that these obligations could only be met through access to spectrum, and that not obtaining access to spectrum would effectively jeopardise their ability to discharge their obligations.

106. Given that the precise details of any such compensation regime are unknown, it is helpful to consider a few potential arrangements:

- Assume that PSBs do not receive spectrum, but are given funds that allow them to buy capacity on commercial multiplexes. In this case, PSBs are exposed to potentially significant price fluctuations, leaving them with either an insufficient budget to meet their obligations, or with funds in excess of what would be required for this purpose (which is likely to imply inefficiencies or distortions elsewhere in the economy). Moreover, there is a material risk that PSBs may not be able to satisfy their requirements at all. For example, multiplex operators may not be prepared to provide the coverage needed by the PSB if most of its other customers need only limited coverage (or may at least not be willing to do so unless the PSB is prepared to cover the full cost of extending coverage to the level required).
- Assume that PSBs would be receiving a given amount of spectrum (considered to be commensurate with their obligations) and be required to pay AIP charges to Ofcom, but would be compensated from some other source (e.g. a direct grant from central government, a specific levy on viewers, or an increase in the licence fee). In order to determine the appropriate level of compensation, it is necessary to establish the precise level of AIP charges over the period for which the funding arrangements are determined. Any deviation of actual charges from those predicted in setting the funding level will create a situation in which PSBs have less funds available for other expenditure such as programming, or are over-funded. Even if the average level of charges was predicted correctly, but actual charges fluctuated significantly, this would create avoidable uncertainty which would tend to make financial planning by PSBs more difficult. In practical terms, the only way of avoiding these risks would seem to be to require Ofcom not to vary the

level and structure of charges from those that have been used in determining the funding requirement for the period of time for which the funding has been set. This might be unacceptable unless this period is relatively short (say one or two years). However, revisiting funding requirements so frequently may be undesirable for other reasons.

- Funding gaps or over-funding can be avoided by tying compensation to the actual level of charges (though applied to a fixed amount of spectrum set periodically in light of what the PSB will need in order to fulfil its role, rather than the amount actually used). This would result in a situation in which money would flow from PSBs to Ofcom, and the exact same amount of money would be flowing back from Ofcom to the PSB – or more likely from Ofcom to some other branch of government, which then funds the PSB's spectrum costs. Such a solution would clearly expose the equivalence of gifting spectrum and providing compensation in terms of the cost to the public, but would create additional administrative costs without in any way affecting broadcasters' incentives relative to a situation in which spectrum was gifted.

Overall, this means that a regime of providing compensation for costs incurred as a result of spectrum charges at its best achieves the same outcome as a direct grant of spectrum (albeit with some additional complications), and may perform significantly worse.

107. In this context it is also worth pointing out that there would be no direct mechanism linking the revenues from spectrum charges to the support provided to existing public service broadcasters. In front of the House of Lords Select Committee on the BBC Charter Review, Ofcom's Chairman, Lord Currie of Marylebone, said that spectrum charges would go to the Treasury, and that they …"*could be recycled back, for example, into public service broadcasting, the broadcasters themselves or some new concept like the public service publisher*" but that "*what that money is used for is not a matter for Ofcom.*" [77]

5.2 Transparency with and without spectrum charging

108. Not exposing PSBs to spectrum charges but providing spectrum as support in kind for the obligations on such broadcasters should not have any disadvantages in terms of transparency. In his review, Cave argues convincingly that *"[t]he spectrum used for broadcasting should be valued and the values released into the public domain*."[78] However, making transparent the value of spectrum used for broadcasting does not require

[77] House of Lords, Minutes of Evidence taken before the Select Committee on the BBC Charter Review, 14 December 2005 (uncorrected transcript), answers to Q1449 and Q1450.

[78] Cave Review, p.166.

that all broadcasters are actually charged for their spectrum use. The use of AIP for commercial broadcasters and/or the commercial value of DTT capacity provide benchmarks for valuing PSB spectrum, irrespective of whether AIP is applied to PSBs. This would allow the public to establish the value of support given to PSBs without money flowing back and forth (which, as argued above, would have potentially significant downsides).

109. Valuing the spectrum gifted to PSBs would provide an important input into the political process in which the cost and benefits associated with a range of public service obligations are assessed and through which the appropriate scope of public service broadcasting is established. This would help, for example, in determining how much additional spectrum should be awarded to PSBs in order to allow them to extend their channel portfolio, or to move towards broadcasting services in high definition (which may be necessary to allow such broadcasters to remain competitive with, and to continue to be able to set the bar for commercial broadcasters).

5.3 Concerns about distortions

110. An argument that may be raised against the provision of access to spectrum for free is that gifting spectrum distorts price signals, which in turn leads to productive inefficiency or distortions of competition.

111. Ofcom, in its spectrum pricing consultation, acknowledges its power to take into account objectives other than economic efficiency when setting AIP, and notes that stakeholders have argued that social benefits or costs associated with spectrum use should be taken into account in using AIP. However, Ofcom refers to the analysis undertaken by Indepen et al. as part of their review of spectrum pricing, and states that "*[f]ollowing the work of Diamond and Mirrlees they concluded that it was better to address externalities such as social benefits by subsidising higher prices charged to end users rather than by subsidising the price of inputs such as spectrum*."[79] Ofcom then states that it believes the approach suggested by Indepen – namely to promote particular social benefits and public policy goals by adjusting end user prices or other policy tools such as direct intervention – to be generally the better way forward.

112. The Diamond-Mirrlees Efficiency Theorem[80], on which Indepen's recommendation is purportedly based, undoubtedly is a seminal result. By showing that, subject to certain conditions, productive efficiency is a desirable objective even if a full Pareto-optimum cannot be achieved, it addresses many of the concerns that have been raised from the insight that:

[79] Spectrum Pricing Consultation, paragraph 2.3.3

[80] See P A Diamond and J A Mirrlees, 'Optimal Taxation and Public Production I: Production Efficiency', *American Economic Review* Vol. 61, 1971, pp 8 – 27; 'Optimal Taxation and Public Production II: Tax Rules', *American Economic Review* Vol. 61, 1971, pp 261 – 278.

- in the real world many of the conditions for a first-best full Pareto-optimum are unlikely to hold (e.g. because governments may wish to use redistributive measures in order to change income distribution); and that
- striving for efficiency in one area of the economy will therefore not necessarily lead to an increase in overall welfare (the so-called theory of second best).

113. However, it would seem naïve to believe that this theorem implies that it would be generally undesirable to provide free access to spectrum in order to support certain public policy objectives, or to manipulate prices of inputs or intermediate goods. In this particular case, two points are relevant:[81]

- The grant of a given amount of spectrum (or the provision of funds calculated by valuing this amount at an arbitrary price) could be properly described as a lump sum transfer. It does not – as argued above – distort price signals at the margin, and therefore does not lead to productive inefficiency. It does not change relative prices for different types of producers and thus distort the structure of production. It is, therefore, not a form of support which could be rejected on the basis of the Diamond/Mirrlees theorem.
- In any case, 'adjusting end user prices' is not a feasible option in the case of support for PSBs. Public service broadcasting is – for good reasons – offered free at the point of use, i.e. there are no end user prices that could be adjusted. For similarly obvious reasons it would not be possible to support Channel 4's PSB obligations by 'adjusting' advertising fees (which in this case would mean charging higher prices

[81] In addition, there are conditions under which the efficiency theorem does not hold. For example, Diamond and Mirrlees themselves discuss a number of assumptions that, in their view, might limit the applications of their theory, namely that there is no cost of tax administration, no tax evasion and constant returns to scale and price taking in private production. In their words, "*[p]ure profits (or losses) associated with the violation of these assumptions imply that private production decisions directly influence social welfare by affecting household incomes. In such a case, it would presumably be desirable to add a profits tax to the set of policy instruments. Nevertheless, aggregate production efficiency would no longer be desirable in general; although it may be possible to get close to t the optimum with efficient production if pure profits are small."* (Diamond and Mirrlees, Optimal Taxation and Public Production II: Tax Rules, p. 278). Subsequent work has considered the impact of further limitations, e.g. restrictions on the choice of tax rates: "*When on the other hand restrictions are imposed on the government's choice of optimal tax rates, influencing producer prices may be a way to change consumer prices, and the Production efficiency theorem no longer applies."* (K J Munk, 'What determines the optimal tax structure form an intuitive point of view', Discussion paper 2002-17, ERPU, University of Copenhagen, referring to Dasgupta and Stiglitz, 'On Optimal Taxation and Public Production', *Review of Economic Studies* Vol. 39, 1972, pp 141-54).

to advertisers), as such fees are determined through competition between broadcasters (and, in all likelihood, competition with other advertising media).

114. A further concern may arise with regard to potential distortions of competition that may be said to arise from the fact that some operators are exposed to spectrum charges while others are not. These concerns are, however, unfounded. This is because gifting spectrum provides a lump sum transfer in support of the obligations accepted by some broadcasters, which does not affect opportunity costs at the margin, and therefore does not distort competition. The cost of using more spectrum would be the same for commercial broadcasters paying AIP charges, and for PSBs receiving a given amount of spectrum for free, and would be determined by the price of DTT capacity.

115. Moreover, the situation would not be different from the situation today, where some broadcasters pay for spectrum through their liability for Additional Payments under their Broadcasting Act licences, while other broadcasters do not.

116. To the extent that the provision of support for PSBs in itself is seen to be affecting competition (e.g. by changing the demand faced by commercial broadcasters), this goes of course to the heart of the rationale for public service broadcasting. The impact on other broadcasters of having PSBs[82], the effects that this has on the overall broadcasting landscape, and the cost of supporting these broadcasters, are clearly relevant factors in considering the appropriate scope of public service obligations. Once such obligations have been defined, it would therefore be inappropriate and inconsistent to withdraw or reduce support (which would result if spectrum charges were imposed without adequate compensation) because of this impact.

[82] In Ofcom's words, "*the existence of separate funding streams has created a competitive interplay between the broadcasters. The BBC exists to use public funds to set standards and establish high production values that the other channels have to match. The commercial broadcasters have pursued audiences in order to generate advertising revenue. In turn, this has encouraged the BBC to produce quality popular programming in order to compete for viewers and justify the licence fee. Channel 4, without either shareholders or a stream of public funding, has been given more freedom to innovate (indeed it has a statutory responsibility to do so).*" (Ofcom, Review of public service broadcasting, Phase1 – Is television special?, p 18). For a simple formal model on the way in which public service broadcasters and commercial broadcasters can affect each other see, for example, D Barrowclough, 'Spilling over and crowding out: The effects of public sector/private sector convergence and competition in the provision of public goods', CESInfo Working Paper 568, 2001.

6 Conclusions

117. This report has considered the economic case for applying AIP to spectrum assigned directly to public service broadcasters, in particular the BBC and Channel 4. Overall, we find that the case for imposing spectrum charges on such broadcasters is weak, and that it risks disrupting their ability to fulfil their public service obligations with no obvious countervailing benefit.

- The efficiency benefits that AIP is supposed to realise are, in this case, being achieved through trade in DTT capacity.
- Further benefits flowing from the fact that spectrum charges make explicit the value of spectrum used by PSBS would be achieved simply by applying an explicit valuation to the spectrum gifted to such broadcasters (whilst allowing them freedom to trade spectrum). In this section, we briefly recap the reasoning behind this conclusion and propose an appropriate policy going forward.

118. There are two main reasons for introducing AIP, namely to promote efficient use of spectrum by ensuring that users face the full opportunity cost of their use and to capture any windfall gains from the use of a scarce publicly owned resource that would otherwise accrue to private operators. Neither of these reasons is greatly relevant to not-for-profit public service broadcasters.

119. As both Ofcom and the Cave Review have acknowledged, trading alone should normally be sufficient to provide incentives for efficient use, provided secondary markets function effectively and users respond appropriately to market signals. Neither of these caveats obviously apply in this case.

- Firstly, given the many players involved in DTT, there is a good prospect of there being a well-functioning market in capacity. Indeed, trading is already a reality in this sector, with a number of transactions having taken place, involving both individual DTT slots for TV channels and the holders of commercial DTT spectrum rights (ownership of both commercial holders of DTT spectrum have recently changed).
- Secondly, because the BBC and Channel 4 compete with commercial rivals for viewers in order to deliver PSB impact (and, in the latter case, advertising revenues) – a position that significantly differentiates them from most other state-owned users of spectrum – they have strong incentives to make most of their spectrum and respond to market signals. They will buy additional capacity wherever the cost of doing so is justified against the improvement in their ability to fulfil their public service role. Although one would not necessarily expect that such broadcasters would sell significant amounts of capacity (which would, moreover, only be desirable if they have been awarded more spectrum than is commensurate with the scope of their public service obligations), they have an incentive to do so if the resultant revenues, when ploughed back into programming, improve overall service delivery despite the reduced capacity. Indeed, their active participation in the commercial market for DTT slots – mainly as buyers - demonstrates

how they face the same incentives to increase capacity or lease under-utilised spectrum at the margins as do commercial broadcasters and multiplex operators.

120. Windfall gain concerns largely relate to private companies. Channel 4 and the BBC are not-for-profit entities that are gifted radio spectrum in order to fulfil their public service obligations. The benefits that the BBC and Channel 4 receive from their spectrum use can therefore be taken into account by the government when assessing the nature of their public service obligations and funding arrangements.

121. Following from our finding that AIP would have little effect on the incentives for spectrum use by the BBC and Channel 4, we go on to consider what other impacts charging might have. A straightforward observation is that levying AIP charges on public service broadcasters who at present receive spectrum without having to make Additional Payments (i.e. Channel 4 and the BBC) will simply increase their cost base. For example, the BBC and Channel 4 could face new costs equivalent to about 8-10% of their annual programming expenditure on public services. Unless these organisations received new funds to compensate for these increased costs, they would necessarily need to cut back their expenditure, and thus their service delivery. The ability of the PSB providers to cut back on spectrum use is very limited, and therefore, they would probably be forced to cut back on other areas of expenditure, such as original programming.

122. Thus, if AIP were to be imposed on the BBC and Channel 4, some alternative funding arrangements would be required in order to enable them to continue meeting their public service obligations. However, none of the apparent options appear attractive:

- Rather than receive spectrum, PSBs could be given funds to buy all their capacity on commercial multiplexes. However, this would risk exposing them to potentially significant price fluctuations and even failing to acquire sufficient spectrum, jeopardising delivery of their public service obligations.
- PSBs could receive a given amount of spectrum and be required to pay AIP charges to Ofcom, but be compensated from some other source, such as a direct grant from central government, a specific levy on viewers or an increase in the licence fee. However, in order to set funding, it would be necessary to predict the level of AIP charges over the relevant period. Any deviation of actual charges from those predicted would leave PSBs are under or over-funded.
- PSBs could simply be reimbursed for the AIP charges on spectrum that they require to meet their obligations. However, this would have the same effect as gifting spectrum in the first place – though it might add unnecessary administrative overheads and thus be inefficient.

123. In summary, a regime of providing compensation for costs incurred as a result of spectrum charges at its best achieves the same outcome as a direct grant of spectrum, and may perform significantly worse.

124. We have shown that applying spectrum charging to the BBC and Channel 4 is undesirable and may even be harmful to the government's objectives for promoting public service broadcasting. Given this conclusion, it would be appropriate for Ofcom and the Government to develop an alternative path:

- We believe that maintaining the in-kind grant of an amount of DTT spectrum necessary to allow PSBs to provide the service they are required to offer is an appropriate solution.
- The value of such spectrum will of course have to be taken into account when deciding on the scope of the public service for which broadcast spectrum should be set aside. Such a decision might be made through the Charter Review process for the BBC, and an equivalent process for Channel 4.[83] It would be appropriate regularly to review both the amount of spectrum gifted to PSBs and this opportunity cost. This would ensure that the cost of funding the BBC and Channel 4 is transparent, and that for both institutions the value of their spectrum is taken into account when measuring their performance.
- PSBs should retain the ability to buy or lease additional DTT capacity on the open market. If, between reviews of their spectrum needs, PSBs want more spectrum than they have been granted to meet their public service obligations, this means that they would face the full opportunity cost of any additional spectrum they use at the margin, which is what is required for efficiency.
- PSBs should also retain the flexibility to lease spare capacity. This flexibility should ensure they have adequate incentives to ensure that potential future efficiency gains in spectrum use are being exploited.

125. Overall, these recommendations are entirely consistent with the objectives of efficiency of spectrum use set out in the Cave Review for the broadcasting sector, which have been broadly accepted by Ofcom and the Government. Although neither Channel 4 nor the BBC would face explicit charges for the spectrum they use, these other measures would be sufficient by themselves to ensure that the broadcasters are exposed to the full opportunity cost of their use – both at the margin, through the trade in DTT capacity, and

[83] Indeed, this proposal seems to be well-aligned with what Professor Cave has described as an "*overall view of spectrum management, … [in which] there should be two processes going on. One is a process which relates largely to commercial use of spectrum, and that is a market process. In essence, you create spectrum licences as tradable property and you allow various firms to buy and sell this property in order to achieve a market objective of providing services to homes and customers. That is the first world. There is also a second world in which the Government, quite rightly, allocates spectrum for specified public purposes, of which defence and public service broadcasting are obvious examples*." Select Committee on the BBC Charter Review, 11 January 2006 (uncorrected transcript), answer to Q1746). It is clear that in such a world the opportunity cost of spectrum use for public purposes are caused by the Government, and it is the Government which should take these costs into account when deciding how much spectrum to allocate.

overall through the review of the appropriate scope of their activities and the amount of spectrum needed to meet their obligations. Thus, such an approach would be consistent with Ofcom's market-based approach to spectrum management.