PUBLIC VERSION

ALLOCATION OF UNSOLD 700MHz SPECTRUM

SUBMISSION BY
VODAFONE HUTCHISON AUSTRALIA

10 June 2016

Executive summary

On 6 May 2016, the Department of Communications and the Arts wrote to Vodafone Hutchison Australia (**VHA**) seeking VHA's views on the proposed allocation of part of the residual 700MHz radiofrequency spectrum. We thank the Department for giving us this opportunity to respond. As the Department will be aware, we have invested significant time and resources to develop a proposal that delivers substantial benefits to the Government and consumers.

The proposed allocation is documented in the exposure draft of the *Radiocommunications (Spectrum Licence Allocation—Residual 700 MHz Band One) Direction 2016* to be issued by the Minister for Communications (**Proposed Direction**).

We commend the government on the Proposed Direction and express our strong support. The Proposed Direction:

- enables the Government to realise a windfall value of some $600 million for a government asset that is otherwise depreciating;
- ensures that VHA is able to deliver high quality mobile data services to meet our customers' demand;
- maintains the long term sustainability of three viable national infrastructure competitors in the Australian mobiles market;
- delivers substantial benefits in a critical sector of the economy, bolstering innovation and productivity to deliver economy-wide benefits; and
- does not attempt to secure all the available spectrum, leaving a further 2x5MHz to be allocated and which could be made available to other acquirers.

We make the following key points in this submission:

1. **Substantial economic dividend:** Allocation of the spectrum to VHA delivers a plethora of economic benefits. The government receives a revenue windfall of some $600 million. The CIE has undertaken a detailed analysis attached to this submission which estimates the economy-wide gains from the Proposed Direction will deliver benefits to consumers of a further $600 million. In addition, and arguably of much more significant long-term value to the economy, the CIE has estimated that there are substantial benefits to mobile telecoms competition – avoiding a duopoly; while driving allocative, productive and dynamic efficiency gains. Such gains will compound over time and flow through into other sectors of the economy, delivering productivity gains and facilitating innovation.

2. **Public benefit is maximised**: The Proposed Direction will ensure the efficient allocation of spectrum, maximising the overall public benefit derived from its use. The 700MHz spectrum has been unused since 2014 and is a depreciating government asset, reducing in value by some $60 million per annum. The costs of delay, including allocation of the spectrum through other processes are therefore substantial. Allocation to VHA will generate substantial revenue and ensure that the spectrum is efficiently utilised. The Proposed Direction is fully consistent with the policy and legislative regime, including the statutory objectives of the *Radiocommunications Act 1991 (Cth)* and the ACMA's 'Principles for Spectrum Management'.

3. **Efficient allocation procedure**: As the ACMA has often stated, while spectrum auctions are optimal for large-scale spectrum allocations involving many competing bidders, they may not be well-suited for small-scale allocations to limited participants. Section 60(1)(c) of the Radiocommunications Act expressly contemplates allocation by way of negotiated price to cater for different allocation circumstances. A negotiated price allows small-scale and targeted allocations on an efficient and low cost basis, particularly where a specific allocation would maximise the value derived from use of the spectrum for licensees, consumers and the wider community.

4. **Long-term competition will be enhanced**: Allocation to VHA will deliver lower mobile prices and higher quality services, while driving continued innovation and improvements in quality and coverage. VHA will use the 700MHz spectrum to deliver continued intense mobile competition on a long-term basis. Telstra's public criticism of the proposal betrays that allocation to VHA is seen as a real threat to Telstra's market power in the mobile telecommunications markets. VHA is the cornerstone of competition in mobile services, the critical third network operator ensuring no mobile telecoms duopoly occurs. The CIE's report evidences that reducing market concentration delivers significant benefits for consumers – commenting in the mobile voice market that "*a 5 percentage point increase in market share to VHA at the expense of Telstra would be associated with a 10 per cent reduction in prices for consumers... [and] equate to an increase consumer surplus of $2 billion*". The CIE state that "*the impacts of a more competitive VHA would likely be larger than a more competitive Optus*".

5. **Competitive neutrality is preserved**: Any suggestion that VHA is "paying a lower price" for the 700 MHz spectrum is demonstrably incorrect. VHA is paying the same, if not more, than the price paid by both Telstra and Optus in 2013, as explained in the Department's information paper. The 700 MHz auction reserve price of $1.36/MHz/pop that is applied in the Proposed Direction has been pro-rated for the remaining licence term – i.e., 11.75 years. We note the proposed term is 78% of the length of Telstra and Optus' 700 MHz spectrum licences and yet VHA will pay 92% of the digital dividend reserve price. The proposed price ($1.25/MHz/pop) remains at the top end of the price range for similar spectrum when benchmarked

internationally, as identified later in this submission. Finally, we note VHA has also sought to acquire only 2x10MHz of the 2x15MHz available, thus ensuring that another operator could acquire additional spectrum.

In summary, as identified in this submission, it is overwhelmingly in the overall public benefit for the residual 700MHz spectrum to be sold, rather than held by the Government. As identified in this submission, it is also demonstrably in the public benefit for the buyer of the spectrum to be VHA at the price proposed.

For the sake of completeness, VHA has provided the CIE analysis of economic benefits of the proposed allocation as part of this submission. VHA has also shared independent and confidential legal advice from Norton Rose Fulbright with the Department. The legal advice confirms that the Proposed Direction is legally accurate and within the Minister's powers.

We are happy to comment on any other submissions or meet with you to discuss any aspect of this submission at any stage. Again, we thank the Department for the opportunity to comment.

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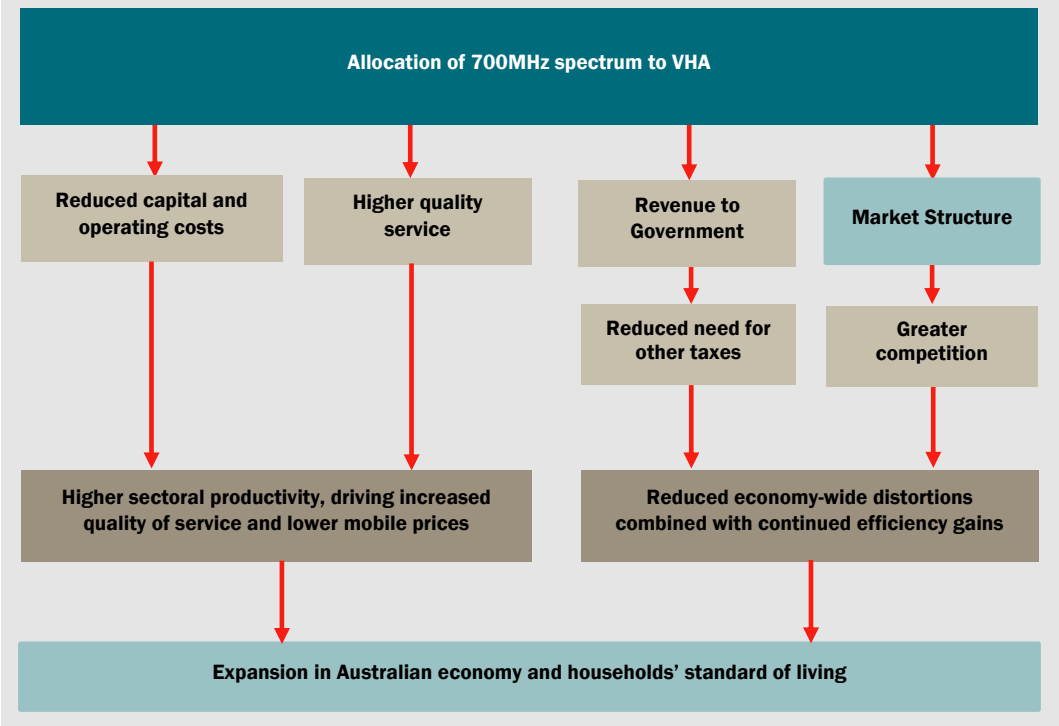
1. Substantial economic dividend

Allocation of the spectrum to VHA delivers a plethora of economic benefits. The government receives a revenue windfall of some $600 million. Further, the CIE estimates the Proposed Direction will deliver benefits to consumers of an additional $600 million. In addition, there are substantial long-term benefits to mobile telecoms competition – avoiding a costly duopoly; while driving allocative, productive and dynamic efficiency gains. Such gains will compound over time and spill-over into other sectors of the economy, delivering innovation and productivity benefits.

(a) Plethora of economic benefits

The allocation of the 700MHz spectrum to VHA will deliver a plethora of economic benefits to mobile consumers, government and the broader community. These benefits are maximised by an allocation to VHA rather than other conceivable (and as far as we are aware speculative) options.

These benefits are illustrated by the following diagram:



Source: The CIE.

For the purposes of this submission, VHA requested the Centre for International Economics (CIE) to identify the magnitude of the economic benefits that could arise. An independent report by the CIE is provided in conjunction with this submission (see **Annex A**).

Some important insights from the CIE report include:

- Spectrum can substitute for other expenditure in the supply of mobile telecoms services, thereby reducing the costs of service provision. The propagation characteristics of 700MHz spectrum, for example result in lower mobile tower density, hence resulting in lower capital and operating costs. Such cost reductions are passed to consumers in a competitive mobile market.

- Greater spectrum will provide greater speed of service for customers in terms of data downloads, thereby delivering high quality of service and enabling higher bandwidth and more sophisticated applications. In turn, this will deliver productivity improvements and greater consumer utility, enhancing overall levels of economic welfare.

- The revenue generated from spectrum will enable the government to rely on other sources of revenue for the same level of expenditure. In turn, this will deliver benefits by avoiding potentially costly and distorting taxation to deliver a similar level of government revenue.

The CIE estimate the productivity gains from the Proposed Direction will increase GDP by $435 million and, above the value of the additional revenue to Government, could deliver close to $600 million in additional benefits to Australian households.

In summary, the economic benefits of allocating radiofrequency spectrum in the manner proposed extend well beyond the price that the government receives. These benefits are manifested in a range of different ways, some of which are difficult to precisely quantify. Nonetheless, it is clear from the CIE's report that both the quantifiable and non-quantifiable benefits are very significant indeed.

(b) Competition as a driver of economic efficiency

In addition to the direct benefits of reduced costs and improvements to quantity of service, there are substantial long-term indirect benefits arising from greater mobile telecoms competition. The benefits of increased competition are well known and have been the subject of a myriad reports over the years in Australia and internationally. Australia's competition law and policy is premised on the substantial economic benefits delivered by competitive markets, consistent with international best practice and modern economic theory.

In the case of mobile telecommunications, ensuring VHA is an effective third mobile competitor by allocating sufficient radiofrequency spectrum to VHA will avoid the high cost of a mobile duopoly that could otherwise result. Global experience demonstrates that three national infrastructure players is the baseline for effective competition in mobile telecommunications markets (as further discussed below). Effective competition will drive allocative, productive and dynamic efficiency gains. Such gains will compound over time and spill-over into other sectors of the economy, delivering innovation and productivity benefits.

While the CIE was not asked to precisely quantify the economy-wide benefits from increased competition in the mobile services sector given the impossibility in doing so, it was asked to estimate the magnitude of the competition benefits. CIE indicated that the competition benefits are likely to be much greater than the productivity benefits identified previously. For instance, the CIE cite empirical work on the relationship between market concentration and prices for consumers in the mobile voice market to illustrate that "a 5 percentage point increase in market share for VHA at the expense of Telstra would be associated with a 10 per cent reduction in prices for consumers... [and] equate to an increase in consumer surplus of ~$2 billion". The CIE goes on to add:

> "..The impacts of a more competitive VHA would likely be larger than a more competitive Optus — the most widely used measure of market concentration would fall by twice as much if VHA achieved a 5 percentage point increase in market share at the expense of Telstra, compared to if this was achieved by Optus instead..."

Competition is an important driver of innovation in the mobile sector in Australia and overseas. The OECD considered the nature of competition in the mobiles sector in Australia in 2014 as part of a report titled "Wireless Market Structures and Network Sharing".[1] This report highlighted the critical importance to each country of having at least three effective mobile competitors, as demonstrated by a wide range of international experiences. This report also highlighted that access to sufficient spectrum is a key determinant of the effectiveness of each of the mobile competitors, hence to competition as a whole.

The OECD report commented as follows, for example:[2]

> "...Wireless networks and the mobile services they enable play a fundamental role in supporting economic and social development. Their contribution is critical in meeting a range of policy objectives, across the entire economy, something that has grown in

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1 OECD (2014), "Wireless Market Structures and Network Sharing", OECD Digital Economy Papers, No. 243, OECD Publishing. http://dx.doi.org/10.1787/5jxt46dzl9r2-en

2 As above.

recent years as the capabilities of these networks increased and competition drove innovation and inclusiveness...

The mobile communication sector is characterised by a number of factors that significantly influence market structure. The most significant of these are constraints due to the limited amount of radio spectrum available...

This report finds that in countries where there are a larger number of MNOs, there is a higher likelihood of more competitive and innovative services being introduced and maintained. Particularly, a larger number of MNOs is often the source for innovative offers that challenge existing market wisdom and practices and a driver for the entire market to become more competitive. As a result, all operators, MNOs and MVNOs, are encouraged to improve their offers in terms of price, services offered and quality of the offer...

One of the effects that are to be expected from increased competition is a reduction in prices or an increase in the content of the offer... The quality of mobile services is essential to the economy and adverse influences on quality could negatively affect other parts of the economy in unforeseen ways...

Most regulators agree that two MNOs are too few to ensure sufficient competition..."

The enhancement to long-term competition that will be achieved by the allocation of the 700MHz spectrum to VHA is considered in further detail below.

2. Public benefit is maximised

The Proposed Direction will ensure the efficient allocation and use of spectrum to maximise the overall public benefit derived. The 700MHz spectrum has been unused since 2015 and is a depreciating government asset, reducing in value by some $60 million per annum. Allocation to VHA will generate substantial revenue for the Government and ensure that the spectrum is immediately and efficiently utilised. The Proposed Direction is fully consistent with the policy and legislative regime, including the statutory objectives of the *Radiocommunications Act 1991 (Cth)* and ACMA's 'Principles for Spectrum Management'.

(a) Consistent with the purpose of Ministerial directions

The Proposed Directions are consistent with the intended purpose of Ministerial directions in the relevant underlying legislation.

The combinatorial clock auction held by the Australian Media and Communications Authority (**ACMA**) in May 2013 (**2013 Auction**) did not result in a complete allocation of all of the 700MHz radiofrequency spectrum proposed for allocation. Some 2 x 15MHz of spectrum in the 700MHz band remained unallocated, namely the 'residual 700MHz spectrum'.

Under clause 7.1 of the *Radiocommunications (Spectrum Licence Allocation – Combinatorial Clock Auction) Determination 2012 (Cth)* (**2012 Determination**), the unallocated 700MHz spectrum from the 2013 Auction could be allocated by "*a procedure to be determined by ACMA*".

The *Radiocommunications Act 1992 (Cth)* (**Radcoms Act**) and the *Australian Communications and Media Authority Act 2005 (Cth)* (**ACMA Act**) expressly enable the Minister to guide ACMA's discretion by giving public directions to ACMA in various circumstances. The powers of the Minister to give directions to the ACMA are broad under the ACMA Act andcarefully circumscribed under the Radcoms Act. The Minister has a number of different direction powers in different contexts, consistent with the objectives of both Acts.

The Minister's use of these direction powers has been a standard part of spectrum allocation practices in Australia to date and remains both necessary and appropriate. The Minister, for example, gave a number of directions to the ACMA in 2012 and 2013 to require and set the parameters for the 2013 Auction.

Under section 14(1) of the ACMA Act, the Minister may give written directions to the ACMA in relation to the performance of its functions and the exercise of its powers. The ACMA must

perform its functions, and exercise its powers, in a manner consistent with any such directions. This provision in the ACMA Act carried across an equivalent provision from previous legislation that enabled the Minister to give directions to the ACA, as the ACMA's predecessor. The intention of the section is to ensure that the ACMA gives effect to government policy, but to make sure that all such policy is transparently communicated. A wide range of directions have been given to the ACMA under this section over the years to convey government policy, including to achieve the 2013 Auction.

Under section 60(10) of the Radcoms Act, the Minister may give written directions to the ACMA in relation to the ACMA's exercise of powers to determine procedures imposing spectrum ownership limits. The ACMA has itself commented in this regard: "*The imposition of competition limits in a price-based allocation is a matter for the Minister for Broadband, Communications and the Digital Economy (the Minister), not ACMA. Under the Radiocommunications Act 1992 (the Act), ACMA must not determine competition limits in a price-based allocation unless it is directed to do so by the Minister.*"

Under section 294(2) of the Radcoms Act, the Minister may give written directions about the matters dealt with in determinations made by ACMA under section 294, relating to the fixing of spectrum access charges and the times for payment. By doing so, the Minister can make the appropriate charges a matter of government policy, rather than an exercise of the ACMA's regulatory discretion. Historically, previous Ministers have preferred to utilise this power to determine spectrum access charges.

The Department has provided an exposure draft of the *Radiocommunications (Spectrum Licence Allocation—Residual 700 MHz Band One) Direction 2016* (**Proposed Direction**) to be issued by the Minister for Communications under:

a) Subsections 14(1) of the ACMA Act; and

b) Subsections 60(10) and 294(2) of the Radcoms Act.

The use of these direction powers by the Minister in the Proposed Direction is necessary and entirely appropriate, consistent with the intent and scheme of the ACMA Act and Radcoms Act, and the historical approach adopted by previous Ministers to spectrum allocation.

(b) Consistent with the objectives of the Radcoms Act

The Proposed Directions are consistent with the objectives of the Radcoms Act.

Section 3 of the Radcoms Act sets out the objectives of the Radcoms Act. Relevantly, the object of the Radcoms Act is to "*provide for the management of the radiofrequency spectrum in order to…(a) maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum; and… (f) support the communications policy objectives of the Commonwealth Government*".

VHA agrees with the statements set out in the Consultation Notice that the sale of 2 x 10MHz of the unsold 700MHz spectrum to VHA would be consistent with the objective of the Commonwealth Government's spectrum policy as set out in the Radcoms Act.

As identified in the Consultation Notice, paragraph 3(a) of the Radcoms Act provides that an aim for the management of radiofrequency spectrum is to maximise the overall public benefit derived from the spectrum by ensuring efficient allocation and use. In this regard:

- The residual 700MHz spectrum has been unused since the end of 2014 and is a depreciating government asset. Unsold spectrum is not providing any benefit to the public. Unsold spectrum is not generating any revenue for the government that could be used to achieve other social objectives. Unsold spectrum is losing value over time.

- In effect, a failure to allocate the residual 700MHz spectrum involves a very high opportunity cost to the government and the public, resulting in an overall public detriment. This detriment is not only the annual depreciation of the spectrum licence (calculated for 30MHz at $62.2 million per annum using the $1.36/MHz/pop reserve price) but is also the loss in utility to consumers associated with an absence of services provided using the spectrum.

- While VHA has not seen the ACMA's report, the Consultation Notice indicates that the ACMA consulted with the industry in 2014. We understand that it concluded that there was no market demand for the spectrum. VHA is not aware of any other third party expressing formal interest in acquiring the residual spectrum – particularly at the very high price of $1.36/MHz/pop contemplated by the government.

- As identified later in this submission, allocation to VHA not only enables the Government to realise a price that is consistent with the $1.36/MHz/pop originally proposed (although adjusted to reflect the remaining term of the licence), but also enables the Government to realise wider public benefits. The public benefits include the benefits derived from the supply of advanced mobile services to consumers (with wider benefits to consumer utility, total social welfare and economic growth), and benefits derived from the additional competition that will result (driving gains in productive, allocation and dynamic efficiency).

It is overwhelmingly in the overall public benefit for the spectrum to be sold, rather than held by the Government. As identified later in this submission, it is also demonstrably in the public benefit for the buyer of the spectrum to be VHA at the price proposed.

While not expressly stated in the Consultation Notice, paragraph 3(f) of the Radcoms Act is also relevant. This paragraph provides that an aim for the management of radiofrequency spectrum is to support the communications policy objectives of the Commonwealth Government. These policy objectives are documented, for example, in section 3(1) of the *Telecommunications Act 1997(Cth)* which provides a regulatory framework that promotes:

a) the long-term interests of end-users of carriage services or of services provided by means of carriage services;

b) the efficiency and international competitiveness of the Australian telecommunications industry; and

c) the availability of accessible and affordance carriage services that enhance the welfare of Australians.

Allocation to VHA in the manner proposed achieve each of these objectives:

- Allocation to VHA will ensure that the spectrum is efficiently utilised to supply advanced mobile services in competition with Telstra and Optus, thereby delivering high quality mobile services in the long-term interests of consumers.

- The resulting competition will promote innovation, as well as continual improvements to quality and coverage, thereby enhancing the efficiency and international competiveness of the Australian telecommunications industry.

- Competition will mitigate the influence of Telstra's substantial market power, thereby enabling greater availability of accessible and affordable mobile carriage services, enhancing the welfare of all Australians. The benefits of competition deliver benefits not only to VHA customers, but to all Australian mobile consumers on whichever mobile network they may choose to connect.

(c) Consistent with the scheme of the ACMA Act

The Proposed Directions are consistent with the scheme of the ACMA Act and the powers vested in the Minister under that scheme.

The ACMA Act does not have express statutory objectives in the same manner as the Radcoms Act. Rather, the Explanatory Memorandum to the *Australian Communications and Media Authority Bill 2004 (Cth)* clarified that the Bill provided for the merger of the Australian Broadcasting Authority (**ABA**) and the Australian Communications Authority (**ACA**) to form a single communications regulator, the Australian Communications and Media Authority (to be known as the **ACMA**).

The formation of the ACMA was a response to convergence within the communications industry. The Bill made only minimal changes to the existing regulatory frameworks that applied to the telecommunications and broadcasting sectors in order to provide for the merger of the ACA and the ABA, so carried across the functions and powers that applied to these regulators. Similarly, the Minister's powers to give directions to the ACMA involved a continuation of the Minister's previous powers to give directions to the ACA and the ABA.

In relation to the ACMA Act, the relevant question is therefore whether the Proposed Direction under subsections 14(1) of the ACMA Act is "in relation to the performance of [ACMA's] functions and the exercise of [ACMA's] powers". This is manifestly the case:

- The ACMA has specific "*spectrum management functions*" as set out in detail in section 9 of the ACMA Act, including under paragraph (a) to "*manage the radiofrequency spectrum in accordance with the Radiocommunications Act 1992*".

- Relevantly, one of the ACMA's spectrum management functions includes "*to do anything incidental to or conducive to the performance of any of the above functions*", providing considerable breadth and scope to the interpretation of its spectrum management functions.

Otherwise, the ACMA is expressly given the power to do all things necessary and convenient to be done for, or in connection with, these functions.

(d) Consistent with the Principles for Spectrum Management

The Proposed Directions are consistent with the manner in which the ACMA has interpreted the requirements of the Radcoms Act and the ACMA Act to date when undertaking its spectrum management functions.

Of the various instruments that the ACMA has produced, the most relevant are the ACMA's 'Principles for Spectrum Management" (**Principles**) of March 2009. The Principles are intended to guide the ACMA's management of the radiofrequency spectrum within its existing legislative responsibilities and government policy settings. A key theme of the Principles is

that maximising the overall public benefit from use of the radiofrequency spectrum requires balanced application of both regulatory and market mechanisms.

The ACMA clarifies in the Principles that it will use a 'Total Welfare Standard' (**TWS**) as its overarching framework for assessing the costs and benefits of different regulatory and market mechanisms for specific spectrum management issues. The ACMA recognises that the assessment of costs and benefits using TWS will often need to take into account both quantitative and qualitative factors.

In the Principles, the ACMA explains that the object identified in paragraph 3(a) of the Radcoms Act (as discussed above), namely to maximise overall public benefit, will be maximised where spectrum is allocated to the highest value use or uses (that is, the use or uses that maximise the value derived from the spectrum by licensees, consumers and the wider community). In assessing the highest value use or uses of the spectrum, the ACMA will also consider the object of the Radcoms Act, the community benefits derived from services, and any other relevant matters. This is relevant to the current 700MHz allocation and is indicates that the benefits to be considered in any allocation extend well beyond the price that the government receives.

Further discussion on what the 'total welfare standard' means in the context of spectrum allocation was also set out in the ACMA's document "*Response to submissions on the draft spectrum management principles*". The ACMA highlighted that this 'total welfare standard' has implications for spectrum planning well beyond the mere determination of the final allocation price. The ACMA commented (at page 25) (emphasis added):

> "... The first spectrum management principle provides a description of how ACMA intends to fulfil the first paragraph of the object of the Act (s.3(a))—by seeking to allocate spectrum to the highest value use, as determined by the sum of the benefits and costs of that use to industry, consumers and the community. It would be inconsistent with the Act to focus solely on commercial value rather than the 'overall public benefit' (or total value). An assessment using a total welfare standard measures all of the costs and benefits, and is therefore consistent with the Act..."

Importantly, this means that the price achieved for spectrum is not the only relevant factor in determining the overall public benefit. For example, allocation of 100% of the spectrum to Telstra at a very high price could maximise the price realised for the spectrum to the government, but would not maximise the value derived from consumers and the wider community. In fact, any such allocation would breach the original spectrum allocation limits and may contravene section 50 of the *Competition and Consumer Act 2010 (Cth)* by reason of operation of section 71A of the Radcoms Act. Any such allocation would not promote the long-term interests of end-users and may have the likely effect of substantially lessening competition in mobile telecommunications markets.

In summary, the Proposed Direction will ensure the efficient allocation and use of spectrum to maximise the overall public benefit derived. The legislative scheme and the manner in which it has been interpreted confirms that the overall public benefit is not identified by the price of the spectrum alone, but is assessed under a 'Total Welfare Standard'. This means that while the proposed price by itself provides sufficient reason for the Government to pursue the Proposed Direction, all of the wider economic benefits identified in Chapter 1 of this submission are both highly relevant and important components of the allocation decision. In particular, the benefits to competition of allocating the spectrum specifically to VHA are highly relevant and pertinent to ensuring a strong third competitor in a three operator market.

3. Efficient allocation procedure

As the ACMA has often stated, while spectrum auctions are optimal for large-scale spectrum allocations involving many competing bidders, they may not be well-suited for small-scale allocations to limited participants. Section 60(1)(c) of the *Radiocommunications Act 1991 (Cth)* expressly contemplates allocation by way of negotiated price to cater for different allocation circumstances. A negotiated price allows small-scale and targeted allocations on an efficient and low cost basis, particularly where a specific allocation would maximise the value derived from use of the spectrum for licensees, consumers and the wider community.

(a) Allocation at a negotiated price has significant benefits

Section 60(1)(c) of the Radcoms Act expressly contemplates that spectrum may be allocated by way of a negotiated price. Section 60(1) therefore recognises that allocation at a negotiated price can deliver significant benefits.

An approach to allocation of spectrum that favours commercial negotiation over an auction has many benefits, but is suited to a different set of circumstances than an auction. While an auction may be suitable for a large-scale allocation of spectrum, commercial negotiations are more suited for discrete spectrum allocations (as in the current case). A negotiated price allows small-scale and targeted allocations on an efficient and low cost basis, particularly where wider community benefits arise under the 'Total Welfare Standard' (discussed above).

Indeed, if total economic welfare can be maximised by allocating spectrum to a particular entity at a fair and reasonable price, it would compromise this outcome to adopt an allocation mechanism that may not achieve this. The policy objective in such circumstances is not necessarily to achieve the highest possible price, but rather to achieve a price that is fair and reasonable yet still delivers the optimal welfare benefits.

Precedent exists for the use of commercial negotiation in these types of circumstances. For example, the reallocation of spectrum licences upon the expiry of previous licences did not occur via auction, but rather involved a negotiated pricing approach:

- The reallocated spectrum licences, for example, were offered for reissue at the price specified in accordance with the *Radiocommunications (Spectrum Access Charges) Direction 2012* (Cth). The purpose of this direction was to specify the amount that the Minister of Communications at that time considered to be the value of the spectrum in relation to the spectrum bands specified and direct the ACMA that the spectrum access charges, in respect to

reissued licences, fixed by it in a determination made under section 294(1) of the Act reflect that amount.

- The spectrum access charge (SAC) for each licence to be reissued was determined by the ACMA and calculated as follows: SAC = Value specified in the Direction x Bandwidth authorised in the licence (MHz) x Population of the licence area. Accordingly, the direction used a $/MHz/pop construct, in the same manner as the current 700MHz spectrum.

The approach set out in the proposed Direction is consistent with the approach adopted in other previous examples of allocation by way of a negotiated price.

In summary, a negotiated price allows small-scale and targeted allocations on an efficient and low cost basis, particularly where a specific allocation would maximise the value derived from licensees, consumers and the wider community.

(b) Auctions are not always appropriate for spectrum allocation

As a general proposition, VHA supports the continued use of auctions for large scale allocations of radiofrequency spectrum. However, allocation by way of auction is not always the optimal method for allocation of radiofrequency spectrum.

As the ACMA has often stated, while spectrum auctions are optimal for large-scale spectrum allocations involving many competing bidders, they may not be well-suited for small-scale allocations to limited participants.

In its document "*Response to submissions on the draft spectrum management principles*" in 2009, ACMA set out its view on the appropriate use of auctions in the allocation of radiofrequency spectrum. The ACMA commented as follows (at page 5):

> "Where supply exceeds demand, ACMA will generally allocate spectrum over-the-counter, at a price that will at least recover direct costs and not be a significant deterrent to use of the spectrum.
>
> Where demand exceeds supply, the feasibility of an auction will be assessed on a case-by-case basis. If an auction is not appropriate, an administrative incentive price will be applied.
>
> An auction may not be appropriate if there is significant risk it would not result in assignment to the highest value use. This could be because of transaction costs, externalities, market power or problems associated with defining the product with sufficient certainty..."

In ACMA's January 2010 paper "*The ACMA response to public submissions: Opportunity cost pricing of spectrum*", the ACMA commented (at page 7) (emphasis added)"

> "...Auctions have typically been associated with spectrum licences and administrative pricing with apparatus licences. However, spectrum licences may be administratively priced, and apparatus licences have been auctioned (for example, trunked land mobile apparatus licences in Melbourne were auctioned in 1999) ...
>
> ...Some submissions also noted that auctions are costly to run and participate in, and thus may not be cost-effective or appropriate due to a number of factors...
>
> ...Auctions are also unlikely to be appropriate in bands where more spectrum is available than is required to meet demand."

Some key insights from these comments are as follows:

- **Administrative costs**: While auctions are appropriate for large-scale allocations, they can be complex and time-consuming to establish and administratively costly to run. VHA has not located in the public domain any estimate of the cost to the government in running a spectrum auction, but VHA understands that these costs are substantial and the Department will be aware of these costs. Such costs may be entirely appropriate in the context of large-scale allocations as they are outweighed by the benefits delivered by the auction mechanism itself, but they may not be appropriate for small-scale allocations of residual spectrum when there are a limited number of prospective buyers.

- **Market power problems**: The ACMA recognises that the size and power of large organisations could enable them to inflate auction prices to increase the market entry costs of their rivals. The ACMA recognises that auctions may not be appropriate in markets where there are market power problems in the absence of appropriately defined allocation limits (also known as "competition limits"). The Australian mobiles market is a market where there are serious market power problems involving the incumbent operator, particularly in regional Australia. While metropolitan markets are competitive, Telstra's market share increases to 100% as one moves outside metropolitan areas and into rural and remote areas with lower population density. Telstra has a network coverage monopoly over some 60% of the geographic area covered by mobile networks in Australia, so by definition has monopoly power over an incredible 60% of Australia by mobile coverage.

The relevance of market power problems to spectrum auctions in Australia is illustrated by the frequent application of competition limits in mobile spectrum allocation processes.[3] However, even these have not operated effectively to ensure the equitable allocation of spectrum that is foundational for the structure of the mobile telecommunications market in Australia and long-term competition within it. While competition limits were imposed in the recent regional 1800 MHz auction, the competition limits were set such that Telstra could (and ultimately did) accumulate more spectrum in the 1800 MHz band than any other operator was able to achieve - and despite Telstra already having the most extensive spectrum holdings in regional Australia.

- **Inflexibilities in funding**: The ACMA recognises that auctions may not be appropriate in circumstances where a party is excluded because of inflexibilities in funding arrangements. This issue is directly relevant to VHA given that its ability to pay for the residual spectrum is based on the use of instalment payments over time.

In this manner, the key insights from the historic comments of ACMA are that while spectrum auctions are optimal for large-scale spectrum allocations involving many competing bidders, they may not be appropriate for small scale allocations, particularly if there are a limited number of prospective buyers. Moreover, spectrum auctions may not be appropriate where total welfare can be maximised by allocating to a particular operator, particularly in circumstances where other market participants (with market power and vested interests) can act strategically to unduly influence auction outcomes and ultimately lead to spectrum not being allocated to achieve the optimal total welfare outcome.

[3] We note a maximum limit of 2 x 25 MHz imposed by the Minister in the 2013 Auction. At that time, the Department considered that: "*If no competition limits are imposed on this auction, there is a strong incentive for participants to seek to purchase more spectrum than they need—that is, to monopolise the spectrum, in order to gain a competitive advantage.*" The competition issues identified during the 2013 Auction remain true today. Telstra already has 2 x 20 MHz of spectrum in the 700 MHz band – i.e., just below the competition limit set by the Minister. VHA's proposed acquisition does not be impede Telstra from moving up to the maximum competition limit as the remaining unsold 2x5 MHz is adjacent to its existing holdings in the band.

4. Long-term competition will be enhanced

Allocation to VHA will deliver lower mobile prices and higher quality services, while driving continued innovation and improvements in quality and coverage. VHA will use the 700MHz spectrum to deliver continued intense mobile competition on a long-term basis. Telstra's criticism of the proposal betrays that allocation to VHA is seen as a real threat to Telstra's increasing market power in mobile telecommunications markets. VHA is the critical third network operator preventing a mobile telecoms duopoly in Australia.

(a) Australia has a seriously distorted mobiles market

The proposed fair and reasonable allocation of 700MHz spectrum to VHA will lay the foundation of the potential for long term sustainable competition in the Australian mobiles market. The importance of this statement cannot be underestimated. Without it there is the very real and deeply problematic prospect of an effective duopoly in metropolitan Australia and a permanent monopoly in many parts of regional Australia.

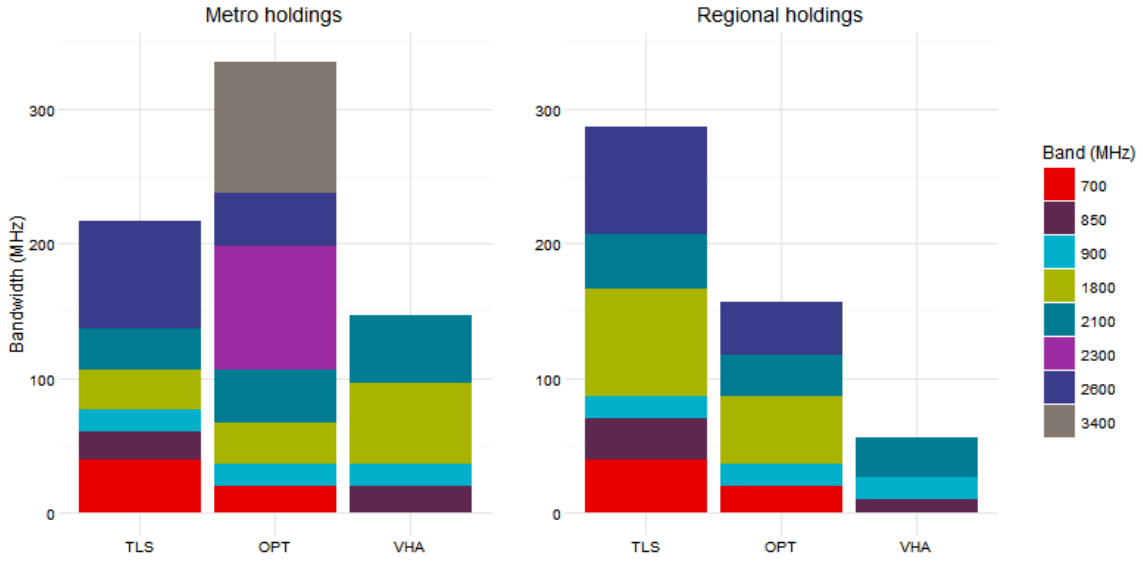
The Department will already be aware of VHA's concerns regarding the nature of competition in the mobile telecommunications markets in Australia, so they are not further documented in this submission. VHA is happy to meet with the Department to reiterate those concerns as necessary.

(b) VHA requires the spectrum to effectively compete

Against this context, VHA's role is critical. With access to the 700 MHz spectrum, VHA will become more competitive in more places; encouraging potential investment beyond VHA's existing geographic footprint. However, importantly, VHA's access to spectrum is not only critical to the future of competition in regional Australia, but also to continued effective competition in metropolitan Australia. Simply put, VHA needs access to sufficient competition to enable it to effectively compete.

An overview of the differences in spectrum holdings for the three mobile operators is set out in Figure 1. As illustrated below, VHA is disadvantaged by not having 700 MHz spectrum because it does not have the same long-term ability as Telstra and Optus to meet network data growth from its existing holdings. The spectrum disadvantage relative to Telstra and Optus is particularly acute in regional Australia.

Figure 1: Holdings of mobile spectrum for Telstra, Optus and VHA



Notes: Metro holdings are based on the Sydney licence area. Regional holdings are based on licence areas that do not include major centres. TPG's holdings are not shown. Includes 2x10 MHz for 2100 MHz apparatus licences in regional Australia.

There are only three national mobile network operators in the Australian mobile telecommunications market, namely Telstra, Optus and VHA. Absent VHA, the market would be a duopoly between Telstra and Optus. VHA plays a critical role in stimulating competition in the mobile services market. The importance of having more than two effective mobile network operators was highlighted by the OCED analysis published in 2014 (see **Section 1(b)**).

VHA strongly emphasises, consistent with the conclusions in that OECD report, that it is critical to VHA's continued effectiveness as a competitor in metropolitan and regional Australia to have access to sufficient radiofrequency spectrum. Additional spectrum is required by VHA to meet forecast demand. If VHA does not obtain access to the spectrum, it will face spectrum scarcity issues and will have less ability to deliver lower mobile prices and higher quality services to the Australian market.

VHA will use the 700MHz spectrum to drive sustainable long-term mobile competition. Allocation to VHA will deliver lower mobile prices and higher quality services, while driving continued innovation and improvements in quality and coverage. In regional Australia, the 700MHz spectrum will also enable greater coverage to be achieved at lower cost, positively impacting on the economics of network build. In metropolitan Australia, the 700MHz spectrum will avoid potential bandwidth constraints and ensure VHA's offering is of a high quality and competitive with other market participants. The 700MHz spectrum therefore avoids Australia's mobile markets trending towards a duopoly in which VHA becomes a less effective competitor.

It is clearly not in Telstra's and Optus' commercial interests for VHA to have access to the spectrum. If VHA does not get access to the spectrum, Telstra and Optus will face reduced competition from VHA and will have the ability to charge higher prices for potentially inferior services. VHA expects that Telstra and Optus will make self-serving submissions opposing any allocation to VHA accordingly, ironically confirming that VHA is seen as a real competitive threat.

5. Competitive neutrality is preserved

Any suggestion that VHA is "paying a lower price" is simply at odds with the facts. VHA is paying the same, if not more, than the price paid by both Telstra and Optus in 2013, as explained in the Department's information paper. The 700 MHz auction reserve price of $1.36/MHz/pop has been used for VHA, pro-rated for the remaining licence term. This price remains at the top end of the price range for similar spectrum when benchmarked internationally, as identified in this submission.

(a) Price has been calculated to ensure competitive neutrality

On a pro-rata basis, VHA is paying the same price as, if not more than, was paid by both Telstra and Optus in 2013.

VHA declined to participate in the 2013 Auction. The reasons for VHA's decision were reported in the media at the time. In practical effect, VHA was not in a financial position at the time to pay the prices that were expected from the auction.

VHA notes the comments made in the Consultation Note as follows:

> "All 700MHz spectrum, including sold and unsold lots, is licenced for 15 year terms, expiring on 31 December 2029. As unsold lots carry the same expiry date, their value reduces as the life of the licence shortens.
>
> The ACMA has a publicly-available model that it uses for adjusting prices for shorter licence terms. This model results in an 11.75-year licence being valued at between $527.9 million and 573 million, with a mid-point of $549.9 million. The top of this range (i.e., $572 million) equates to $1.25/MHz/pop."

As this comment indicates, the Department used two approaches to estimate the fair value of the unsold 700 MHz spectrum. The first approach (Approach A) indicated a fair value for the spectrum of $1.15/MHz/pop. The second approach (Approach B) indicated a fair value of $1.25/MHz/pop. Both approaches were based on adjusting the price Telstra and Optus paid (i.e. the reserve price of $1.36/MHz/pop) during the 2013 Auction, taking into account the shorter licence period remaining. The proposed price is the maximum of the government's fair value estimates for the unsold 700 MHz spectrum, which means VHA's spectrum licence will cost the same, if not more than, the prices paid by Telstra and Optus' for their 700 MHz spectrum adjusted for licence period, ensuring competitive neutrality. In practical effect, VHA is not gaining any advantage over Telstra or Optus as a result of the later allocation.

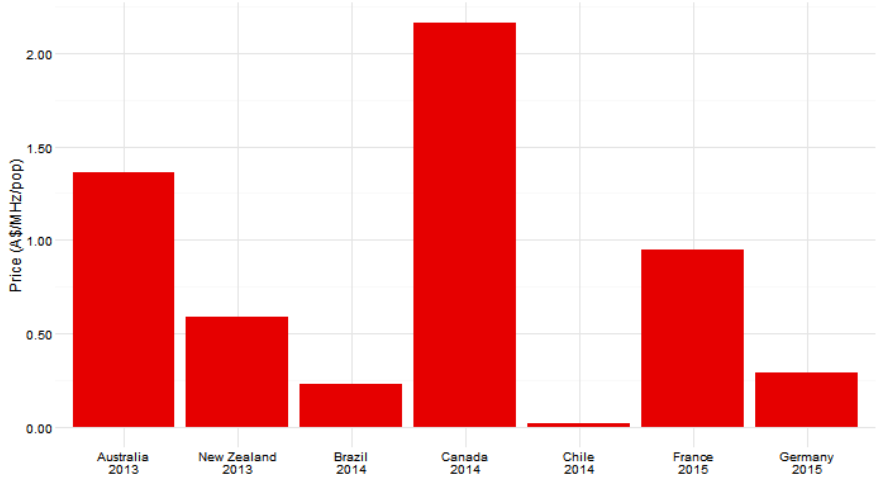
VHA has no objection to paying the proposed price of $1.25/MHz/pop for the residual spectrum. We consider the proposed price to be unequivocally fair and reasonable to all parties who participated in the digital dividend auction – Telstra, Optus and TPG – at which the 700 MHz reserve price was $1.36/MHz/pop. We note the proposed term is 78% of the length of Telstra and Optus' 700 MHz spectrum licences and yet VHA is paying 92% of the digital dividend reserve price.

(b) Price is still very high by international standards

A price of $1.36/MHz/pop for 15 years (although pro-rated to $1.25/MHz/pop for 11.75 years) remains high by international standards.

Indeed, Australia set one of the highest prices for 700MHz spectrum of any comparable overseas jurisdiction. Figure 2 below shows that Australia set the second highest price after Canada for 700MHz spectrum and set a price more than double that in New Zealand.

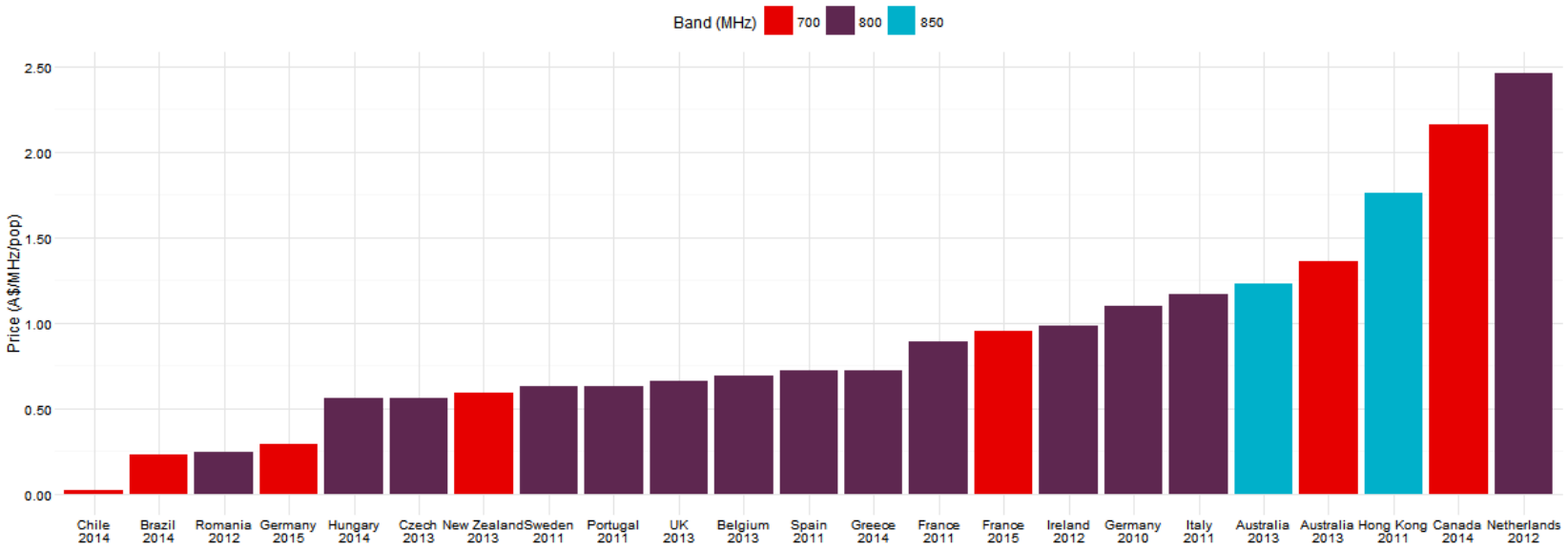
Figure 2: International benchmarking of 15-year equivalent 700 MHz band prices



Notes: Parameters used to make this chart include EUR/AUD FX rate of 0.6619, an adjustment factor to deliver 15-year equivalent pricing using an 8% post-tax nominal WACC.

When the international benchmarking exercise is extended to include the pricing for comparable 800MHz and 850MHz spectrum, it is clear that the price for 700MHz spectrum in Australia is also at the high end of the prices for all three bands, as illustrated by Figure 3 below. Any current international benchmarking of the price for the residual 700MHz spectrum would therefore result in a price that is significantly lower than the price that was paid in 2013.

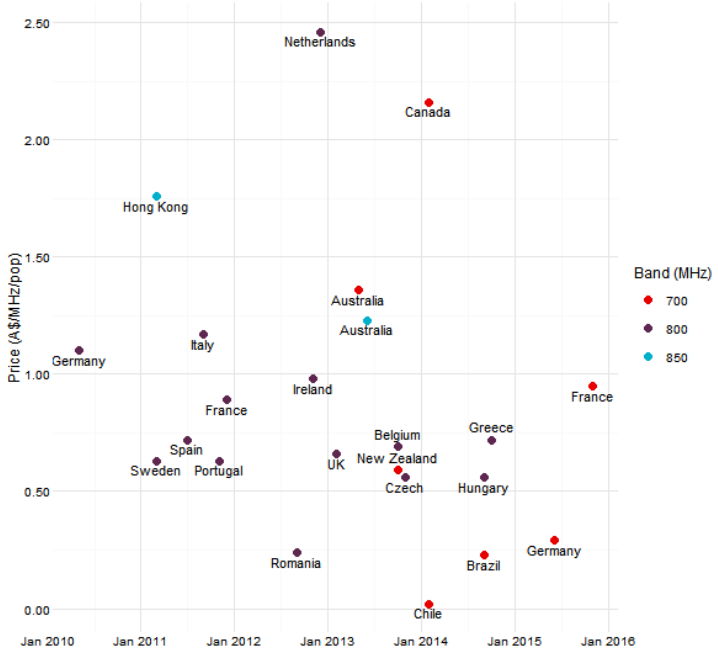
Figure 3: International benchmarking of 15-year equivalent 700 MHz, 800MHz and 850MHz band spectrum prices



Notes: Parameters used to make this chart include EUR/AUD FX rate of 0.6619, an adjustment factor to deliver 15-year equivalent pricing using an 8% post-tax nominal WACC.

This same result can be depicted over time in a scatter plot, as illustrated by Figure 4 below:

Figure 4: Pricing of 15-year equivalent 700 MHz, 800MHz and 850MHz band spectrum over time



In an April 2016 presentation by NERA, the average price for 700MHz spectrum payable in international spectrum auctions was calculated at $0.38/MHz/Pop.

Clearly, this analysis demonstrates that VHA is not receiving the spectrum at a 'low price' by international standards. Rather, VHA is receiving the spectrum at the same price, if not more, than was paid by Telstra and Optus in the 2013 Auction. This price is a very high price for 700MHz spectrum by international standards.

(c) Payment by instalments delivers higher price

We welcome the proposal to permit payment of $572 million in three instalments, with 50% payable upfront and two equal instalments, which are then adjusted for the time value of money. The total access charge under this option is $594.3 million.

The 5% interest rate is a premium over the Government's risk free rate of 1.6% for a 3-year bond. The recent fall in the risk free rate means the premium of 3.4% is above the debt risk premium that would be typically payable for an entity with the credit rating of VHA's shareholders or the credit ratings of comparable firms in the Australian telecommunications industry. In this manner, the instalment payments include a premium that is paid to the Government to adjust for the time cost of money. The proposed use of 5% discount rate is competitively neutral with financing available from Australian financial institutions and will deliver additional value for the Australian Government.

6. Legal requirements are fulfilled

For the sake of completeness, VHA instructed Norton Rose Fulbright to review the Proposed Direction to identify whether it is legally accurate and within the Minister's powers. The resulting advice from Norton Rose Fulbright confirms that the Proposed Direction is legally accurate and within the Minister's powers. The advice is shared by VHA on a confidential basis with the Department.

7. Conclusions

We commend the government on the Proposed Direction and express our strong support.

As identified in this submission, the Proposed Direction:

(a) delivers a substantial economic dividend;

(b) maximises the public benefit from the allocation and use of the 700MHz spectrum;

(c) utilises an efficient allocation procedure;

(d) enhances competition for the long-term interests of end users;

(e) preserves competitive neutrality; and

(f) complies with the objects of the relevant legislation and is within the Minister's powers.

The Proposed Direction enables the Government to realise a windfall value of some $600 million for a government asset that is otherwise depreciating.

The Proposed Direction will enable VHA to deliver high quality mobile data services to meet consumer demand, competing with Telstra and Optus.

The Proposed Direction will deliver substantial economic benefits in a critical enabling sector of the economy, bolstering competition and productivity as an engine for future economic growth.

We are happy to comment on any other submissions or meet with you to discuss any aspect of this submission at any stage. Again, we thank the Department for the opportunity to comment.

Annex A: The CIE report

BRIEFING

The economic dividend from the allocation of spectrum to VHA

Prepared for
Vodafone Hutchison Australia

June 2016

THE CENTRE FOR INTERNATIONAL ECONOMICS
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Executive summary

The release of spectrum has a number of different economic impacts for a mobile network operator and Australia. Table 1 sets out a taxonomy of impacts from the provision of spectrum to mobile communications.

1 Taxonomy of economic impacts from spectrum release to mobile communications

Impact	Description
Reduced capital and operating costs to provide mobile broadband	Spectrum can substitute for other expenditure in producing mobile communications services. For example, with more spectrum an operator may use fewer mobile communications sites and hence has lower capital and operating costs. There is an opportunity cost of spectrum, through less spectrum available for another use. This is not considered as part of this project but would be an important consideration for policy decisions.
Improved quality of services, particularly speed	Spectrum can provide for greater speed of service for customers in terms of data downloads.
Increased competition	Spectrum may have an impact on the market structure of mobile communications. This in turn may push prices closer to costs.
Changes in Government revenues and hence the need to impose other taxes	Spectrum release may provide revenue to the Government, avoiding the need for other forms of taxation.

Source: The CIE.

The amount that a mobile carrier is willing to pay for spectrum reflects is in some cases aligned to the economic or economywide value of providing spectrum. For example, a carrier's willingness to pay will reflect reduced capital and operating costs and improved service quality. Together these two impacts comprise *productivity* improvements in providing services. There are other areas where a carrier's valuation will not include or will diverge from the economic value. For example, a carrier might place a high value on spectrum because this would stop competition from emerging.

VHA's value for spectrum will reflect the productivity gains it can achieve from having additional spectrum. There is no reason to expect that VHA would place a value on spectrum related to reducing competition, given its position in the market. In this case, the value of productivity gains is at least the amount that VHA is willing to pay, of $572 million.

Economic dividend from spectrum allocation to VHA

The economic dividend from providing an additional 2*10MHz of 700MHz spectrum will reflect:

- how productivity changes for VHA impact on broader economic outcomes. Greater productivity in providing services will free up resources for use in other parts of the economy. There would also likely be some flow-through from improved productivity to prices of mobile services;
- the economywide implications of the Government revenue provide by VHA. Additional Government revenue has to, at some point, lead to either a reduced need for other taxes, or increased provision of services; and
- impacts related to improved competition in mobile services.

The quantitative implications of the first two impacts are set out in table 2.

Productivity gains in providing mobile services would increase GDP by $435 million (in present value terms). A better measure of the gain to Australian people is the impact on household welfare, which is estimated to increase by $313 million. These gains arise because resources are freed up from the mobile communications sector to be used to expand the economy.

The gains arising from the implications of additional government revenue for the Australian Government are estimated at are estimated at $109 million to $286 million. These estimates are based on the revenue being used to (marginally) reduce taxation. The Australian Treasury has estimated the costs to the economy of Australian Government taxes range from 19 cents (GST) to 50 cents (company tax) per dollar of revenue collected.

In total, the gains to Australians of additional spectrum allocation to VHA are estimated at $422 to $599 million (present value).

2 Impacts of spectrum allocation on household welfare

	Impact on household welfare	Impact on GDP
	$m, npv	$m, npv
From higher VHA productivity	313	435
Other impacts		
Government revenue reducing the costs of taxation	109-286	NA
Competition impacts	Discussed below	NA
Total measured impacts	**422-599**	**NA**

Note: The net present value is based on a 7 per cent discount rate from 2016 to 2027. The additional 700MHz spectrum is assumed to be available from 2018.
Data source: The CIE.

The economywide impacts set out above do not include impacts arising from making the provision of mobile services more competitive. Additional spectrum would provide VHA with a stronger platform to compete with Telstra and Optus. Because of its spectrum constraints, VHA currently faces high costs for achieving a higher market share, reflecting the substantial costs for additional sites to meet capacity, or costs of compromising network quality. Providing additional spectrum alleviates these constraints on VHA, particularly in regional areas.

We have previously noted that the outcomes in the Australian telecommunications market appear to be less competitive than in overseas markets. The incumbent, Telstra, receives a significant price premium over other operators in fixed line and mobile services (in the order of one third more than other providers for the same bundle for mobile services).[1] Such outcomes are not observable in other markets examined (the UK and New Zealand). Spectrum availability, particularly in regional areas, was noted as one factor driving a less competitive market structure in Australia.

It is not possible to quantify the overall economic impacts of spectrum allocations in terms of competition, although it is clear that:

- competition has been an important driver of innovation in the mobile sector in Australia and overseas; and[2]
- spectrum availability is a key driver of market structure for mobile communications. Spectrum allocated to VHA would have a more pro-competitive impact than spectrum allocated to either Optus or Telstra.

To give a view on how important this could be, using empirical evidence of the relationship between market concentration and prices for consumers in the mobile voice market[3]:

- a 5 percentage point increase in market share for VHA at the expense of Telstra would be associated with a 10 per cent reduction in prices for consumers; and
- this would equate to an increase in consumer surplus of ~$2 billion.

The impacts of a more competitive VHA would likely be larger than a more competitive Optus — the most widely used measure of market concentration would fall by twice as much if VHA achieved a 5 percentage point increase in market share at the expense of Telstra, compared to if this was achieved by Optus instead.

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1 The CIE 2015, *Australia's telecommunications market structure: the price premium paid by consumers*, prepared for VHA.

2 OECD (2014), "Wireless Market Structures and Network Sharing", OECD Digital Economy Papers, No. 243, OECD Publishing. http://dx.doi.org/10.1787/5jxt46dzl9r2-en

3 Hazlett, T. W., Muñoz, R. E., and Avanzini, D. B., 2012, *What really matters in spectrum allocation design*. Northwestern Journal of Technology and Intellectual Property, Volume 3, Issue 3: Article 2.

1 Approach to measuring the value of spectrum allocation

What is the economic value of spectrum?

The release of spectrum has a number of different economic impacts for a mobile network operator. Table 1.1 sets out a taxonomy of impacts from the provision of spectrum to mobile communications.

1.1 Taxonomy of economic impacts from spectrum release to mobile communications

Impact	Description
Reduced capital and operating costs to provide mobile broadband	Spectrum can substitute for other expenditure in producing mobile communications services. For example, with more spectrum an operator may use fewer mobile communications sites and hence has lower capital and operating costs. There is an opportunity cost of spectrum, through less spectrum available for another use. This is not considered as part of this project but would be an important consideration for policy decisions.
Improved quality of services, particularly speed	Spectrum can provide for greater speed of service for customers in terms of data downloads.
Increased competition	Spectrum may have an impact on the market structure of mobile communications. This in turn may push prices closer to costs.
Changes in Government revenues and hence the need to impose other taxes	Spectrum release may provide revenue to the Government, avoiding the need for other forms of taxation.

Source: The CIE.

In terms of avoided cost, this reflects how additional spectrum impacts on *coverage* and *capacity*.

Coverage impacts are not dependent on the amount of demand for data over a mobile network operator's network. Instead, these impacts reflect different propagation distances for spectrum of different frequency bands. These impacts occur as a mobile network operator seeks to expand its coverage. In the case of 4G coverage, additional spectrum provided in, say, 2020, would have a smaller impact than spectrum provided now because the network would already have been rolled out to achieve coverage. Changes to reduce site numbers because of additional spectrum availability would then occur only gradually.

Capacity impacts are directly related to the amount of traffic demand for a mobile network operator. Where there is more traffic demand, an operator will have to provide more sites in order to be able to provide services without there being network congestion.

In this case, more spectrum provides a bigger 'pipeline' and could mitigate the need for additional sites.

The different economic impacts can be estimated with different levels of precision. Cost impacts can be relatively well understood through modelling site requirements at different traffic levels and spectrum availability scenarios. Cost and value impacts combined are, in some cases, revealed through willingness to pay by mobile operators. These impacts flow into improved productivity for mobile broadband and lower prices for consumers. Productivity for mobile broadband measures the ratio of outputs to labour and capital inputs — because spectrum substitutes for these inputs it increases productivity.

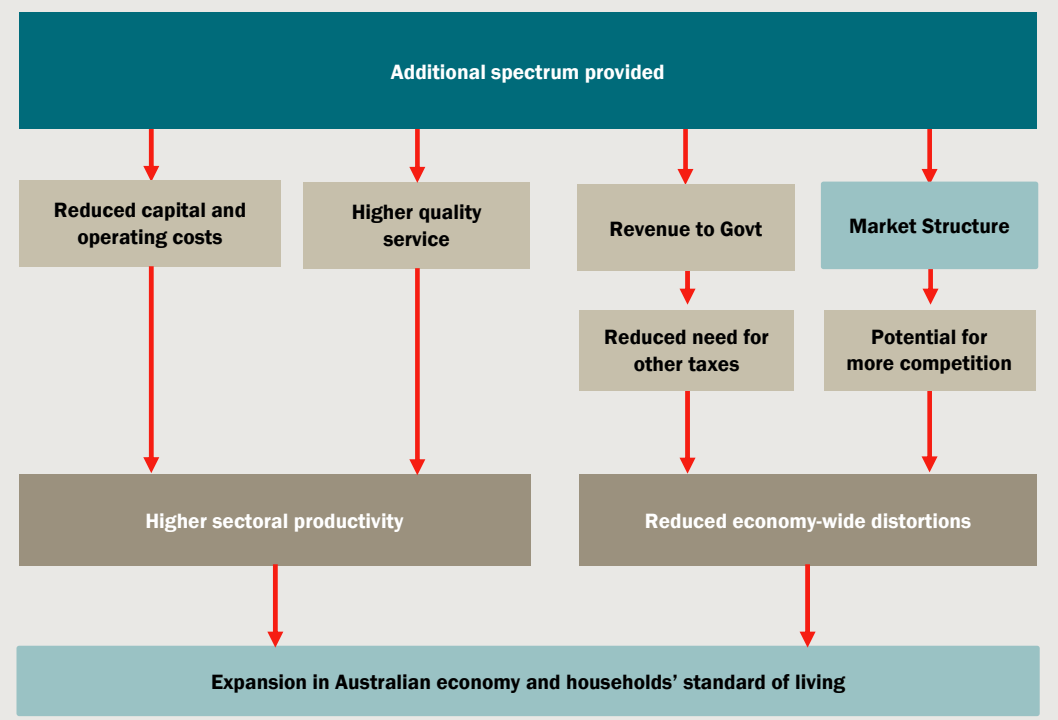
Mobile operators may also pay for spectrum for reasons unrelated to their expected productivity. These factors could include:

- purchasing spectrum allows entry into a less than perfectly competitive market, where operators can charge margins above their costs and earn economic rents. Whether or not this applies to the Australian mobile data context is not clear and will depend on the number of firms that can be accommodated within the Australian market;
- operators purchase spectrum to manage risks around traffic demand — that is, they attach an option value to holding spectrum; and
- operators purchase spectrum to manage risks around future site availability.

It is very difficult to disentangle between these reasons. Their economic impacts are also very different (see chart 1.2). Avoided cost and improved quality directly impact on the productivity of the mobile sector, and then through this to the broader economy because of freeing up resources that can be used in other sectors, and through lower prices. Additional spectrum may also lead to improved competition or reduced need for other taxes. This in turn reduces economy-wide distortions in consumer and producer decisions.

The policy focus should encompass the *welfare impacts* arising from all these mechanisms. This is not the same as the government revenue. For example, a policy that focused solely on increasing revenue from spectrum sales might lead to less spectrum being allocated than a policy focused on economic efficiency/welfare. A discussion of these issues is set out in Attachment B.

1.2 Tracing economic impacts of spectrum allocation to mobile communications



Source: The CIE.

Drivers of the economic value of spectrum allocations

The types of factors that increase and decrease an operator's willingness to pay for spectrum are set out in table 1.3 (not an exhaustive list). Not all of these translate into value implications for society as a whole (these are highlighted in red). Of most importance, a high willingness to pay to use spectrum to restrict competition has negative value for society.

Value for spectrum will be highest for operators who have less spectrum relative to the amount of the market that they serve, or a poorer mix of spectrum, such as less low frequency spectrum available for coverage.

1.3 Factors driving operator willingness to pay for spectrum

Increase	Decrease
Necessary to operate a network (or enter market)	Conditions placed on the licence, for example rollout or sharing obligations
Availability and costs of other capacity and demand management options	Greater amount of current spectrum holdings
The size of holding – given the scarcity of spectrum larger bandwidth sizes (which enable operators to offer higher speed services) may be on offer infrequently	Balance sheet pressures/shareholder appetite for investment
Frequency of spectrum allocation fits with network strategy	Upfront payment

Increase	Decrease
Longer licence period	
Greater expected traffic growth	
Ability to use spectrum for strategic game playing and locking out other entrants	

Source: The CIE.

Key steps in our approach

There is substantial uncertainty about the value of spectrum, and different levels of uncertainty for different aspects. In order to estimate the economic impacts of spectrum we:

- consider VHA's willingness to pay as a lower bound for the productivity gains to VHA from having additional spectrum;
- apply productivity changes in the CIE Regions computable general equilibrium model to trace through impacts across the Australian economy. (Attachment A contains details on the CIE Regions economic model.); and
- consider separately other non-cost impacts such as the value of revenue to Government and competition.

Current spectrum holdings and market shares

The valuation of spectrum for each mobile operator will reflect the amount of spectrum they have available, and the amount of customers and data that they serve. The more spectrum an operator has, the lower the value of additional spectrum.

The spectrum holdings for mobile operators are set out in tables 1.4 and 1.5. VHA has substantially less spectrum than Telstra. It also has significantly less sub-1 GHz spectrum than Optus in regional areas.

1.4 Summary of mobile operators' spectrum holdings

Band	Optus	Telstra	VHA	Notes
700MHz	2x10MHz national	2x20MHz national	-	
850MHz	-	2x10MHz national + additional 2x5MHz outside largest 5 cities	2x5MHz national + additional 2x5MHz in largest 5 cities	
900MHz	2x8.4MHz national	2x8.4MHz national	2x8.2MHz national	
1800MHz (excluding 2016 auction)	2x15MHz in largest 5 cities + small number of regional licences	2x20MHz in Adelaide, Brisbane and Perth, 2x15MHz in Melbourne and Sydney, 2x10MHz in Cairns, Canberra and Hobart, 2x12.5MHz to 2x15MHz in regional areas	2x30MHz in Melbourne and Sydney, 2x25MHz in Adelaide, Brisbane and Perth, 2x5MHz in Canberra, Darwin and Hobart	

Band	Optus	Telstra	VHA	Notes
1900MHz	5MHz in metro areas	10MHz in metro areas	5MHz in main capital cities	Not currently used (no equipment ecosystem)
2GHz	2x20MHz in metro areas, 2x15MHz in regional areas and 2x10MHz in remote areas	2x15MHz in metro areas, 2x20MHz in regional areas and 2x10MHz in remote areas	2x25MHz in Melbourne and Sydney, 2x20MHz in Adelaide, Brisbane and Perth, 2x10MHz in Canberra, Darwin and Hobart, 2x5MHz in regional areas	
2.3GHz	98MHz in Adelaide, Brisbane and Perth, 91MHz in Melbourne and Sydney, 70MHz in Canberra	-	-	
2.5GHz	2x20MHz national	2x40MHz national	-	

Source: The CIE and Analysys Mason 2014, *The economic impacts of mobile broadband on the Australian economy, from 2006 to 2013,* prepared for the Australian Communications and Media Authority, January.

1.5 1800 MHz spectrum allocations from 2016 auction

Jurisdiction	Optus	Telstra	TPG	Unsold	Vodafone	Total
	MHz	MHz	MHz	MHz	MHz	MHz
Adelaide			10			10
Canberra (inc. south coast of NSW)	40	20	20		40	120
Central Queensland (Mackay)	50	50		20		120
Darwin	50	50	20			120
North Queensland (Cairns/Townsville)	50	55			20	125
Northern New South Wales (Grafton)	50	50	20			120
Regional South Australia	50	55	20			125
Regional Victoria	40	40	20		20	120
Regional Western Australia	40	50		10	20	120
South Queensland (Maryborough)	40	40	20	10	10	120
Southern NSW/Riverina (Albury)	50	50	20			120
Tasmania	40	50	20	10		120
Western New South Wales (Dubbo)	50	50	10	10		120

Source: ACMA 2016, 1800 MHz spectrum auction— Spectrum lots, highest final bids and winning bidders.

The market shares for the mobile handset market and wireless broadband services market are set out in table 1.6. Note that 'other' is mobile virtual network operators, whose customer and data load is borne by the Telstra, Optus and VHA networks.

1.6 Market shares for mobile sector

	Optus	Telstra	VHA	Other	Total
	Per cent	Per cent	Per cent	Per cent	Per cent
Mobile handset services	27	45	18	10	100
Wireless broadband services	14	64	7	15	100

Note: Based on subscriber numbers.
Source: ACCC Telecommunications report 2014/15, Figure 2.7 and Figure 2.8.

2 The value of spectrum

Productivity gains from allocation of spectrum

VHA has proposed to pay 1.25/MHz/pop for access to 2*10MHz of 700MHz band spectrum, or a total payment of $572 million. We consider that this is a lower bound of the productivity impacts (avoided cost and higher value products) for VHA. There are other factors taken into account by operators outside of productivity impacts, including how spectrum holdings impact on competition. In the case of VHA, this is not relevant, as VHA is not in a position to be purchasing spectrum to minimise competition.

To estimate the economywide impacts, we break down the payment of $572 million into likely impacts on capital (i.e. for sites) and labour and other operating expenditure. This is done using simulations of the impact of additional spectrum of the Analysy Mason Analysys Mason *Mobile Network Capacity Forecasting Model*, developed for the Australian Communications and Media Authority. This indicates that impacts eventuate as:

- 50 per cent reductions in capital expenditure and 50 per cent reductions in operating expenditure; and
- of reductions in operating expenditure, about 20 per cent would be from labour savings and the remainder from reductions in intermediate inputs.

To consider the economywide impacts of spectrum allocation to VHA, we then use the CIE Regions computable general equilibrium model. Reductions in costs from additional spectrum are modelled as a productivity improvement for the mobile sector.

Further details of the model are set out in Attachment A and The CIE and Analysys Mason 2014.[4]

Taxation efficiency impacts of spectrum release

Spectrum acquisition is a cost to mobile operators and provides revenue to the Australian Government. VHA has proposed to pay $572 million for additional 700MHz spectrum. The revenue received from this will provide a windfall gain for Government and avoid the need for other taxes, or allow additional service provision by Government. Note that the timing of these impacts are uncertain, as additional revenue could be used to reduce the amount of Government debt in the short term. Over the longer term, any Government revenue impact has to have either an impact on tax levels or an impact on

4 The CIE and Analysys Mason 2014, *The economic impacts of mobile broadband on the Australian economy, from 2006 to 2013,* prepared for the Australian Communications and Media Authority, January.

the amount or quality of services delivered, relative to what would occur in the absence of the impact.

We follow the approach of assuming that additional revenue would lead to a (marginal) reduction in some other taxes. This means that proceeds from the sale of spectrum reduce the economic distortions that arise from these other taxes. The economic distortions of different taxes are very different — some state taxes have distortions of over 50 cents per dollar of revenue raised (table 2.1).[5] The main Australian Government taxes — income tax, company tax and the GST — are less distorting. The most recent study, by Australian Treasury, found that the GST imposed a cost of 19 cents per dollar of revenue raised, labour income tax of 21 cents and company tax of 50 cents. It would be expected that a Government would reduce the most distorting tax first, if it gained other additional revenue. We present a range based on the economic distortions from the GST (lower end) to company tax (higher end).

- **The economy-wide impacts of an additional $572 million in revenue, from reducing the costs of taxation, is between $109 million and $286 million.**

2.1 Relative efficiency of selected taxes (descending order), by study

KPMG Econtech [a]		KMPG Econtech		Commonwealth Treasury	
2010	MEB [b]	2011	MEB [b]	2015	MEB [b]
Municipal rates	0.02	Land tax	0.09	Broad based land tax	-0.1
GST	0.08	GST	0.12	Personal income tax (labour & capital)	0.16
Land taxes	0.08	Personal income tax	0.24	Broad based GST	0.17
Labour income tax	0.24	Motor vehicle stamp duty	0.33	Current GST	0.19
Conveyancing stamp duties	0.34	Payroll tax	0.35	Labour income tax	0.21
Motor vehicle stamp duties	0.38	Company tax	0.37	Company tax	0.50
Corporate income tax	0.40	Commercial transfer duty	0.74	Stamp duty on conveyances	0.72
Payroll tax	0.41	Residential transfer duty	0.85		

[a] Modelling and results were prepared for and incorporated into the Henry Tax Review

[b] Marginal excess burden is the cost of the tax due to changing it by a small amount (usually such that total government revenue increases by $1).

Sources: KPMG Econtech 2010, CGE analysis of the current Australian tax system, prepared for Department of Treasury, 26 March; KPMG Econtech 2011, Economic analysis of the impacts of using GST to reform taxes; Australian Treasury 2015, Understanding the economy-wide efficiency and incidence of major Australian taxes.

Note that despite there being benefits of reduced distortions from taxation, revenue raising should not be viewed as the objective of spectrum policy. For example, a higher amount of revenue might be raised by releasing less spectrum. However, a smaller

5 Calculated from The CIE 2012, "Removing inefficient taxes on housing: a big boost to the economy", *Tax Policy Journal.*

amount of spectrum released would mean smaller economic impacts such as reducing costs for mobile operators, increasing service quality and potentially increasing competition. It has been argued (persuasively) that these effects outweigh the taxation impacts from spectrum release (Box 2.2).[6]

2.2 Trade-off between raising revenue and market efficiency

There is evidence in the literature that welfare impacts of increased spectrum allocation in output markets exceed the welfare impact of revenue received through the allocation process.

Hazlett, Muñoz and Avanzini (2012) found that the 'consumer gains in wireless output markets dominate social welfare generated by government extraction in spectrum inputs'.[7] The authors compared the estimated consumer surplus attributable to wireless services against auction revenue paid to the United States government between 1994 and 2009:

- Auction revenues — once off payment of $0.63 per MHz per person.
- Wireless services value — annual value of $2.90 per MHz per person for voice only services up to $3.50 per MHz per person for voice and text message services.

The study estimated the net present value (applying a real discount rate of 5 per cent) of the consumer benefit from wireless services over the period between 1994 and 2009 was at least eight times the magnitude of the receipts captured by the licence auctions held over the same period.

The magnitude in difference increases to over 240 times as large when the proportion of auction revenue that is a transfer payment is removed. Note these estimates likely underestimate the magnitude as producer surplus of wireless services was not been included.

Similarly, Hazlett and Muñoz (2008) found that the welfare cost of withholding spectrum via reserve prices likely exceeded public gains from the revenues raised in either Belgium or Greece.[8]

6 Hazlett, T. W., Muñoz, R. E., and Avanzini, D. B., 2012, *What really matters in spectrum allocation design*. Northwestern Journal of Technology and Intellectual Property, Volume 3, Issue 3: Article 2.

7 Hazlett, T. W., Muñoz, R. E., and Avanzini, D. B., 2012, *What really matters in spectrum allocation design*. Northwestern Journal of Technology and Intellectual Property, Volume 3, Issue 3: Article 2.

8 Hazlett, T. W. and Muñoz, R. E., 2008, *A welfare analysis of spectrum allocation policies*.

The economic dividend from spectrum allocation to VHA

The economic dividend from providing an additional 2*10MHz of 700MHz spectrum to VHA will reflect:

- how productivity changes for VHA impact on broader economic outcomes. Greater productivity in providing services will free up resources for use in other parts of the economy. There would also likely be some flow-through from improved productivity to prices of mobile services;
- the economywide implications of the Government revenue provide by VHA. Additional Government revenue has to, at some point, lead to either a reduced need for other taxes, or increased provision of services; and
- impacts related to improved competition in mobile services.

The quantitative implications of the first two impacts are set out in table 2.3.

Productivity gains in providing mobile services would increase GDP by $435 million (in present value terms). A better measure of the gain to Australian people is the impact on household welfare, which is estimated to increase by $313 million. These gains arise because resources are freed up from the mobile communications sector to be used to expand the economy.

The gains arising from the implications of additional government revenue for the Australian Government are estimated at are estimated at $109 million to $286 million. These estimates are based on the revenue being used to (marginally) reduce taxation. The Australian Treasury has estimated the costs to the economy of Australian Government taxes range from 19 cents (GST) to 50 cents (company tax) per dollar of revenue collected.

In total, the gains to Australians of additional spectrum allocation to VHA are estimated at $422 to $599 million (present value).

2.3 Impacts of spectrum allocation on household welfare

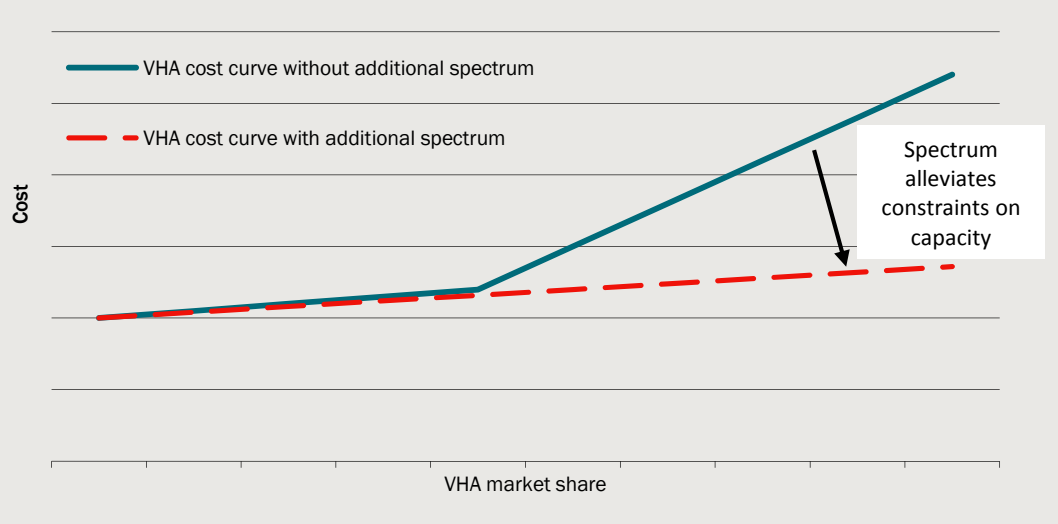
	Impact on household welfare	Impact on GDP
	$m, npv	$m, npv
From higher VHA productivity	313	435
Other impacts		
Government revenue reducing the costs of taxation	109-286	NA
Competition impacts	Discussed below	NA
Total measured impacts	**422-599**	**NA**

Note: The net present value is based on a 7 per cent discount rate from 2016 to 2027. The additional 700MHz spectrum is assumed to be available from 2018.
Data source: The CIE.

Value of competition

Releasing additional spectrum to VHA is likely to have implications for the level of competition in the market. This is because additional spectrum allows VHA to expand its market share at a lower cost (chart 2.4). Where an operator can only expand their coverage or market share at high cost, then the plausible amount of competition is limited. The more spectrum in the market, the greater the likelihood that firms will compete on price, rather than on quantity, moving the market closer to the competitive equilibrium.

2.4 Spectrum reduces constraints on increasing capacity



Note: Hypothetical curves only.
Data source: The CIE.

The OECD 2015 found that:[9]

> …in countries where there are a larger number of MNOs [mobile network operators], there is a higher likelihood of more competitive and innovative services being introduced and maintained. Particularly, a larger number of MNOs is often the source for innovative offers that challenge existing market wisdom and practices and a driver for the entire market to become more competitive. As a result all operators, MNOs and MVNOs, are encouraged to improve their offers in terms of price, services offered and quality of the offer.

It noted spectrum availability as one of the two key drivers of market structure for mobile communications. Increased competition does not automatically increase social welfare, and therefore should be treated as a means to an end, and not an end in itself. In a market with significant fixed costs and economies of scale, 'forced' allocation of spectrum to an inefficient user for the sake of increasing competition may decrease social welfare. For example, in the U.S. spectrum remained unallocated after the 1995-1997 auctions due to

9 OECD (2014), "Wireless Market Structures and Network Sharing", OECD Digital Economy Papers, No. 243, OECD Publishing. http://dx.doi.org/10.1787/5jxt46dzl9r2-en, p. 5.

the use of bidding credits. When the spectrum was eventually sold the winning bidder was not an efficient provider.[10]

There is empirical evidence that spectrum availability increases competition and that competition decreases prices for consumers in the mobile communications market. Hazlett et al. (2008) use a cross-country pricing model assuming Cournot competition to estimate the welfare impacts of releasing additional spectrum for mobile voice services.[11] The degree of market concentration is modelled based on the Herfindahl-Hirschman Index (HHI) (box B.2). The two key results of the study[12], both found to be statistically significant and consistent with economic theory, were:

- additional spectrum allocation decreases market concentration (HHI) — a 1 per cent increase in spectrum decreases HHI by 0.046 per cent; and
- a decrease in HHI decreases market price — a 1 per cent decrease in HHI decreases market price by 2.5 per cent.

To put this in perspective, a 5 percentage point increase in market share for VHA at the expense of Telstra would reduce the HHI by 4 per cent. If the impacts were as estimated by Hazlett et al 2008, this would imply a 10 per cent reduction in prices for consumers. This would equate to an increase in consumer surplus of ~$2 billion per year.

The impacts of a more competitive VHA would likely be larger than a more competitive Optus. Using the same example above, except with Optus market share increasing by 5 percentage points at the expense of Telstra, then:

- the reduction in market concentration as measured using the HHE would be half that compared to VHA increasing market share; and
- if the impacts were as estimated by Hazlett et al 2008, this would imply a 5 per cent reduction in prices for consumers, compared to a 10 per cent reduction implied by an increase in VHA market share.

Significant price impacts are consistent with previous analysis we have undertaken on Australia's telecommunications market.[13] The CIE 2015 found that:

- Telstra received a price premium of $19.30 per mobile subscriber per month compared to other operators, for the same bundle of services. This would be roughly one third more than other providers;
- Telstra had a higher market share than occurred in New Zealand and the UK. It was also the dominant player in both fixed line and mobile services, unlike in other markets; and

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10 Hazlett, T. W., Muñoz, R. E., and Avanzini, D. B., 2012, *What really matters in spectrum allocation design*. Northwestern Journal of Technology and Intellectual Property, Volume 3, Issue 3: Article 2.

11 Hazlett, T. W. and Muñoz, R. E., 2008, *A welfare analysis of spectrum allocation policies*.

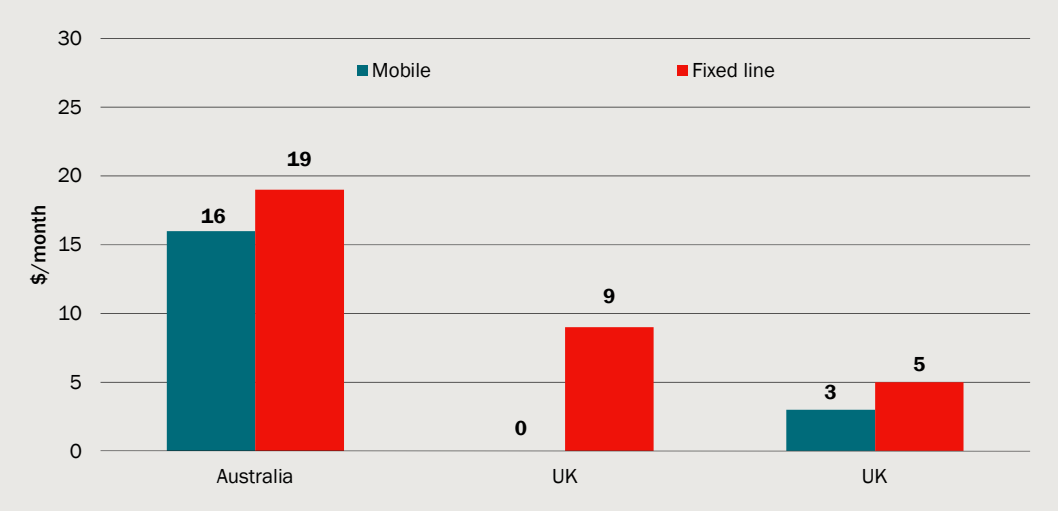
12 The study estimated six models, the results presented here are based on the preferred model, Model 6.

13 The CIE 2015, *Australia's telecommunications market structure: the price premium paid by consumers*, prepared for VHA.

- price premiums were much lower or non-existent to the dominant provider in other markets (chart 2.5).

The CIE 2015 noted spectrum availability, particularly in regional areas, as one of five important constraints to competition.

2.5 Price premiums for the dominant provider



Data source: CIE.

A CGE model and assumptions

Adaptations to economic model

The model used for this analysis, CIE-REGIONS, is a 53-sector, 8-region, computable general equilibrium (CGE) model of the Australian economy. The model was developed based on the MMRF-NRA model of the Productivity Commission[14]. It has a base year of 2005/06 and does not separately identify the mobile communications industry which is included in the telecommunications sector. Therefore adaptations must be made to the model to:

- split out the mobile communications sector from the telecommunications sector and
- roll forward the model from 2005-06 to 2012-13.

Splitting out the mobile communications sector

Splitting the mobile communications sector out of the telecommunications sector involves the following tasks:

- identifying the size of the industry;
- estimating the cost structure of the industry;
- estimating the uses of the mobile communications products; and
- integrating the sector into the rest of the economy

The size of the mobile communications industry

The database of the CIE-REGIONS model was originally compiled from the 2005-06 input-output tables published by the ABS in which the mobile broadband industry was not separately identified. Since the release of 2006-07 IO tables, production and uses information of mobile and other telecommunication network services including wireless and satellite (IOPC 58020010) have been reported in the product details tables (ABS Cat.No.5215.0.55.001), and the latest release of IO product details tables are for 2008-09.

IBISWorld estimates the wireless telecommunications industry revenues in its industry report J5802 from 2003-04 to 2012-13 and provides projections up to 2017-18.

14 Productivity Commission 2006, *Potential Benefits of the National Reform Agenda*, report to the Council of Australian Governments, Canberra.

A.1 Production value of Australian mobile communications industry

	ABS	IBISWorld	ABS to IBISWorld
	$m	$m	Per cent
2005-06		15 666	
2006-07	15 109	16 670	90.6
2007-08	18 846	17 528	107.5
2008-09	15 501	18 510	83.7
2009-10		21 415	
2010-11		21 151	
2011-12		20 936	

Source: ABS, Australian National Accounts: Input-Output Tables (Product Details) - Electronic Publication, various years, Cat.No.5215.0.55.001; IBISWorld, 2013, Wireless Telecommunications Carriers in Australia, IBISWorld Industry Report J5802,

Table A.1 compares the data from these two sources. In two of the three years with comparable data, the IBISWorld estimates are higher than the ABS values. It is likely that the difference comes from the coverage of the industry. For example, 13 per cent of the industry revenue in 2012-13 was from handsets and equipment sales in the IBISWorld report. If applying this share to the 2005-06 industry revenue, the sales of handsets and equipment would be a little over $2 billion, being equivalent to the electronic equipment inputs into the whole telecommunications sector for that year.

This suggests that part of the handsets and equipment sales are not treated as the output of the mobile broadband industry. We therefore deduct half of the handset and equipment sales from the IBISWorld industry revenue, that is, the industry output would be 6.5 per cent less than the IBISWorld value. It is estimated that the size of the mobile communications industry was $14 647.3 million for the year 2005-06.

Cost structure

IBISWorld provides estimates of mobile communications industry value added and wages together with industry revenue. In 2005-06 the value added and wage accounted for about 35 per cent and 12 per cent, respectively, of the revenue. These shares are applied to the estimated $14.6 billion industry output to estimate the industry value added, labour cost, and total intermediate input costs for the model.

The sectoral composition of intermediate inputs for the whole communications sector is then used to estimate the specific inputs for each sector into the mobile communications sector. Similarly the shares of other value added components for the whole sector are used to estimate the costs of other factors into the mobile communications sector.

The left half of table A.2 summarises the cost structure of the mobile communications sector in 2005-06. Intermediate inputs account for 65.4 per cent of the total cost, with the top 10 input sectors accounting for 52.6 per cent. Labour and capital costs account for 11.9 per cent and 21.3 per cent, respectively.

A.2 The cost and use structures of mobile communications 2005-06

	Costs			Uses	
	$m	Per cent		$m	Per cent
Intermediate inputs	**9574.7**	**65.4**	**Total industrial use**	**8493.3**	**58.0**
Top 10 sectors	*7698.3*	*52.6*	*Top 10 sectors*	*6539.9*	*44.6*
Business Services	2917.9	19.9	Trade	1593.4	10.9
Electronic Equipment	1391.4	9.5	Business Services	1438.7	9.8
Construction Services	899.9	6.1	Technical Services	928.0	6.3
Technical Services	593.7	4.1	Public Services	760.6	5.2
Trade	496.6	3.4	Transport Services	523.5	3.6
Financial Services	321.7	2.2	Education	309.3	2.1
Chemicals	317.6	2.2	Other Services	287.9	2.0
Transport Services	287.0	2.0	Other Construction	242.5	1.7
Printing and Publishing	267.3	1.8	Financial Services	238.9	1.6
Metal Products	205.3	1.4	Accom. & Hotels	216.9	1.5
Total value added	**5072.6**	**34.6**	**Total final use**	**6154.0**	**42.0**
Labour	1744.7	11.9	Household	5796.1	39.6
Capital	3120.9	21.3	Government	40.3	0.3
Land	0.0	0.0	Exports	317.6	2.2
Other	207.0	1.4	Other	0.0	0.0
Total cost of production	**14647.3**	**100.0**	**Total use**	**14647.3**	**100.0**

Source: CIE estimates

Use structure

The right half of table A.2 reports the detailed use structure of the mobile communications for 2005-06 and indicates 58 per cent of use is by other sectors for the year 2005-06. The top 10 industrial sectors account for 44.6 per cent of the services, and private households just under 40 per cent.

This compares to:

- ABS estimates that the share of industrial use of the mobile communications services was 58.5 per cent for 2006-07, 60.2 per cent for 2007-08 and 55.8 per cent for 2008-09; and
- IBISWorld estimates that the share was 33.5 per cent for 2012-13 (chart A.3).

These differences may reflect measurement differences and changes in use through time. The economic model shows a decline in industrial use through time and is therefore consistent with both sources.

A.3 Industrial use share of mobile broadband

Data source: 2006-07 through to 2008-09 from ABS, 2012-13 from IBISWorld

Rolling forward the model to 2012/13

The next step of the modelling is to roll forward the model with the newly constructed database from 2005-06 to 2012-13 using a modelling program called RunDynam. It runs a series of year-on-year simulations of the model with macro and industry specific targets and shocks. These targets and shocks include:

- annual growth of gross state product (table A.4);
- annual growth of regional population (table A.5);
- annual growth of national employment, investment, household consumption, and exports (table A.6); and
- annual growth of the mobile broadband industry activity (volume) and productivity improvement (table A.7)

In a normal simulation, most of these targets are generally endogenous, that is, determined by the model run. In the rolling forward or projection simulations, these targets are achieved through adjusting some usually exogenous variables.

A.4 Annual growth rate of gross state product

	NSW	VIC	OLD	SA	WA	TAS	NT	ACT
2006-07	2.1	3.8	5.7	2.0	6.2	2.7	5.7	4.4
2007-08	2.9	3.5	4.8	5.8	3.9	2.9	7.0	3.1
2008-09	1.0	1.1	1.0	1.9	4.3	2.4	4.8	4.1
2009-10	2.0	1.9	1.4	1.0	4.3	0.1	1.2	3.1
2010-11	2.6	2.7	1.0	2.3	4.0	0.2	1.2	3.2
2011-12	2.4	2.3	4.0	2.1	6.7	0.5	4.4	3.5
2012-13	2.0	2.0	3.8	1.8	6.0	2.3	3.9	2.0

Source: CIE compilation based on ABS Cat.No.5220.0; 2012-13 forecast based on State Treasury projections.

A.5 Annual growth of regional population

	NSW	VIC	OLD	SA	WA	TAS	NT	ACT
2006-07	1.4	1.8	2.6	1.2	2.7	0.8	2.2	2.2
2007-08	1.6	2.0	2.6	1.1	3.1	1.1	2.9	1.7
2008-09	1.6	2.2	2.6	1.3	3.2	1.2	2.8	1.8
2009-10	1.3	1.7	1.8	1.1	2.3	0.9	1.7	2.0
2010-11	1.0	1.4	1.6	0.8	2.7	0.5	0.7	1.7
2011-12	1.1	1.6	2.0	1.0	3.4	0.2	1.7	1.9
2012-13	1.1	1.4	2.1	1.0	2.0	0.7	1.5	1.2

Source: CIE compilation based on ABS Cat.No.3218,0; ABS projections for 2012/13 series B.

A.6 Annual growth of national macroeconomic variables

	Investment	Household consumption	Exports	Federal government spending	State government spending	Employment
2006-07	8.7	5.5	3.3	6.9	0.5	2.8
2007-08	9.5	2.8	4.1	4.7	4.2	3.1
2008-09	-4.6	0.2	0.7	1.5	2.3	1.0
2009-10	5.8	2.8	7.1	4.7	3.1	0.1
2010-11	5.7	3.4	-2.3	2.3	2.2	2.7
2011-12	10.0	3.3	5.9	6.7	2.1	1.4
2012-13	-1.3	1.9	6.5	0.4	0.7	0.5

Source: CIE compilation based on ABS Cat.No.5206,0

A.7 Annual growth of mobile broadband industry

	Volume	Productivity
2006-07	10.5	3.0
2007-08	12.1	6.5
2008-09	13.9	9.5
2009-10	16.7	11.8
2010-11	15.4	13.3
2011-12	9.8	14.2

Source: CIE estimates

B Competition impacts from spectrum allocation

Spectrum allocation can be a driver of market structure and competition. At a basic level, operators cannot operate a network without spectrum. If operators or potential new market entrants are not given the opportunity to acquire spectrum then they cannot operate and begin competing. The spectrum that is acquired, in terms of size of holding, frequencies held, licence conditions including the location applicable to the licence, begins to drive different coverage and quality outcomes for operators.

To compete on a national scale effectively, operators require a portfolio of spectrum holdings — a mixture of lower frequencies, sub 1 GHz spectrum, for coverage layers and higher frequencies, greater than 1 GHz, for capacity in the network. Different technologies also have different spectrum requirements. For mobile broadband technologies, an optimal amount of spectrum supports higher speeds, spectral efficiency and other quality issues.

Through the market structure, spectrum allocation may impact on the level of competition. Generally, more competition means lower prices for consumers and/or increased value derived from a non-price competition such as better quality network or improved customer service. There may also be dynamic impacts from a more competitive market structure, such as greater pressure for productivity improvement.

Spectrum allocation can increase competition in a mobile broadband market.[15] Increased competition does not automatically increase social welfare, and therefore should be treated as a means to an end, and not an end in itself. In a market with significant fixed costs and economies of scale, 'forced' allocation of spectrum to an inefficient user for the sake of increasing competition may decrease social welfare. For example, in the U.S. spectrum remained unallocated after the 1995-1997 auctions due to the use of bidding credits. When the spectrum was eventually sold the winning bidder was not an efficient provider.[16]

Market structure of wireless broadband industries

The majority of international wireless broadband markets, including the Australian market, are oligopoly markets characterised by a few firms each with a high degree of

15 Crampton, P., E. Kwerel, G. Rosston and A. Skrzypacz 2011, "Using spectrum auctions to enhance competition in wireless services", *Journal of Law and Economics*, Vol. 54, November..

16 Hazlett, T. W., Muñoz, R. E., and Avanzini, D. B., 2012, *What really matters in spectrum allocation design*. Northwestern Journal of Technology and Intellectual Property, Volume 3, Issue 3: Article 2.

market concentration and barriers to entry. Firms in an oligopoly market have some price setting power in much the same way as a monopoly firm.

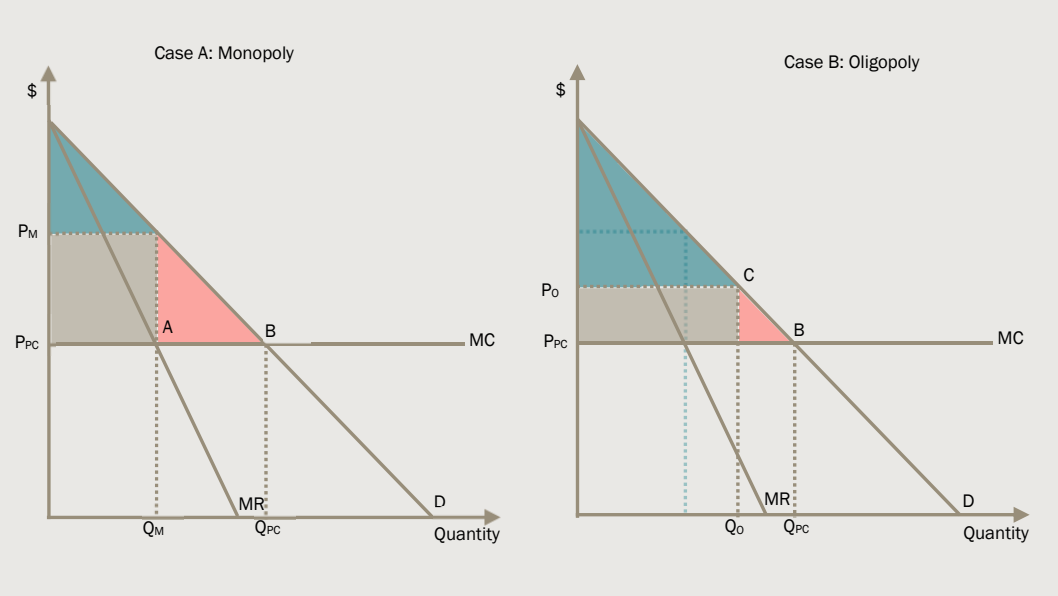
A distinguishing feature of an oligopoly market is the strategic interdependence between firms. Each firm must take into consideration the likely reactions of the other incumbent firms when making pricing and investment decisions.

An oligopoly has a higher level of competition than a monopoly but as it is not perfectly competitive, social welfare may not be maximised by the prices chosen by the businesses in the industry.

Chart B.1 shows the different levels of social welfare under a monopoly and an oligopoly relative to a perfectly competitive market.

- ***Perfectly competitive market*** — in Case A and B, the equilibrium point is B, price and quantity are P_{PC} and Q_{PC} respectively, social welfare is maximised and there is zero deadweight loss.
- ***Monopoly market (Case A)*** — equilibrium point is A where one firm sets the price and quantity at P_M and Q_M, respectively, to maximise profits. Social surplus includes consumer surplus (blue shaded triangle), producer surplus (grey shaded rectangle). Social welfare is not maximised and there is deadweight loss to society (red shaded triangle).
- ***Oligopoly market (Case B)*** — Each firm strategically sets quantity with consideration of the expected output of other firms. The equilibrium point is C, where the market has set the price, P_O, based on the total output of all firms, Q_O. Relative to a monopoly market, social surplus (consumer and producer) increases and deadweight loss decreases. However social welfare is not maximised as deadweight loss is still present.

B.1 Social surplus and deadweight loss under monopoly and oligopoly



Data source:

Modelling an oligopoly

A standard model of an oligopolistic industry is the Cournot model. In this model, each business maximises its profit, subject to how it influences prices. The equilibrium is where each business would not choose to change their behaviour, given what other businesses are doing. In this model, as the number of firms in a market place increases:

- the industry output increases; and
- the market price decreases and approaches the price set in a perfectly competitive market.

The Cournot model can be used to estimate the increase in social welfare (or equivalently the decrease in deadweight loss) associated with an increase in the number of firms in the market.

Modelling the impact of additional spectrum allocation

Hazlett et al. (2008) use a cross-country pricing model assuming Cournot competition to estimate the welfare impacts of releasing additional spectrum for mobile voice services.[17] The degree of market concentration is modelled based on the Herfindahl-Hirschman Index (HHI) (box B.2).

B.2 Herfindahl-Hirschman Index (HHI)

The HHI is a measure of market concentration based on market shares of the industry's firms. It is calculated as follows:

$$H = \sum_{i=1}^{N} s_i^2$$

Where N is the number of firms and s_i is the market share of firm i.

The HHI ranges between 0 and 1, as the index increases from 0 to 1, the market concentration increases (competition decreases) as the number of firms reduces from a large number of very small firms to a single monopolistic producer.

Hazlett et al.'s (2008) model simulates the change in HHI due to allocations of additional spectrum. HHI is endogenous to the model causing increases in spectrum allocated to result in reduced market concentration (increased competition). Based on the modelled change in HHI, the model estimates the associated change in the equilibrium price.

17 Hazlett, T. W. and Muñoz, R. E., 2008, *A welfare analysis of spectrum allocation policies*.

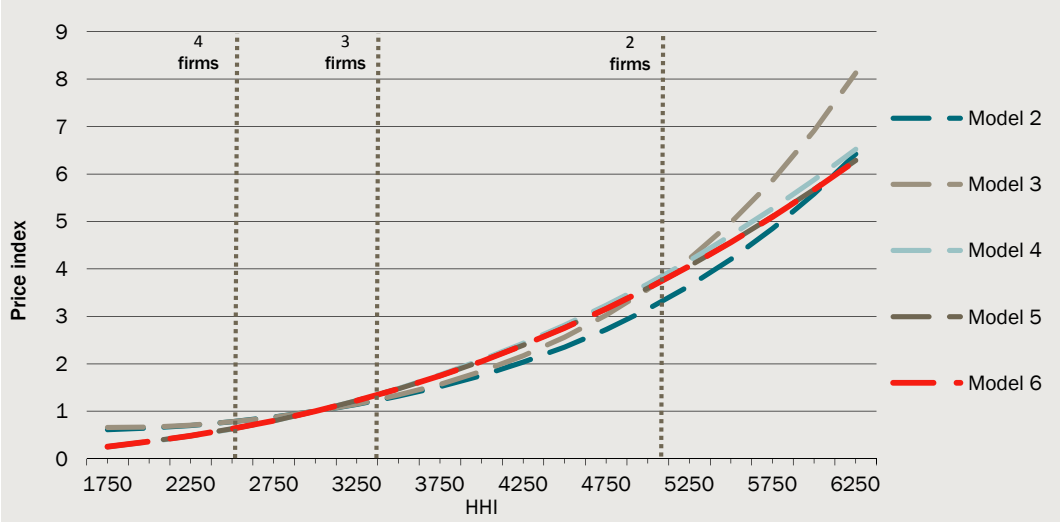
The study estimated the relationship between spectrum allocation and HHI, and between HHI and market price. The two key results of the study[18], both found to be statistically significant and consistent with economic theory, were:

- additional spectrum allocation decreases market concentration (HHI) — a 1 per cent increase in spectrum decreases HHI by 0.046 per cent
- a decrease in HHI decreases market price — a 1 per cent decrease in HHI decreases market price by 2.5 per cent.

These estimated relationships imply that increases in competition can have large impacts on price, however additional spectrum allocation has only a small impact on competition.

Chart B.3 shows the estimated relationship between HHI and price over the HHI range estimated in the study. The HHI for two, three or four firms each with equivalent market share is 5000, 3333 and 2500 respectively. An increase from two to three firms decreases the market price by 64 per cent, and similarly an increase from three to four firms decreases the market price by 51 per cent approximately.

B.3 Relationship between price and HHI



Note: Model 1 not included in chart because it estimated significantly larger magnitudes than the other five models and inclusion distort chart.

Data source: The CIE based on modelling in Hazlett, T. W. and Muñoz, R. E., 2008, *A welfare analysis of spectrum allocation policies*.

The study found that retail prices decreased by about 8 per cent due to an increase of 60 MHz in spectrum allocated for mobile telephony in the United States' wireless telephone market.[19] This decrease in price was estimated to increase consumer surplus by approximately $8.8 billion annually. However, the estimated increase in consumer surplus is potentially inaccurate as producer surplus was not estimated. A subset of the estimated consumer surplus may actually be a transfer of producer surplus to consumer surplus and therefore not represent a net increase in social surplus.

18 The study estimated six models, the results presented here are based on the preferred model, Model 6.

19 Increase to an existing base of 170 MHz.

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