ceg COMPETITION ECONOMISTS GROUP

Economic aspects of the USO

A report for nbn co

Jason Ockerby
Johnathan Wongsosaputro

July 2016

COMPETITION ECONOMISTS GROUP

Table of Contents

1 Introduction **1**

2 Framework for imposing a universal service obligation **4**

2.1 The objectives of a universal service obligation 4

2.2 Market failure rationale for a universal service obligation 5

2.3 Income redistribution and regional policy rationales for imposing a universal service obligation 7

2.4 Weighing alternative policies to addressing universal service objectives 9

3 Competition amongst RSPs on the nbn network delivering universal service objectives **12**

3.1 Outcome of competition amongst RSPs 13

3.2 Existence of externalities in broadband access 21

4 Competition from mobile networks **23**

4.1 Empirical literature on fixed line and mobile substitution 24

5 Eligible revenues **30**

List of Figures

Figure 3-1: Number of access seekers at each POI 15

Figure 3-2: Distribution of two year per premise DTCS backhaul costs at all 121 POIs for the two hypothetical access seekers 20

List of Tables

Table 1-1: Summary of issues 3

Table 3-1: Number of access seekers at each POI 14

Table 3-2: Comparison of minimum copper broadband and nbn network pricing by RSPs (two-year costs) 18

Table 4-1: Chronological summary on fixed-mobile substitution (FMS) 24

COMPETITION ECONOMISTS GROUP

1 Introduction

1. We have been engaged by nbn co to provide advice in relation to the Productivity Commission's review of the universal service obligation. In the review, the Productivity Commission has been asked to give consideration to:[1]

> *… the nature, scope and objectives of a universal service obligation, whether the retail market for relevant services will deliver appropriate outcomes for consumers without Government intervention and, if not, what options should be considered by Government to deliver universal services and the costs and benefits of these interventions*

2. We have been asked a series of questions in relation to these matters. In answering these questions, we have been asked to have regard to nbn co's role as set down by Government in its Statement of Expectations, as well as the resulting change in industry structure and the ubiquity of broadband in Australia.

3. We note that the Productivity Commission has observed that the ubiquitous nature of the nbn network will have an effect on its review. Amongst a range of changes in the industry, the Productivity Commission noted that:[2]

> *The Australian Government continues to roll out the National Broadband Network (NBN), which is intended to deliver broadband to all Australian premises using a range of technologies and subject to a wholesale capped price. The NBN effectively provides universal access to fixed broadband services (and, hence, to voice over internet protocol services).*

4. The Australian Government has written to nbn co with a Statement of Expectations that nbn co is to deliver on the Government's policy of "at least 25 Megabits per second to all premises … as soon as possible".[3] nbn co has also given a Special Access Undertaking (SAU) to the Australian Competition and Consumer Commission (ACCC) that sets price caps for its wholesale services for approximately the next 25 years, with service prices being able to increase by no more than CPI - 1.5% annually.[4]

5. In this environment, a retail universal service obligation which has the objective of achieving universal availability of services at affordable prices across high- and low-

---

1 Terms of reference. Telecommunications Universal Service Obligation, Productivity Commission Act 1998, 28 April 2016

2 Productivity Commission, Telecommunications Universal Service Obligation, Issues Paper, page 1.

3 Letter to NBN Chairman, Government Expectations, dated 8 April 2014.

4 nbn co, Special Access Undertaking given to the ACCC in accordance with Part XIC of the Competition and Consumer Act 2010 (Cth), accepted on 13 December 2013.

cost areas may be redundant. The availability of services up to 25 megabits per second to all premises in Australia is assured and nbn co's wholesale prices and price controls, which have been accepted by the ACCC as reasonable, embody an implicit cross-subsidy between low-cost and high-cost areas. Its entry-level service prices might be regarded as affordable given they are intended to allow RSPs to match current broadband prices which have seen fixed broadband household penetration reach 72% as at December 2014, and is forecast to grow to 80% by 2019.[5]

6. The ubiquity of these wholesale commitments means that retail service providers (RSPs) have the capability to deliver retail broadband services to all premises in Australia, once the nbn network rollout is completed, which includes the specific voice capability allowed by nbn services. If competition is effective amongst RSPs within nbn co's serving areas,[6] retail prices should reflect the efficient costs of converting nbn co's wholesale services into retail voice and broadband services (which as we discuss below are not significantly different across nbn co's serving areas).

7. Table 1-1 sets out the issues discussed in the remainder of the report, and provides a summary of our analysis.

5 nbn co, Corporate Plan 2016, p. 42.

6 Commonly referred to as its points of interconnection (or POIs).

Table 1-1: Summary of issues

Section	Issue	Analysis
2	Economic framework for evaluating the merits of a USO at the retail level	• Whether a USO should be implemented depends on the cost of the intervention relative to its benefits • Market failure is the main economic justification for government intervention such as imposing a USO • Income redistribution and regional policy rationales would also support a USO • The USO creates direct and indirect costs and distortions in the market (e.g., defining a costly-to-replicate universal service may drive out competitors to the universal service provider) • There are a number of alternative policies whose net benefits could outweigh that of a USO at the retail level
3	Competition among RSPs in the absence of regulatory obligations	• nbn co is already internalising significant cross-subsidies in setting uniform prices at the wholesale level • There is evidence of competition among RSPs o 118 of 121 POIs feature 3 or more access seekers o Retail prices are fairly similar across RSPs regardless of technology used o RSP costs are fairly similar across POIs • Positive externalities in telecommunications may be overstated, and could also be internalised by policies that target small user groups instead of being broadly applied to all end-users
4	nbn co's competition from other technologies (e.g., mobile and fixed-wireless)	• OECD analysis suggests that the USO should specify capability or performance requirements instead of specifying technologies • Empirical literature shows a clear trend of increasing fixed-mobile substitution o When mobile penetration is low, fixed-line and mobile services tend to be complements o As mobile penetration increases and technology develops, mobile is increasingly a substitute for existing fixed-line services. The degree of substitutability in the future will depend on the growth in bandwidth capability of each network (and changing end-user preferences) o Literature initially showed that mobile and fixed-line telephony were substitutes in terms of traffic, then more recent literature found access substitution as well o Despite lower capacity of mobile network technologies, future developments (e.g., 5G) may provide substitutes for entry-level fixed line broadband access
5	Industry levy as a funding source for the USO	• Methods to define revenues for imposing an industry levy include: retail revenues; gross revenues; and net revenues • Retail revenue definition is preferable – gross revenue results in "double taxation" and net revenue causes greater distortions • Net revenues definition will exacerbate double marginalisation problem and result in incidence of levy falling on investors in network infrastructure (harming incentives to invest)

2 Framework for imposing a universal service obligation

8. We have been asked:

> *To provide an economic framework for deciding whether or not to impose a universal service obligation at the retail level to voice and broadband services given the ubiquity of the nbn network.*

2.1 The objectives of a universal service obligation

9. The Productivity Commission sets out a fundamental question of whether intervention in the form of a universal service obligation will provide benefits that exceed the cost of intervening. It recognises that, at least in part, this depends on the ability of the market to fulfil the objectives of universal service. The Commission observes:[7]

> *If universal services objectives have a sound basis, then there may be a case for the Australian Government to intervene through a particular policy or mix of policies. However, whether or not the Government should intervene will depend on the costs of the intervention relative to the benefits. In part, this will depend on evolving technology and the availability and reliability of alternatives to the current USO.*

10. A retail universal service obligation is a requirement at the retail level to serve customers regardless of their location (i.e., regardless whether they are in high-cost to serve areas or low-cost to serve areas). It is generally linked to a uniform pricing requirement at a level that is regarded as affordable. A universal service obligation therefore represents a combination of:

- a subsidised expansion of telecommunications services to provide a given quality of service that may not have otherwise been provided in all areas; and
- restrictions on the level and structure of prices to ensure affordability of the services – in general the obligation may require a basic service to be offered at a particular price (rather than a restriction on the price of all service offered by the provider). The restriction will require the provider to engage in a degree of price discrimination based on the quality attributes of services.[8]

---

7 Issues Paper, page 19.

8 Note that the universal service obligation in Australia does not impose price controls on the service provider, and is instead framed in terms of the obligation "to ensure that standard telephone services are

11. There are a range of potential justifications that can be made for a universal service obligation, including on social and political grounds. For example, the services may be considered a "necessity" for participation in modern society, or access to such services may simply be seen as a community standard (i.e., once a good is consumed by the vast majority of users) and therefore a belief that access should be extended to all. The soundness of such arguments is questionable as they could easily be extended to many other private goods, such as personal computers, motor vehicles or televisions.

2.2 Market failure rationale for a universal service obligation

12. A number of economic justifications may be made for a universal service obligation. One key economic rationale for imposing a universal service obligation is that some form of market failure is preventing an efficient price-quality bundle from being provided to the market. In the absence of market failures, competitive markets will deliver the efficient quantity and quality of services at prices that reflect the least cost of production.

13. In economics, market failure refers specifically to the reason the market may not deliver an efficient quantity of service.[9] That is, a market is said to have failed when the price-quality relationship at the market-clearing quantity does not equate to the additional utility enjoyed by consumers of the service and the minimum resource cost to society of producing incrementally more of the service.

14. Market failure does not refer to the situation in which a market does not deliver a particular price-quality outcome that was considered (arbitrarily) to be fair or affordable. It may however be the result of a market failure if some segment of the market or area was not served. That is, if there are marginal consumers with low willingness to pay but who would nevertheless pay a price that exceeds the marginal

reasonably accessible to all people in Australia on an equitable basis, whether they reside or carry on business". See: *Telecommunications (Consumer Protection and Service Standards) Act 1999* (Cth), s 9.

9 The common sources of market failures include externalities, imperfect competition and public goods (telecommunications service are both excludable and rivalrous in consumption and therefore do not have the common features of public goods). The perceived existence of network externalities has historically been used to justify universal service obligations in relation to access to a voice telephony service in high-cost areas. A network externality exists when existing users of the network benefit from adding new users to the network. Where these externality benefits exceed the deficit between the new users own marginal benefit from joining the network and the incremental cost of connecting the user, market intervention may be justified.

There may also be regulatory failures that prevent a market from delivering efficient outcomes. These might include regulatory obligations that raise the cost of entry in the market or pricing controls/rules that distort price-quality outcomes.

cost of serving them, there may be a market failure that could explain the lack of provision of a service that allows them to consume.

15. More broadly, there may be a market failure which prevents higher qualities of service being offered on an existing network (e.g., a reason why the network in high-cost areas has not been upgraded to provide high-speed broadband services). Arguably, due to Telstra's historic local access monopoly there was a failure in the market to provide telecommunications infrastructure that is capable of delivering the high speed broadband services that end-users would value.[10] However, the Government's requirements for nbn co to deliver wholesale services of at least 25 megabits per second to all premises in Australia means that any such failure has been addressed or will be addressed once the nbn network is complete.

16. Therefore, in the context of imposing a retail universal service obligation to services in Australia today, the principal areas where market failure might be identified related to aspects where competition may not be sufficiently workable to deliver an efficient outcome. This could be the case where:

    a. there is a market failure that is preventing competition between retail service providers (RSPs) using the nbn services to deliver an efficient price-quality relationship in all areas. We have been asked to consider the potential market failures that prevent the market from delivering an efficient price-quality bundle. We consider these issues in section 3 of this report; or

    b. there are insufficient competing networks to the nbn network (e.g., mobile or fixed-wireless network) which are able to deliver an efficient price-quality relationship. We have been asked to consider issues involved in answering this question – which we do in section 4 of this report.

17. However, even if there is market failure, it does not necessarily follow that a universal service obligation should automatically be imposed. There are other market interventions that should be considered that could address the market failure at lower cost.

18. The imposition of a universal service obligation creates economic costs, for example, these costs come in the form of:

    - distortions to prices from the raising of universal service levies to fund the obligation – a universal service levy on prices for broadband and voice services will reduce the consumption of those services creating a welfare cost (commonly referred to as a deadweight loss);

[10] As discussed in section 3.1, monopolies (or firms in monopolistically competitive markets) will generally not deliver the optimal quality of service.

- political economic costs from rent-seeking behaviour (e.g., seeking to raise the quality to increase subsidies, inflating the cost estimates and allocating the levy to favour anti-competitive outcomes); and
- distortions to competition from imposing a uniform retail price at a specified quality level in both high and low cost areas – the specified price-quality bundle may make entry by RSPs not subject to the obligation less likely in areas with high retail costs (i.e., costs in addition to the uniform price offered by nbn co) and limit the pricing discretion of RSPs subject to the obligation in low-cost areas.

19. In order to justify imposing a universal service it must be considered that the benefits of the imposition exceed the costs. In addition, a universal service should only be considered when alternative policies cannot address the market failure at lower cost (see section 2.4 below).

2.3 Income redistribution and regional policy rationales for imposing a universal service obligation

20. A number of alternative economic rationales for a universal service obligation might be considered. A universal service obligation may be seen as a means to achieving wealth redistribution (see Cremer et al 2001). That is, rather than provide tax concessions or issue lump sum amounts to low-income individuals, requiring universal access at affordable prices to what would otherwise be private goods could serve as a means to redistribute wealth.

21. Such an approach may be a second best alternative to lump sums, as observed by Cremer et al (2001):[11]

> *The recent economic literature has shown that such policies can be optimal in a second best sense, i.e., when policy makers do not possess the necessary information to implement (potentially) more efficient policies like direct transfers.*

22. A universal service obligation effectively creates a public service with some form of price regulation, which achieves a redistribution between people living in high-cost areas and people living in low-cost areas; and potentially between low income individuals and high income individuals.

[11] Cremer, H., F. Gasmi, A. Grimaud and J.J. Laffont (2001), 'Universal service: an economics perspective', Annals of Public and Cooperative Economics, 72, 5–43

23. nbn co, for example, is regulated through a wholesale price cap, although there is no obligation for nbn co to impose uniform prices.[12] We have also been informed by nbn co that the geographically uniform wholesale prices for nbn co's entry-level services are intended to allow RSPs to match the retail prices for equivalent services in the market today in urban areas (based on unbundled copper local loops). Given the relatively high penetration of broadband services in urban areas, retail prices at this level might fit the affordability benchmark for a universal service obligation.

24. As noted by Laffont and Tirole (1999), the case for subsidising medium- and high-income individuals living in high-cost (rural) areas may be in part regional planning and part fulfilling a social promise to individuals incurring sunk cost to live in such areas:[13]

> *… the case for protecting medium- and high-income customers in rural areas, of course, cannot stem from purely redistributive concerns. Rather, if a case is to be made (independently of the regional planning argument to be stated later), it ought to do with a possible implicit promise by governments that citizens deciding to live in high-cost areas would not be penalized by high utility prices. If such an implicit promise was made (an assertion which is open to question), then the scrapping of the corresponding subsidies implies an expropriation of those who have made the (relational, professional, psychological, or physical) investment of living in high-cost areas. So, if the existence of an implicit promise is established, compensation is called for, although it need not necessarily take the form of a subsidy on utilities' services.*

25. Cremer (2001) put forward a few other economic justifications that might support a universal service obligation. First, telecommunications could be viewed as a public good in the sense that it is a necessity in a functioning democracy in order to achieve objectives such as social inclusion. This view considers the welfare cost of social exclusion as exceeding the incremental cost of the network. Second, a USO could be used as an instrument to conduct regional policy in order to benefit certain regions that also happen to be high-cost to the telecommunications network – a justification also observed by Laffont and Tirole (1999):

> *Regional planning attempting to encourage a more harmonious distribution of residents away from large congested metropolitan areas. This rationale is based on the existence of externalities: noninternalized*

---

12 In some future periods, it may be that nbn co lowers its wholesale prices in some areas but not others. It will nevertheless be the case that prices in all areas will be subject to the wholesale price caps and therefore, prices will reflect the cross-subsidy reflected in the existing price caps.

13 Laffont and Tirole (1999). Competition in Telecommunications, Munich Lectures in Economics, MIT Press, page 219

congestion externalities in large cities; social benefits from maintaining a rural habitat (this perception is often dear to the French, for example).

26. It is unclear whether regional planning and/or the fulfilment of a social contract with rural Australians is the intended basis of universal service policy for telecommunications. In any event, the implicit cross-subsidies embedded in nbn co's wholesale prices would go a substantial way towards the fulfilment of these objectives in relation to broadband services. The question would remain whether competition amongst RSPs was sufficient or whether achieving these objectives would be impeded. We turn to that issue in section 3.

2.4 Weighing alternative policies to addressing universal service objectives

27. Alternative policy interventions in the market may address the perceived failure to deliver the desired price-quality relationship to all areas at lower cost. Alternative measures to imposing a universal service obligations include one or more of:

- subsidy schemes for end-users – including direct transfers or voucher systems that provide end-users with a subsidy if they acquire voice or broadband services – such schemes may be most appropriate where network externalities are identified as the principal source of market failure or to achieve income redistribution or regional planning objectives;
- capital contributions from end-users – requiring end-users to contribute to the costs incurred as a result of the decision to connect to the network;
- risk sharing models – in which the government, consumers and investors contract to share the risks associated with the success of investments in higher quality; and
- regulatory reform – policies that reduce the barriers to RSPs from providing services across Australia may be justified where regulatory failure exists or when barriers to effective competition are identified.

28. The costs of implementing a universal service obligation stem from many aspects of the policy, including defining the price-quality parameters of the service, the obligation being extended across all areas, and the need to estimate and fund the cost of the obligation.

29. First, since it is difficult to quantify the exact benefits and costs of a universal service obligation, such a market intervention will often generate high administrative costs, while also creating distortions through diverting resources away from other parts of the economy. As a result, in the process of implementing the USO, the policy could end up incurring high costs and risks that cancel out or even exceed any of the intended benefits.

30. Second, the universal service obligation also requires an administrative party to determine the precise scope of the service required in numerous high-cost areas around Australia. This is likely to be an arbitrary exercise that may understate or overstate the requirements in each high-cost area, which makes it difficult to set the correct level and extent of uniformity in prices that should be set. For example, a goal of 100% take-up is likely to require very low prices in order to induce consumers to take up the service, while also incurring extremely high costs to service the highest-cost percentiles of the population. Consideration will need to be given to determining the level of take-up that is realistic (and desirable), as well as the price level that would achieve that.

31. Third, imposing a universal service obligation runs the risk of crowding out alternative investments that could be viable for serving unprofitable areas, which could distort competition in the long run, particularly if the obligation is set in a technology-specific manner. In addition, if universal service attaches regulatory obligations or consumer guarantees that are costly to replicate it may drive competitors out of high-cost areas, cementing the universal supply as a monopoly in those areas.[14] For this reason, the universal service obligation should be minimally specified, without mandated service levels or features above the most basic "connectivity elements". We further discuss the issue of crowding out investments in section 4.

32. Fourth, a universal service obligation generates substantial uncertainty regarding the future political economy. For example, once an obligation is imposed it will likely be difficult to withdraw without material objections. In addition, there may be risks that future obligations will continue to be required but will be unfunded or underfunded. This might occur if the universal service provider was incorrectly perceived as having recouped its costs or is seen to be receiving additional hard-to-estimate benefits from providing universal service.[15] Such uncertainty raises the possibility that investors will require an additional premium in order to account for the increased risk to the level of funding.

33. Alternative policies will have their own attendant costs which will need to be compared with those identified with the policy of imposing a universal service obligation. However, as a general rule, policies that specifically target the source of market failure will usually be preferable in the sense that they generate the least amount of distortion. In contrast, approaches that seek to address a specific market failure through broader policies are less preferable since they affect a wider array of

[14] It would not be surprising to see rent seeking behaviour in which the universal service provider(s) support service features that raise the cost of serving high-cost areas (e.g., short fault rectification times and customer payments).

[15] This was the case for the TSO in New Zealand.

economic decisions, which results in additional distortions. This is commonly referred to in economics as the "specificity rule".

34. In the present case, the specificity rule suggests that subsidising low-income and high-cost end-users through direct transfers or voucher systems is likely to result in less distortive effects compared to a broad policy such as a universal service obligation.

35. The candidate policies for addressing universal service obligations should thus be evaluated based on their potential to encourage better use of finite economic resources, for example, discourage users from connecting to the network and later disconnecting without paying the cost of that decision (requiring capital contributions from end-users would assist in this regard).

3 Competition amongst RSPs on the nbn network delivering universal service objectives

36. We have been asked to consider the following question:

> *In a world in which nbn co supplies universal coverage of wholesale broadband services, is it reasonable to expect retail competition to be sufficient to ensure services reflecting a desirable price-quality relationship are supplied to customers without a specific obligation on one or more RSPs?*

37. Consistent with our discussion in section 2.2, a precondition for regulatory interventions, such as a universal service obligation, should be the existence of a failure in the market to deliver efficient outcomes. In this section we consider the robustness of competition between RSPs and whether it is sufficiently workable to deliver an efficient price-quality relationship.

38. However, the objectives of a universal service obligation may extend beyond economically efficient outcomes. As discussed in section 2.3, it may be seen as desirable from an income redistribution or regional planning perspective to ensure that a minimum quality of service is available at all locations at an affordable price. A uniform retail price based on the average cost of serving all areas may be sufficient to achieve these objectives as it will create a transfer from consumers in low-cost areas to consumers in high-cost areas and remove communications access and pricing as a differentiating factor in decisions to reside in different regions.[16]

39. The ubiquitous deployment of the nbn network and nbn co's commitment to wholesale price caps for a range of key services provides a platform for the delivery of many of these universal service objectives.[17] That is, if we accept that the wholesale services supplied by nbn co provide the desired price-quality bundle at the wholesale level, it remains to be assessed whether competition between RSPs on the nbn network will deliver on the identified universal service objectives.

40. It is worth noting that nbn co is already internalising significant cross-subsidies in supplying wholesale broadband services at uniform prices (which will make up a

[16] Determining the average cost of a particular service supplied on the network is made problematic by the existence of substantial fixed costs which are common to the supply of basic and higher-quality services.

[17] Whilst nbn co is not strictly subject to a uniform pricing requirement, we are instructed that it can only spatially differentiate prices by pricing below its wholesale price caps, due to its commitments in its special access undertaking.

significant proportion of the final retail price for end-users). Therefore, the nbn network deployment and pricing commitments already represent significant market interventions to achieve the universal service objectives discussed above (including addressing perceived market failures in the delivery of broadband infrastructure in high-cost areas).

41. Nevertheless, in the following section we consider the barriers to competition amongst retail service providers (RSPs) purchasing wholesale services from nbn co in delivering on the universal service objectives. We focus on the extent to which RSPs have an incentive to convert the wholesale inputs from the nbn network into efficient price-quality bundles and the extent to which they will deliver spatially uniform prices.

3.1 Outcome of competition amongst RSPs

42. Unregulated monopolies (or firms in monopolistically competitive markets) will generally not deliver the optimal quality of service (this has been recognised in economic literature for some time).[18] In essence, a monopoly firm will increase quality if it will increase its profits. It is profitable for the firm to increase quality if its revenues increase by more than the incremental cost of supplying the higher quality (i.e., its marginal revenues exceed the marginal cost). However, the marginal revenues gained by improving quality depend on how *consumers at the margin* value the higher quality rather than the value to the *average consumer* (or consumers in total).[19]

43. This difference means that quality gains that would be socially beneficial (i.e., where the total/average value to consumers exceeds the total/average cost of increasing quality) may not be adopted.[20] Therefore, for an (unregulated) monopoly, the decision to improve quality may not be socially optimal. In contrast to a competitive market, a firm can increase market share by offering consumers price-quality bundles that are more attractive than their competitors. Absent the existence of externalities, the competitive process should deliver improved price-quality relationships.

3.1.1 Evidence of competition at the retail level

44. There are potentially a range of indicators of competition between RSPs, including: the extent of barriers to entry, expansion and exit; the level of customer switching

[18] Spence, A. (1975). Monopoly, Quality, and Regulation. *The Bell Journal of Economics*, 6(2), 417-429

[19] The ability of a monopoly to price discriminate will, to some extent, mean that it can capture some of the value that infra-marginal consumers place on higher quality.

[20] It may also mean that in some circumstances, too much quality is adopted. This is the case where the marginal consumer values quality increases more than the average consumer.

activity; changes in prices relative to input cost changes; the profits earned by RSPs; and the degree of innovation and product development. However, a readily available indicator of the degree to which efficient outcomes will be expected is the raw number of RSPs competing in the market.

45. nbn co has provided us with data on the number of access seekers connected to each of its 121 points of interconnection (POIs). nbn co has also informed us that many of these access seekers are aggregators serving a number of retailers, which means that our analysis is likely to underestimate the competitiveness of the retail market at each POI.[21]

46. The number of access seekers at each POI, broken down into metro, outer metro, and regional POIs, is shown in Table 3-1 and Figure 3-1. It is notable that three of the POIs have two access seekers, while the remaining 118 have three or more access seekers, which confirms that no access seekers will have a monopoly at any POI.

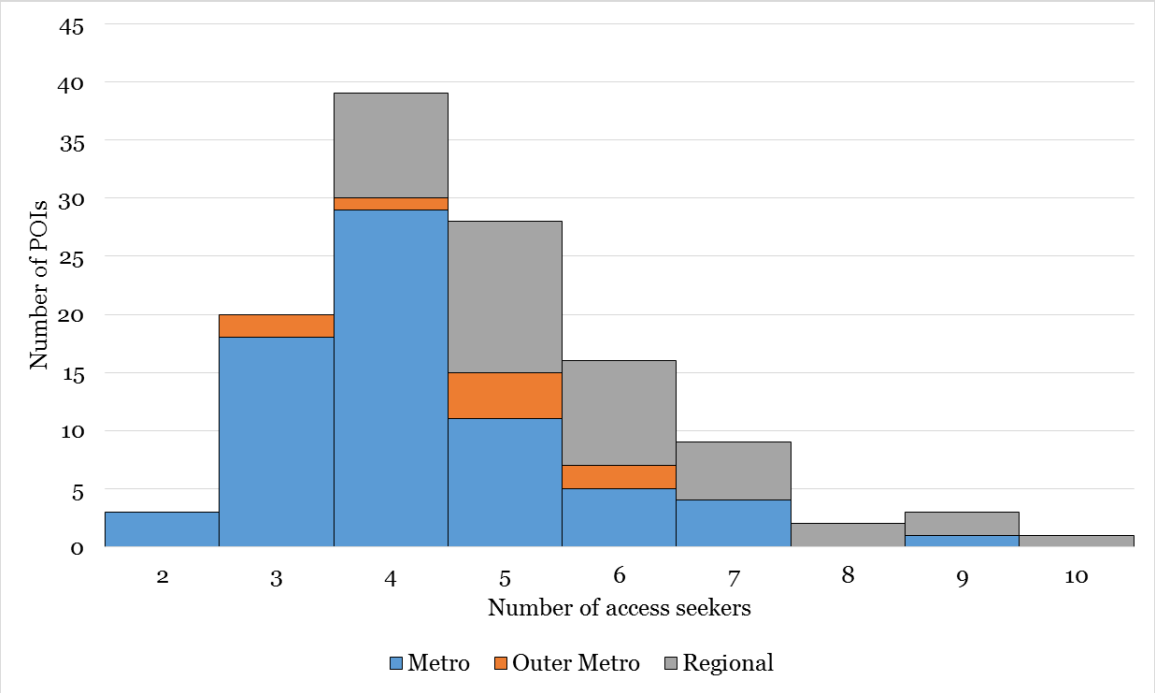
Table 3-1: Number of access seekers at each POI

Access seekers at each POI	Metro	Outer Metro	Regional	Total
2	3			3
3	18	2		20
4	29	1	9	39
5	11	4	13	28
6	5	2	9	16
7	4		5	9
8			2	2
9	1		2	3
10			1	1
Total	71	9	41	121

Source: nbn co

[21] Aggregators are firms offering capacity to defray the fixed costs of establishing a presence at a POI and transmitting traffic back to a central network node (such as in the major capital cities). By allowing RSPs to buy capacity without requiring additional infrastructure to be deployed, aggregators serve to reduce the barriers of entry faced by potential entrants, including to address issues of scale. In the process, aggregators fulfil the function of making the telecommunications retail industry more competitive.

Figure 3-1: Number of access seekers at each POI



Source: nbn co

47. The majority of the POIs have a large number of access seekers, which is an indicator of competition at the retail level (particularly as the cost structure of each firm can be expected to be reasonably similar). The economic literature suggests that an industry with three or more firms is unlikely to result in collusive prices. An industry with three firms would generally be regarded as sufficiently competitive, subject to the risk of future conditions reducing the number of surviving firms from three to a duopoly.[22] Based on these insights, we can therefore conclude that the 118 POIs with three or more access seekers are likely to be workably competitive.

48. There may also be effective competition amongst RSPs in the case where there are only a small number of access seekers at a POI. This will be the case where the access seekers have formed agreements with multiple RSPs to aggregate traffic. Once the fixed costs of connecting to the POI have been sunk, absent collusion, even two aggregators would reasonably be expected to be competing to supply capacity to other RSPs. In these circumstances, two access seekers may be sufficient to force prices down to competitive levels.

49. Turning specifically to three POIs with only two access seekers, we note that the POIs are all locations which are classified as metropolitan areas, and are generally lower-

[22] See: Kovacic, W., R. Marshall, L. Marx and M. Raiff (2007), "Lessons for Competition Policy from the Vitamins Cartel", in Ghosal, V. and J. Stennek (eds), *The Political Economy of Antitrust*, vol 282, Contributions to Economic Analysis Series, Elsevier, Chapter 6, pp. 149-176.

cost to serve. We have been informed by nbn co that the POIs with only two access seekers have very low activations at this point in time. With such few connected premises, there may be insufficient demand to currently support more than two access seekers for the POI, but this may change as the rollout of the nbn network continues.

3.1.2 Uniformity of retail prices

50. If the retail cost of serving customers varies depending on location, then spatially uniform prices represent a form of price discrimination. Whilst some degree of market power is necessary to practise price discrimination, it is not inconsistent with a workably competitive market.[23]

51. RSPs may adopt spatially uniform prices for a number of reasons. A primary reason is "simplicity". Uniform prices lower the cost of competing by reducing the need to communicate different prices to customers in different areas. Another reason why we might expect uniform pricing for communications services is a response to varying price elasticity across areas. If the price elasticity of demand is correlated with the cost of serving areas (i.e., higher elasticity in rural areas) we might expect to see uniform pricing.[24]

52. In the following sections we discuss the extent to which prices are spatially (or geographically) uniform. We also consider the extent to which RSPs' costs differ depending on the POI being served (recognising that the wholesale prices that nbn co offers to RSPs is the same at each POI).

3.1.2.1 Retail prices are uniform on the nbn *network*

53. It is useful to compare the retail prices offered on services connected to Telstra's distribution network against the prices for nbn co's network. If retail prices for nbn co's services are lower than the corresponding prices for Telstra's network, this could suggest that the level of competition among retailers of nbn co's network is likely to be higher than the competition among retailers of Telstra's network.[25] While pricing differences can be a result of several factors, such as differences in costs, our analysis nevertheless errs on the side of caution, since many of these factors serve to increase the costs of nbn co's services.

---

23 Anderson S. and Thisse J-F. (1988) Price Discrimination in Spatial Competitive Market, European Economic Review, Volume 32, Issues 2–3, March 1988, Pages 578-590

24 See for example, Lederer, P. (2012) "Uniform Spatial Pricing", Journal of Regional Science, 11, 2, 315-342

25 We understand that nbn co's prices for entry level nbn services were intended to, amongst other things, allow RSPs to match prices for equivalent services supplied over Telstra's copper network.

54. To that end, we note two additional factors that suggest that our analysis is likely to underestimate the competitiveness of retailers connected to nbn co's network:

    i. Construction of nbn co's network prioritises the high-cost areas over low-cost areas,[26] which means that the wholesale service price to RSPs would be lower if the network were fully constructed; and

    ii. nbn co's networks (fixed-line, fixed-wireless, and satellite) generally provide higher speeds than Telstra's copper network, which would ordinarily attract a price premium.

55. Our research of the pricing plans of major telecommunications retailers suggests that the major retailers do not currently engage in price discrimination based on POI location.[27] That is, even if RSPs' costs are different for each location, these are not reflected in prices.

56. Table 3-2 shows the minimum prices of nbn services from 10 RSPs. Two observations can be drawn from Table 3-2, both of which indicate that the RSPs are already competitive without requiring additional regulation.

57. First, the minimum prices of nbn services appear to be fairly similar across RSPs, with most price differentials arising out of variations in the quality of service provided, such as differences in speeds and bandwidth limits. The fact that the pricing between RSPs is already similar can be an indicator of competition at the retail level.

58. Second, the prices offered by the RSPs for nbn plans are generally in line with – or lower than – the prices of their ADSL plans. Most of the cases with a substantial difference between ADSL and nbn prices can be explained by differences in data allowance.

59. We consider that retail prices on the copper network are an appropriate benchmark for competitive retail prices because local loop unbundling and the wholesale regulation of copper has resulted in reasonably strong competition at the retail level (at least in areas where the copper network has been unbundled). Once again, the fact that the retail prices on nbn plans are similar to the retail prices of ADSL plans suggest that reasonable competition already exists among RSPs on the nbn network.

60. Of the ten RSPs in Table 3-2, only IPSTAR offers a separate set of plans for the nbn co's satellite services, and its minimum prices are broadly comparable to the prices of

---

26 Letter to NBN Chairman, Government Expectations, dated 8 April 2014, p.2.

27 See for example: Telstra https://www.telstra.com.au/content/dam/tcom/personal/help/pdf/cis-personal/broadband/personal-critical-information-summary-telstra-broadband-s-NBN.pdf; Optus http://smb.optus.com.au/opfiles/Shop/All/cis/Cis%20Documents/CIS_My_Basics_Bundle.pdf; TPG http://www.tpg.com.au/forms/FTTN_M.pdf; iinet https://www.iinet.net.au/about/legal/cis/cis-NBN-fibre.pdf; Internode http://www.internode.on.net/pdf/legal/cis/cis-internode-NBN-fibre.pdf.

IPSTAR's fixed fibre plans. This likely results from the fact that nbn co is already charging uniform prices at the wholesale level, such that no extra distribution costs are incurred from servicing low-density areas.

61. Here, the fact that the price of IPSTAR's nbn satellite plan is similar to its nbn fixed line plan can be attributed to competitive pressure, which forces retail prices down to levels corresponding to zero economic profit. If the costs incurred by RSPs are the same regardless of the technology being used at the wholesale level, then competitive pressure will also result in retail costs being similar for all wholesale technologies.[28]

62. There is therefore no need for a USO to be implemented at the retail level since nbn co's uniform wholesale prices, coupled with nationwide competitive pressure at the retail level as observed in section 3.1.1, will already incentivise retailers to offer uniform retail prices across Australia.

Table 3-2: Comparison of minimum copper broadband and nbn network pricing by RSPs (two-year costs)

Retailer	ADSL	nbn network
Telstra	$2,003 (100 GB)	$1,800 (100 GB)
Singtel-Optus	$2,045 (unlimited, includes calls)	$1,920 (unlimited, 12/1)
TPG	$1,319.91* (20 GB, PAYG calls)	$1,229.76 (50 GB, 12/1, PAYG calls)
iinet	$1,439.76 (250 GB, PAYG calls)	$1437.60 (200 GB, 12/1, includes calls)
Bendigo Telco	$1,198.80 (50 GB)	$1,656 (100 GB, 12/1)
engin	$739.95 (10 GB)	$1,198.80 (50 GB)
MyNetFone	$958.80 (20 GB)	$1,199.76 (200 GB, 12/1)
Bendigo Bank Telco	$1,198.80 (unlimited)	$1,438.80 (unlimited, 12/1)
IPSTAR broadband^	$1,103.76 (50 GB)	$1,199.76 (50 GB, 12/1)
Internode	$1,439.76# (250 GB, includes phone)	$1,198.80 (50 GB, 12/1)

*Source: RSP websites; CEG analysis. Speeds and monthly bandwidth in parentheses. *Cost for 50 GB standalone ADSL is $719.76; ^Cost of* nbn™ *Sky Muster satellite 12/1 plan is $840 for 20 GB and $960 for 60 GB; #Cost of ADSL component of the bundled plan is $799.96.*

[28] We note that nbn plans that are offered via satellite will have different "price-quality" bundles because the fair use policy reflects limits on the capacity of nbn co's satellite networks. See: nbn co, Wholesale Broadband Agreement, Fair Use Policy (7 April 2016), section 1.3 and 2.3, pp. 4-6.

3.1.2.2 RSP costs are not substantially different across POIs

63. The more modest the differences in costs, the less likely it will be to observe price differentials among RSPs. As discussed in section 3.1.2, if retail costs are the same across Australia, then competitive pressure will also force retail prices to be fairly similar. Setting aside the cost of wages and the cost of transmission between capital cities, both of which are expected to be fairly uniform, two important costs faced by RSPs are the wholesale distribution costs of services provided by nbn co and the cost of backhaul from the POI to the capital city.

64. Given that nbn co already implements uniform pricing on its wholesale services, the remaining major source of potential differences in network costs is the cost of backhaul. Whilst in reality access seekers may provide their own backhaul capacity, it is possible to analyse the differences in backhaul costs using the ACCC's domestic transmission capacity service (DTCS) pricing calculator, which generates a benchmark price for backhaul capacity according to the route category, capacity, and distance required.[29] Using this calculator, we estimate the cost of backhaul from each POI back on the distance to the closest capital city (the route category is determined by the location of the POI).

65. Figure 3-2 shows the box-and-whisker plots of the estimated two-year backhaul costs for two hypothetical access seekers with 50% and 25% of the market share, respectively associated with the retail broadband services at all 121 POIs. In generating these results, we have sourced distances between each POI and the corresponding capital city from Google's API. We have also assumed the total backhaul capacity demand at each POI to be the product of:

    - the average capacity per premise (we assume capacity demand at each POI is the product of the average end-user download demand (137 GB/month/premise)[30], which corresponds to a capacity requirement of between 800-900 kbps per premise; and
    - the total number of activated premises around each POI assuming a broadband penetration rate of 72%[31].

66. Each hypothetical access seekers are assumed to acquire the proportion of demand according to their market shares at each POI.

---

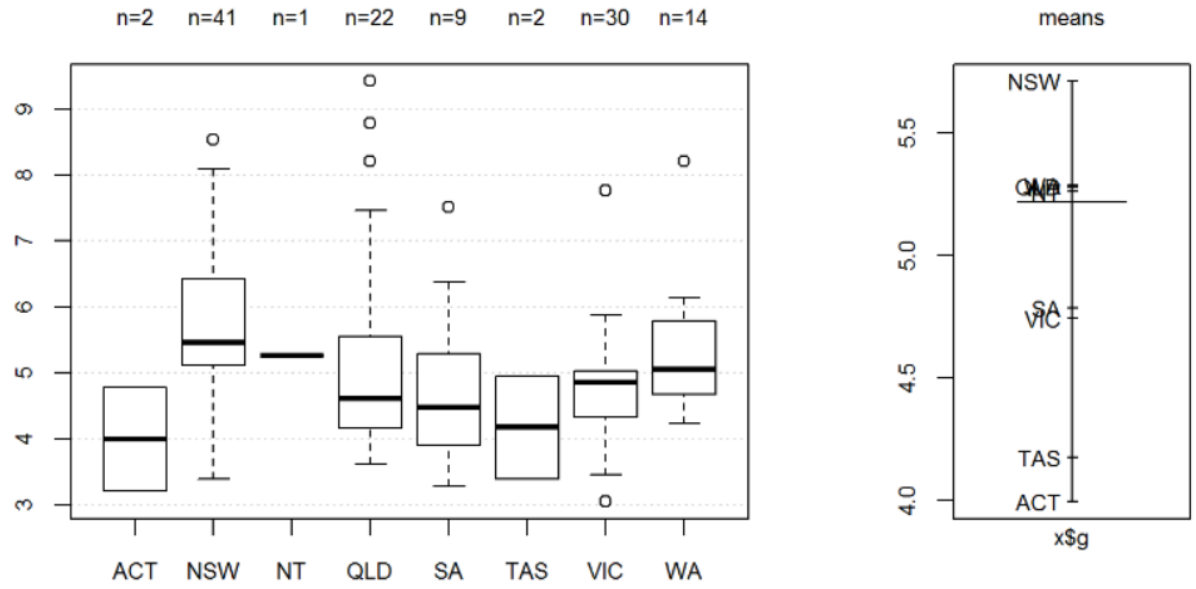
29 ACCC, Domestic transmission capacity service final access determination inquiry 2014, Final Report, April 2016.

30 See *The nbn network: The state of play*, Commsday Wholesale & Datacentre Summit, July 19 2016, p. 7.

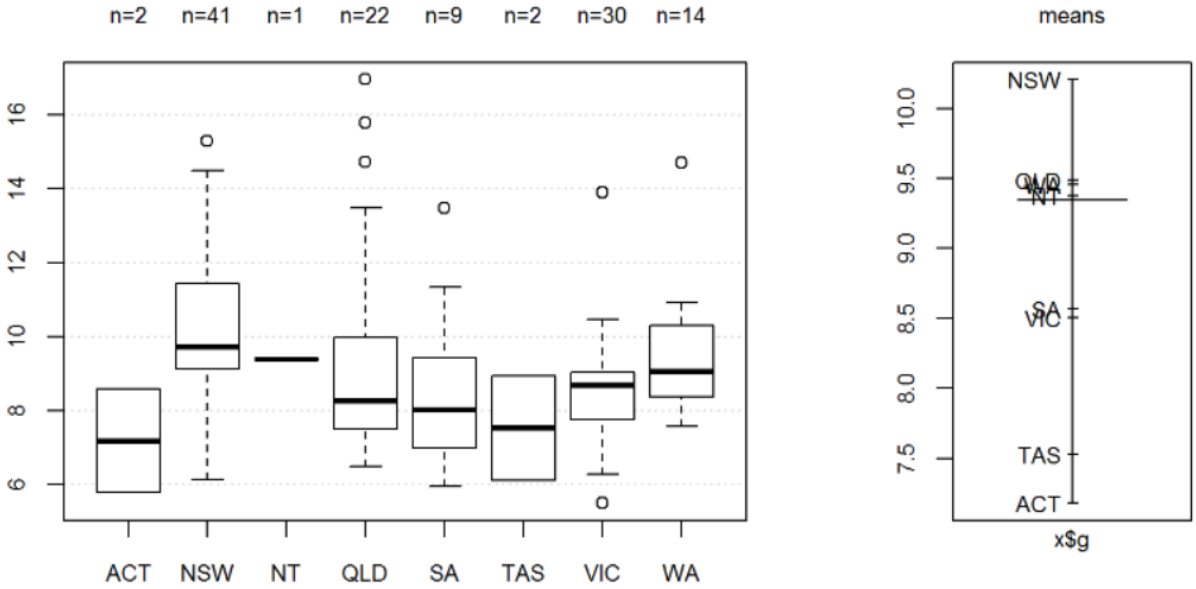
31 See footnote 5.

Figure 3-2: Distribution of two year per premise DTCS backhaul costs at all 121 POIs for the two hypothetical access seekers

Access seeker with 50% market share:



Access seeker with 25% market share:



Source: CEG analysis

67. Compared with Table 3-2, it can be seen that the backhaul costs, ranging from $3 to $9 for the larger access seeker (with 50% market share) and $5 to $17 for the smaller access seeker, represents only a small proportion of the retail price and there does not appear to be material variation in the backhaul costs associated with different POIs. The per premises price paid by the larger access seeker is relatively lower

because the ACCC's pricing formula is concave to take into account the economies of scale in supplying DTCS services.

68. In sum, given the uniform wholesale prices already being charged by nbn co, as well as the fact that the ACCC's benchmark backhaul prices are fairly even across all 121 POIs, the costs faced by RSPs should be fairly uniform across Australia. Under these conditions, one can rely on competitive pressure to force retail prices to induce RSPs to set uniform retail prices for all locations without having to rely on a separate USO at the retail level.

3.2 Existence of externalities in broadband access

69. Telecommunications networks tend to be associated with a number of positive externalities for the wider economy, which will not be taken into account in the decision-making process of the parties to each transaction.

70. First, connection to essential goods tends to generate positive externalities as it allows consumers to become more productive in employment and in other aspects of their daily activities. This generally applies to all essential services. In addition, unique to telecommunications networks is the two-way nature of communications, in which the service is consumed when consumers connect to one another. As a result, consumers already on the network derive additional benefits from additional users being connected to the network, since it widens the range of people that existing users can communicate with. This two-way property does not generally apply to other networks such as utilities, where consumers benefit from being connected to the utility source instead of each other.

71. Finally, if there are more consumers subscribing to broadband services from rural areas, it is likely that services attractive to rural consumers will be developed, which would in turn enhance the attractiveness of, and demand for, the enabling of broadband services. For example, the fixed cost of producing information services to improve the productivity of agricultural production would be defrayed over a greater number of consumers if they can be supplied over broadband networks.

72. These externalities may not be fully captured by infrastructure providers, which could lead to inefficiently low levels of provision.

73. However, such externalities can easily be overstated. As noted by Cremer (2001):[32]

> *… under closer scrutiny, it may not be self-evident that network externalities necessarily result in an inefficiently low degree of network participation.*

[32] Cremer, H., F. Gasmi, A. Grimaud and J.J. Laffont (2001), 'Universal service: an economics perspective', Annals of Public and Cooperative Economics, 72, 5–43

74. The 'external' benefits of broadband access may be readily internalised by small user groups who directly benefit from rural users connecting to broadband services. This could come in the form of discounts from suppliers of downstream services that rely on broadband access or transfers from friends and family of rural users.

75. As noted above, the uniform prices that nbn co offers at the wholesale level already represent a substantial intervention to achieve some of the universal service objectives, including internalising network externalities. Any additional intervention would need careful consideration.

4 Competition from mobile networks

76. We have been asked to consider the following question:

> *Are competing telecommunications networks (e.g., mobile or fixed-wireless networks) substitutes of the nbn network? What impact would any such substitutability have on the USO?*

77. Advances in mobile technology have increased the quality of telecommunication services that can be provided over the mobile network, to the point that these services can be reasonably substitutable for a range of fixed line services under various circumstances. The degree of substitutability depends on characteristics such as the capacity that needs to be transported - mobile networks generally have lower capacities than fixed line networks, so the highest level of substitutability would be for entry-level fixed line broadband services and voice telephony. This observation favours a loosening of the definition of the service that is subject to the universal service obligation.

78. As the OECD observed in its 2003 policy roundtable discussion of USO:[33]

> *Service definition: Service definitions should be performance-based, not input-based; they should not be technology dependent, should not be provider dependent, should be reviewed for continued relevance, and should not necessarily involve the same service provision in both high and low-cost areas.*

79. The OECD went on to argue:[34]

> *One of the most important reasons not to exclude alternative providers is that their services may actually be lower cost than a physically-defined service. For example, a wireless telephone network may be lower cost to install and operate than a wired network when populations are spread out. Similarly, a passenger bus service may be lower cost than a passenger rail service. Hungary's recent proposal on universal services included the idea that the provider should be the most cost effective, whether fixed-line or mobile.*

80. The OECD's analysis therefore suggests that the USO should not define universal service with reference to a specific technology, such as "fixed line telephone service", but should instead specify the capability or performance that is required to fulfil the obligations.

---

33 OECD, Policy roundtables: Universal Service Obligations, 2003, p. 8.

34 OECD, Policy roundtables: Universal Service Obligations, 2003, p. 9.

4.1 Empirical literature on fixed line and mobile substitution

81. Telecommunications technology has evolved fairly quickly over the last two decades, and the literature on fixed-mobile voice substitution has shown the same rapid evolution in findings.

82. The empirical literature indicates that fixed-mobile voice substitution has increased considerably over the past decade at a very fast pace. When mobile was first introduced, it had an apparent complementary effect on fixed-line telephony since it expanded the available communications network. As mobile penetration increased, however, mobile telephony eventually had a substitutive effect on fixed-line telephony, starting with substitution in terms of traffic before leading to substitution in access.

83. There is some evidence that the advent of DSL broadband, which was a significant development which increased the bandwidth capability of fixed-line networks, might have resulted in a slowing of access substitution, but the recent and ongoing developments of 4G and 5G mobile technology may in turn result in further access substitution in fixed-line and mobile telephony. The most recent empirical studies (discussed below) shows evidence of access substitution between fixed and mobile networks.

84. Imminent developments in mobile technologies (5G) are expected to allow much higher bandwidths. In January 2015, Ofcom stated that "5G mobile is expected to be capable of delivering extremely fast data speeds - perhaps 10 to 50 Gbit/s - compared with today's average 4G download speed of 15 Mbit/s".[35] In the meantime, the most likely service where fixed to mobile substitution will continue is for voice and lower bandwidth broadband services.

85. Table 4-1 provides a chronological summary of the literature that we have reviewed. We note that our review is primarily intended to illustrate how the findings in literature have evolved over time in line with developments in telecommunications technology, and does not represent a comprehensive review of every paper on this topic.

Table 4-1: Chronological summary on fixed-mobile substitution (FMS)

Paper	Data	Conclusion on FMS	Comments
Sung, Kim and Lee (2000)	South Korean regional, 1991-1998	Substitutes at access level	1% increase in mobile phones reduced new fixed connections by 0.1-0.2% and increased fixed disconnections by 0.1-0.2%

35 Ofcom, Laying the foundations for '5G' mobile, January 2015. Accessible at: http://media.ofcom.org.uk/news/2015/6ghz/

Barros and Cadima (2001)	Portugal, 1981-1999	Weak substitutes at access level	Mobile voice had weak substitutive effect on fixed-line access
Horvath and Maldoom (2002)	Survey of British telephone users, 1999-2001	Substitutes at traffic level, some evidence of substitution at access level	Traffic: Mobile phone ownership reduced fixed line bills by £74 (£10) per quarter in 2001 (1999-2000). Access: £10 saving per quarter led to 3% increase in mobile phone ownership in 2001. No significant substitution found in 1999-2000.
Ward and Woroch (2004)	U.S household surveys, 1999-2001	Substitutes at traffic level	Cross-price elasticities estimated between 0.13 and 0.33. Interstate wireline calling volumes would have been 22-33% higher had mobile prices remained unchanged.
Mao, Tsai and Chen (2008)	ITU and Telco reports for G7, NIE, ASEAN, and BRIC, 1997-2004	Traffic substitution for countries with fixed line penetration >100%, and penetration substitution for countries with fixed line penetration <100%	G7 and NIE mostly featured traffic substitution in response to growth in mobile traffic, in which second fixed lines were substituted with mobile connections. ASEAN and BRIC mostly featured exhibited penetration substitution, with first fixed lines being substituted by mobile.
Vogelsang (2010)	None (survey of existing literature)	Substitutes at traffic level, but insufficient to allow deregulation of unbundled local loops and backhaul	Argued that universal service should be targeted at mobile instead of fixed line for voice services (and broadband to some extent) in rural areas due to the lower cost and faster deployment
Briglauer, Schwarz and Zulehner (2011)	Austria, 2002-2007	Substitutes at traffic level but not at the access level	Mobile calls and fixed calls were in the same market, but mobile access and fixed access were not in the same market
Grzybowski (2011)	27 EU countries, 2005-2009	Fixed line and mobile connections were substitutes	Decreases in the prices of mobile services resulted in increases in the share of "mobile only" households and decreases in the shares of "fixed only" and "fixed + mobile" households. Internet usage encouraged households to retain fixed-line connections for internet access.
Srinuan, Srinuan and Bohlin (2012)	Sweden surveys, 2009	Very weak substitutability between DSL and mobile broadband	Households with multiple broadband technologies available showed that all technologies were substitutable. Households with only DSL and mobile broadband available had low substitutability for DSL.
Grzybowski and Verboven (2016)	27 EU countries, 2005-2011	Mobile telephony was a substitute for fixed-line voice connections. Internet and fixed	FMS reduced fixed line penetration by >14% points in 2012, although this effect was heterogeneous across households and regions. Internet and fixed networks were

		networks were complements.	complements, which had the effect of slowing the reduction in fixed-line voice penetration by 9% points in 2012.
Lange and Saric (2016)	20 EU countries, 2008-2011	Substitutes at access level	1% increase in price of fixed-line telephony led to 0.14-0.15% increase in demand for mobile telephony. Mobiles and VoIP were complements.

Source: Articles and CEG analysis

86. Pre-2000 empirical literature on the topic of fixed-mobile voice substitution appears to be somewhat mixed. For example, Sung *et al* (2000) observed that two empirical studies published in 1999 drew contradictory conclusions,[36] whereby Gruber and Verboven (1999) found that the stock of fixed telephones reduced the diffusion of mobile telephones,[37] while Gruber (1999) found that fixed line and mobile telephones were substitutes.[38]

87. Nevertheless, Sung *et al* (2000) considered that the dominant view pre-2000 was that the services were complements:[39]

> *Until recently, mobile telephones were believed to serve primarily as a complement to fixed telephones. The presence of mobile telephones confers a benefit on existing fixed telephone subscribers because the number of telephones that can be reached is increased. Also, a call originating from mobile telephones benefits fixed telephone subscribers.*

88. At the same time, Sung *et al* (2000) argued that as mobile phone penetration increased, mobile phones and fixed line telephony would eventually become substitutes:[40]

> *On the other hand, as mobile telephones become widely spread, they began to compete directly with fixed telephones, first for usage and ultimately for access. The potential for mobile telephones to become a substitute for, and*

36 Sung, Kim and Lee, Is a POTS Dispensable? Substitution Effects Between Mobile and Fixed Telephones in Korea, April 2000.

37 Gruber, H., and F. Verboven, The Diffusion of Mobile Telecommunications Services in the European Union, CEPR Discussion Paper No. 2054, 1999.

38 Gruber, H., Competition and Innovation: The Diffusion of Mobile Telecommunications in Central and Eastern Europe, European Investment Bank, 1999.

39 Sung, Kim and Lee, Is a POTS Dispensable? Substitution Effects Between Mobile and Fixed Telephones in Korea, April 2000, pp. 3-4.

40 Ibid, p. 4.

directly compete with, fixed telephones has become clear (Vanston and Hodges, 1998).

89. As it turns out, Sung's *et al* (2000) prediction was largely accurate, with the extent of fixed-mobile voice substitution increasing with time. Empirical literature first began finding evidence of substitution in fixed-mobile telephony at the traffic level, before later finding evidence of substitution at the access level. As the internet grew in prominence over the last decade, studies started reporting that fixed-line and mobile broadband were substitutes at the traffic level, with some recent studies reporting substitutes at the access level as well.

90. Literature in the early 2000's on the topic of fixed-mobile voice substitution was largely in agreement that fixed-line and mobile telephony were substitutes at the traffic level. Based on surveys of British telephone users, Horvath and Maldoom (2002) found that mobile phone ownership reduced fixed-line bills by £74 per quarter in 2001.[41] Similarly, Ward and Woroch (2004) concluded from U.S. household surveys in 1999-2001 that interstate wireline calling volumes would have been 22-33% higher if mobile prices had not fallen over that time period.[42]

91. Until recently, studies on fixed-mobile voice substitution presented mixed evidence. Sung *et al* (2000) itself found that a 1% increase in the number of mobile phones in South Korea during 1991-1998 led to a reduction in fixed connections by 0.1-0.2%, as well as increase in fixed disconnections by 0.1-0.2%. Barros and Cadima (2001) also concluded that mobile voice telephony had weak substitutive effect on fixed-line access in Portugal during 1981-1999.[43]

92. Mao's *et al* (2008) study using international data in 1997-2004, on the other hand, found that countries with high fixed-line penetration (above 100%) mostly featured traffic substitution, while penetration substitution was observed mainly in countries with low fixed-line penetration.[44] That is, in mature economies with well-developed fixed-line infrastructure and high fixed line penetration, improvements in mobile phone technology usually resulted in consumers reducing their usage of fixed-line services without cancelling their fixed-line access. On the other hand, consumers in developing economies with poorly developed fixed-line infrastructure tended to

41 Horvath and Maldoom, Fixed mobile substitution: a simultaneous equation model with qualitative and limited dependent variables, dot.econ discussion paper 02/02, August 2002.

42 Ward and Woroch, Usage Substitution between Fixed and Mobile Telephony in the U.S., Working paper, May 2004.

43 Barros and Cadima, The impact of mobile phone diffusion on the fixed-link network, CEPR Discussion Paper Series 2598, March 2001.

44 Mao, Tsai and Chen, FMS patterns: Penetration vs. traffic substitution in different groups of countries, *Technological Forecasting & Social Change*, 75 (2008), pp. 356-384.

respond to improvements in mobile technology by increasing their mobile access and reducing their fixed-line access.

93. Briglauer *et al* (2011) analysed data from Austria in 2002-2007 and concluded that mobile calls and fixed calls were in the same market, but mobile access and fixed access were not in the same market.[45]

94. Regardless of the mixed evidence in these studies, it is fairly telling that even within these earlier studies, some authors considered that substitutability in mobile and fixed-line services was likely to increase as mobile technology continued to advance. For example, Ward and Woroch (2004) suggested:[46]

> *Substitutability may increase over time due to continued price declines and feature improvements of mobile services outpacing those of wireline service. At some point in the near future, it is possible that mobile telephone service will be able to significantly constrain wireline providers' exercise of market power. When this does occur, it will be appropriate to modify many of the current regulatory stances toward provision of fixed telecommunications services.*

95. In addition, in a survey of empirical literature on the issue of fixed-mobile substitution, Vogelsang (2010) considered that if there was sufficient fixed-mobile substitution to induce competition between the fixed-line and mobile markets, then this could support a deregulation of fixed networks:[47]

> *To the extent that mobile markets are deemed competitive and that mobile competition exerts enough pressure on fixed network operators, market dominance regulation of fixed networks could be revoked. This possibility already seems to hold true in the markets for fixed-line calling in some countries, such as Austria (Briglauer et al., 2009) and can be expected for other countries soon.*

96. More recent literature began investigating the impact of the internet on fixed-mobile substitution in telephony as well as broadband. Grzybowski (2011) evaluated telephony and broadband data from 27 EU countries in 2005-2009.[48] It was found that fixed line and mobile connections were substitutes for telephony, but internet

---

45 Briglauer, Schwarz and Zulehner, Is fixed-mobile substitution strong enough to de-regulate fixed voice telephony? Evidence from the Austrian markets, *Journal of Regulatory Economics*, 39 (2011), pp. 50-67.

46 Ward and Woroch, Usage Substitution between Fixed and Mobile Telephony in the U.S., Working paper, May 2004, p. 13.

47 Vogelsang, The relationship between mobile and fixed-line communications: A survey, *Information Economics and Policy*, 22 (2010), p. 13.

48 Grzybowski, Fixed-to-Mobile Substitution in the European Union, Unpublished paper, December 2011.

usage was a complement for fixed line connections, since households with higher internet usage had an incentive to retain their fixed-line connections for internet access.

97. Srinuan *et al* (2012) analysed surveys of Swedish households about their broadband usage patterns in 2009, and found that the behaviour of households with access to multiple broadband technologies suggested that all of the available broadband technologies (DSL, cable, LAN/fibre, and mobile) were substitutable with one another.[49] However, when the sample was restricted to households that only had access to DSL and mobile broadband, it was found that DSL was a strong substitute to mobile, but mobile was a weak substitute to DSL.

98. Grzybowski and Verboven (2016) studied internet and telephony data from 27 EU countries in 2005-2011, concluding that mobile telephony and mobile broadband were both substitutes for fixed-line voice connections.[50] Specifically, it was found that fixed-mobile substitution reduced fixed line penetration by over 14% points in 2012, although this effect was heterogeneous across households and regions. It was further observed that internet usage and fixed line telephony were complements, since fixed-line voice penetration would be 9% lower in 2012 in the absence of DSL.

99. Finally, Lange and Saric (2016) used data from 20 EU countries over 2008-2011 to conclude that fixed-line and mobile telephony access were substitutes.[51] Specifically, a 1% increase in the price of mobile telephony led to a 0.23-0.27% increase in the number of active analogue circuit-switched retail subscribers, while a 1% increase in the price of fixed-line telephony resulted in a 0.14-0.15% increase in the number of active individual mobile connections.

49 Srinuan, Srinuan and Bohlin, Fixed and mobile broadband substitution in Sweden, *Telecommunications Policy*, 36 (2012), pp. 237-251.

50 Grzybowski and Verboven, Substitution between fixed-line and mobile access: the role of complementarities, Ku Leuven Center for Economic Studies, Discussion Paper Series DPS14.12, June 2014.

51 Lange and Saric, Substitution Between Fixed, Mobile, and Voice over IP Telephony – Evidence from the European Union, Dusseldorf Institute for Competition Economics, Discussion Paper No 221, May 2016.

5 Eligible revenues

100. We have been asked to consider the following:

> *In the event that a universal service obligation is funded through an industry levy, would it be preferable to impose the levy based on retail revenues or on eligible revenues?*

101. A levy on the revenues of telecommunications operators will necessarily distort prices and result in less efficient outcomes (i.e., it will produce outcomes that reduce welfare). Minimising the effect on economic efficiency will therefore be key to defining the revenue base on which to apply the levy.

102. There are a number of ways to define the revenues for the purposes of imposing a universal service levy. They include methods based on:

- retail revenues – which are revenues earned by telecommunications operators in selling services to end-users;
- gross revenues – which are revenues earned by telecommunications operators from all sources, including retail sales and wholesale sales (where the services are resold to end-users); and
- eligible (or net) revenues – which are gross revenues less payments to other telecommunications operators for wholesale service, and is the basis for the current policy that applies in Australia.

103. It can be readily observed that adopting a gross revenue definition will create material economic distortions as it double counts industry revenue and results in "double taxation" of non-vertically integrated supply chains.

104. Neither the retail revenue definition nor the net revenue definition would result in double taxation. A levy based on retail revenues only applies at one layer of the market. A net revenue definition operates at each of the vertical layers in the market, but the levy is based on revenues that are net of revenues on which upstream operators would have paid the levy.

105. However, the net revenue definition will likely distort prices materially more than a retail revenue definition. This occurs because a net revenue approach adds to the problem of double marginalisation that exists in the vertical supply chain and its incidence is likely to disproportionately fall on upstream infrastructure operators distorting incentives to invest.

106. Double marginalisation occurs when a less than perfectly competitive retail market is supplied by a less than perfectly competitive wholesaler. The profit maximisation behaviour of each firm will lead them to mark-up prices above their own marginal

costs. As the mark-ups flow through the 'chain of monopolies' the resulting total mark-up will be more than what was profit maximising for the wholesaler.

107. The problem of double marginalisation in vertical supply chains persists unless there is perfect competition at the retail level. Whilst competition between RSPs may be sufficient to not require additional market intervention, the existence of fixed costs alone means that it remains far from perfectly competitive.

108. If a universal service levy is imposed on wholesale revenues it would be seen in effect as a cost increase for retailers, to which a mark-up would be added. This would result in a further distortion from the imposition of the levy and a further reduction in economic efficiency. The implication of this analysis is that taxes on wholesale inputs should generally be avoided for efficiency reasons. The citation for the Nobel Prize in Economics (1996) awarded to James Mirrlees and William Vickrey notes that:

> *The general theory of optimal taxation in a second-best economy encompasses few clear-cut recommendations. If one condition for social efficiency is violate, as a rule there is reason to violate others as well. However, Diamond and Mirrlees (1971) obtained a highly universal result. Under relatively general conditions, it is desirable to maintain production efficiency. In concrete terms, this means that taxes should not be levied on factors of production.*

109. As the net revenue definition results in a tax on wholesale revenue it will lead to an unambiguous loss of economic efficiency relative to a retail revenue definition. Under a retail definition, wholesale prices would be unchanged and therefore the existing level of double marginalisation will be unaffected.

110. The choice of revenue definition affects the magnitude and incidence of the levy. That is, the definition of revenue will affect whether the levy is spread evenly across the industry or whether it is borne by parts of some segment of the industry. A net revenue definition will have a greater distortionary effect on demand due to the compounding effect of the mark-up (discussed above). It will also have a more uneven effect if the level of pass through is less in some segments of the industry rather than others. For example, pass through may be more complete in segments of the industry due to a greater level of competition. The greater the distortion and more uneven the effect the greater the impact on incentives to invest which will have harmful effects in the long-term.