

Regulating Wholesale Broadband Services in Australia

IN RESPONSE TO THE AUSTRALIAN COMPETITION & CONSUMER COMMISSION'S CONSULTATION PROCESS

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Executive Summary

This report explains why the long-term interests of broadband end-users in Australia can be best served by setting prices for wholesale broadband services below the costs that the National Broadband Company (NBN Co) has incurred to supply these services. The report also identifies the need for oversight of NBN Co's operations by the Australian Competition & Consumer Commission (ACCC). In particular, the ACCC should establish and enforce NBN Co's service quality standards and cost allocation procedures. The report further explains why price cap regulation, not revenue cap regulation, should govern the prices of wholesale broadband services in Australia.

I. Introduction

1. Broadband is a vital resource that has the potential to deliver enormous benefits to all Australian citizens. The essential nature of broadband connectivity has become particularly apparent during the recent pandemic. Now more than ever, citizens depend on broadband access for such essential activities as work, education, and commercial transactions. The widespread adoption of broadband can increase employment, speed new business development, enhance workplace efficiency, promote educational attainment, and improve health care.¹
2. The full potential of broadband will only be realized in Australia if high quality broadband service is widely available throughout the country and if Australian citizens subscribe to the service. Consequently, ensuring that broadband achieves its full potential in Australia requires a focus on both its deployment and its adoption.
3. Broadband deployment in Australia is complicated by the country's relatively large size (7.68 million square kilometers) and relatively modest population (approximately 26 million).² Most Australian citizens live in the country's coastal regions. The remainder of the country is sparsely populated. The resulting low population density generates relatively high per-household costs of broadband deployment.³
4. This high cost, in turn, makes it challenging for Australia to: (i) "[encourage] investment in infrastructure while maximising competition especially in areas of relatively low population

¹ See: (i) Intel, "Realizing the Benefits of Broadband," White Paper, Intel World Ahead, accessed June 16, 2022, <https://www.intel.com/content/dam/www/public/us/en/documents/white-papers/world-ahead-broadband-paper.pdf>; and (ii) Deloitte Access Economics, "Benefits of High Speed Broadband for Australian Households," Department of Broadband, Communications and the Digital Economy, 2013, <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/finance/deloitte-au-fas-benefits-highspeed-broadband-v2-240914.pdf>.

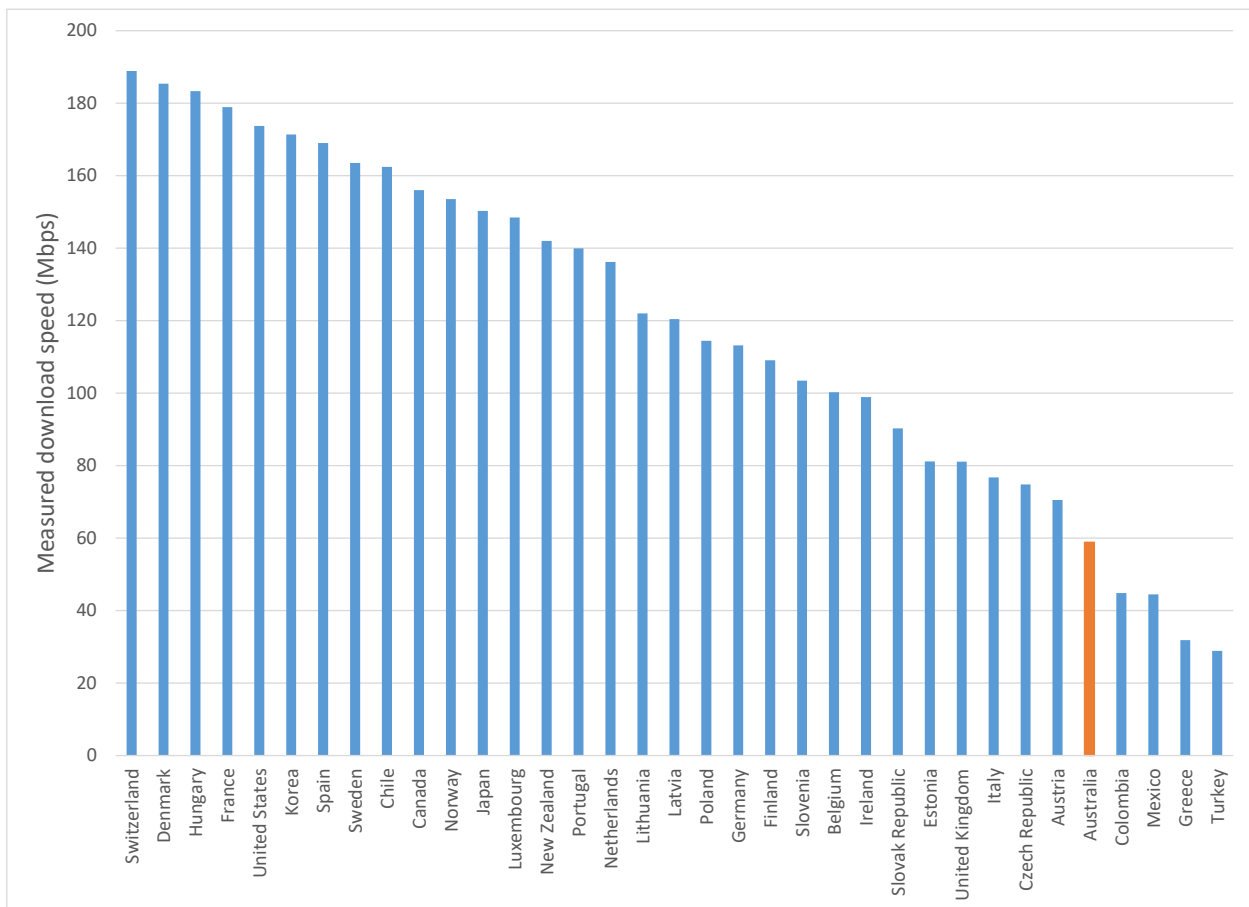
² Worldometer, "Australia Population," accessed July 7, 2022, <https://www.worldometers.info/world-population/australia-population>.

³ Colin Oliver, "Toward Universal Broadband Access in Australia," ITU, Case Study, p. 4, November 2009, https://www.itu.int/net/ws/stocktaking/docs/activities/1291039454/Australia_broadband_case.pdf ("Toward Universal Broadband Access in Australia").

density,” and (ii) “[support] consumer access to widely available, high quality services.”⁴ To address these challenges, the Australian Government has charged a government enterprise, the National Broadband Network Co. (NBN Co), with the mandate “to build and operate a wholesale-only, open access” national broadband network.⁵

5. Australia has made significant progress in its broadband deployment efforts. However, as Figures 1 and 2 indicate, download speeds are lower and fixed broadband prices are higher in Australia than in many other countries. Consequently, going forward, it is important to ensure that Australia implements policies that enhance broadband performance and reduce the prices of broadband services.

FIGURE 1. AUSTRALIA’S BROADBAND SPEEDS ARE RELATIVELY LOW



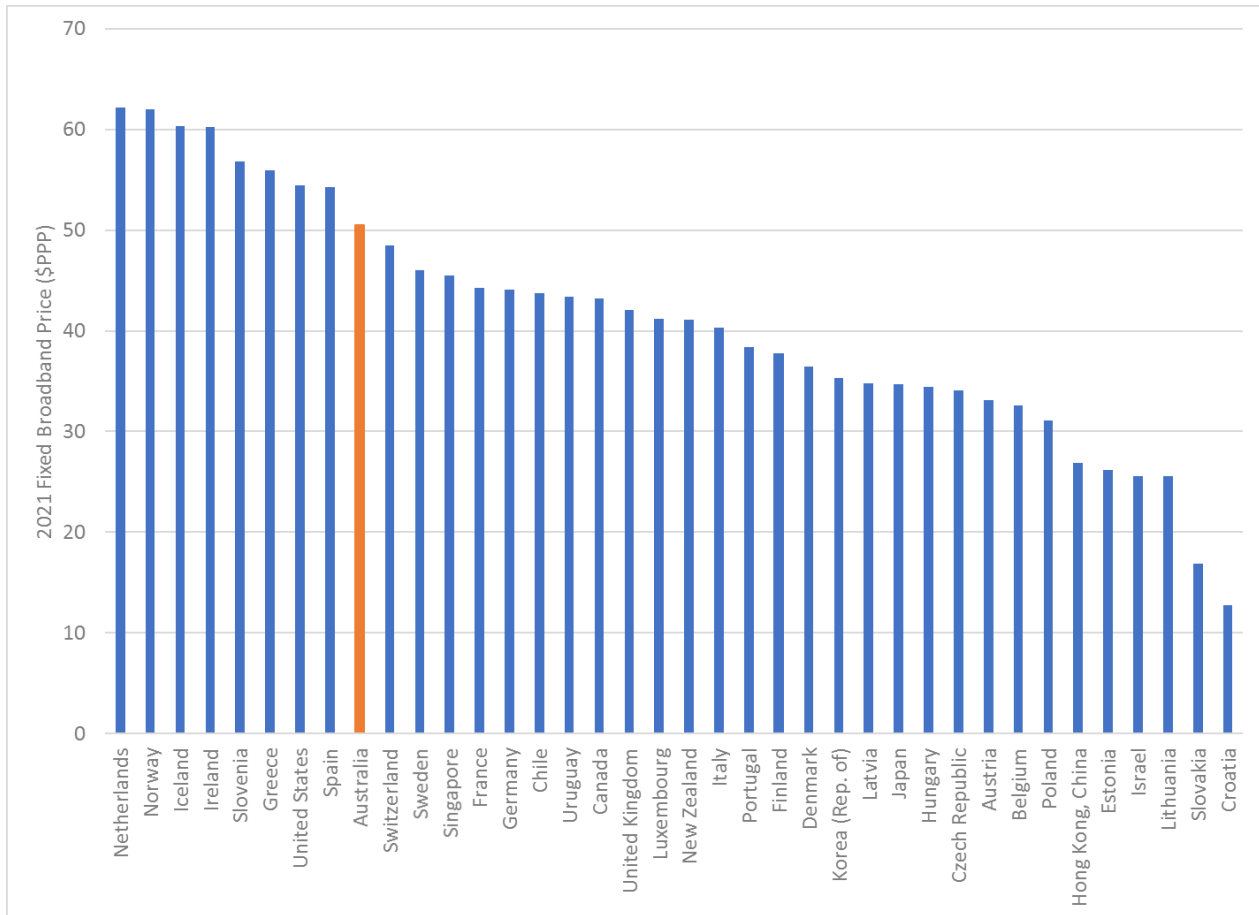
Source. Table 2.2, “Average Experienced Download Speed of Fixed Broadband Connections,” OECD, <https://www.oecd.org/sti/broadband/broadband-statistics>.

⁴ Toward Universal Broadband Access in Australia, p. 5.

⁵ Toward Universal Broadband Access in Australia, p. 4.

Note. Speeds as measured by Ookla in January 2021.

FIGURE 2. AUSTRALIA’S BROADBAND PRICES ARE RELATIVELY HIGH



Source. “ICT Price Baskets 2008-2021,” ITU, <https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/IPB.aspx>.

Note. The figure reports 2021 prices for the ITU’s “Fixed-broadband basket (5GB).” Prices are measured in Purchasing Power Parity (PPP). The countries in the figure are those the ITU identifies as high-income countries.

- The purpose of this report is to identify regulatory policies that will promote the widespread availability of high quality wholesale broadband services at stable, low prices in Australia. These policies are identified in part by assessing whether elements of NBN Co’s proposed variation to its Special Access Undertaking (SAU) promote the long-term interests of end-users of broadband services in Australia.⁶

⁶ NBN Co Special Access Undertaking, Accepted by the ACCC on 13 December 2013, as varied up to and including the Second SAU Variation Date, 2022.

7. The remainder of this report proceeds as follows. Section II identifies the central role the Australian Competition & Consumer Commission (ACCC) should play in designing and implementing sound regulatory policy in Australia's broadband sector. Section III explains how less than full recovery of the costs of supplying wholesale broadband services can promote the widespread adoption of broadband in Australia. Section IV emphasizes the importance of employing price cap regulation, not revenue cap regulation, on an ongoing basis to regulate the prices of wholesale broadband services. Section V stresses the need to have the ACCC establish and enforce meaningful service quality standards for wholesale broadband. Section VI emphasizes the importance of ACCC oversight of NBN Co's allocation of costs between core and non-core services. Section VII summarizes and concludes this report.

II. Oversight of the Supply of Wholesale Broadband Services

A. Oversight of NBN Co's Operations is Important

8. As noted above, the government of Australia has charged a government enterprise, NBN Co, with supplying most wholesale broadband services in the country. Consequently, competitive forces generally cannot be relied upon to promote the availability of high quality wholesale broadband services at stable, low prices. Similarly, in the absence of substantial private equity investment, the full force of capital market oversight cannot be relied upon to hold NBN Co's executives fully responsible for their decisions and actions. Therefore, formal regulatory oversight of NBN Co's operation is advisable to help ensure the availability of high quality wholesale broadband services at stable, low prices.

B. Goals of an Effective Oversight Policy

1. Oversight Policies Must Promote the LTIE

9. The ACCC must decide whether to accept or reject NBN Co's proposed variation to its SAU. If the ACCC rejects the variation, the ACCC must introduce alternative regulatory policies. In performing both these tasks, the ACCC is instructed by the Competition and Consumer Act 2010 (CCA) to determine whether relevant policies promote the long-term interests of end-users (LTIE). As the ACCC observes, "In determining whether a particular thing

promotes the LTIE, the CCA requires the ACCC to consider the extent to which the thing is likely to result in the achievement of the following objectives:

- promoting competition in markets for listed services.
- achieving any-to-any connectivity in relation to carriage services that involve communications between end-users, and
- encouraging the economically efficient use of, and economically efficient investment in the infrastructure by which these services are supplied, and any other infrastructure by which these services are, or are likely to become capable of being supplied.”⁷

2. Ensuring Efficiency is a Fundamental Goal

10. The ACCC further observes that it will “examine efficiency from an economic perspective. The economic concept of efficiency consists of three components:
 - Productive efficiency refers to the efficient use of resources within each firm to produce goods and services using the least cost combination of inputs.
 - Allocative efficiency refers to the allocation of goods and services across the economy in a way that is most valued by consumers. It can also refer to the allocation of production across firms within an industry in a way that minimizes industry-wide costs.
 - Dynamic efficiency refers to the efficiencies flowing from innovation leading to the development of new services or improvements in production techniques. It also refers to the efficient deployment of resources between present and future uses so that the welfare of society is maximized over time.”⁸

C. The SAU’s Modular Structure Provides Regulatory Flexibility

11. The prevailing SAU specifies terms and conditions that apply to NBN’s provision of fiber-to-the-premise (FTTP), fixed wireless, and satellite wholesale broadband services.⁹ The terms and conditions in the SAU provide a baseline for commercially negotiated access agreements between NBN Co and suppliers of retail broadband services.

⁷ ACCC, Proposed Variation to the NBN Co Special Access Undertaking, Consultation Paper, May 2022 (“ACCC (2002)”), pp. 12-13.

⁸ ACCC (2002), pp. 14-15.

⁹ Multi-technology mix services are not covered by the SAU. See ACCC (2002), p. 5.

12. The SAU entails a modular timing structure that allows some regulations to be modified during the term of the SAU. The SAU entails three modules:¹⁰
 - Module 0 (start of SAU to 2040) concerns regulations that pertain to commercially negotiated wholesale broadband agreements and terms and conditions for NBN's cost recovery.
 - Module 1 (start of SAU to June 2023) includes the commitment to supply initial NBN offers, initial prices for NBN offers, methods for changing prices over time, non-price terms and conditions, and the Long Term Revenue Constraint Methodology.
 - Module 2 (starts July 2023) "sets out long term arrangements for determining NBN's required revenue for the remainder of the SAU."¹¹
13. NBN Co's proposed variation to its SAU retains this basic modular structure. The ensuing discussion will focus on key elements of Module 0 and Module 2 in the proposed SAU variation.

III. Financing Broadband Deployment

A. Low Prices Promote Broadband Adoption

14. The widespread adoption of broadband and the efficient utilization of the broadband infrastructure in Australia are promoted by low prices for wholesale broadband services.¹² Low wholesale prices encourage low retail prices for broadband services, which in turn encourage expanded broadband adoption. A "low" wholesale price in this context is a price that is relatively close to the average incremental cost of supplying the service.¹³ When the price of a service reflects its average incremental cost, consumption of the service will

¹⁰ ACCC (2002), p. 5.

¹¹ ACCC (2002), p. 5.

¹² Targeted subsidies to low-income households also can promote widespread adoption of broadband and the efficient utilization of the broadband infrastructure.

¹³ A firm's incremental cost of supplying a particular service, "service S," is the difference between the firm's total cost of supplying all its services and the total cost the firm would incur if it supplied all its services except service S. See William Sharkey, *The Theory of Natural Monopoly* (Murray Hill, NJ: Bell Telephone Laboratories, 1982): 106. Thus, in essence, no common costs are allocated to the provision of service S when the incremental cost of supplying service S is calculated. The average incremental cost of supplying a service (which can be substantially less than the fully-allocated average cost of supplying the service) is the ratio of the incremental cost of supplying the service to the number of individuals purchasing the service.

increase whenever its value to a consumer exceeds the extra cost of serving the consumer. Consequently, prices that reflect average incremental cost promote allocative efficiency.

1. Prices Below Average Incremental Cost Can Promote Allocative Efficiency

15. For a service like broadband, even prices below average incremental cost can promote allocative efficiency. This is the case because broadband adoption entails externalities: expanded broadband use by one party can generate benefits for other parties. To illustrate, widespread adoption of broadband can enhance the ability of researchers to collaborate remotely, thereby increasing the likelihood of new discoveries (e.g., life-saving medicines) that can benefit many individuals other than the original broadband adopters. Widespread broadband adoption will also facilitate distance learning at all levels of education and enhance the availability and efficacy of telemedicine, with corresponding benefits for all Australian citizens.
16. In the presence of such externalities, expanding consumption to a level at which the private value of consumption is less than the corresponding incremental cost can ensure that the social value of consumption (which exceeds the private value) is equal to incremental cost. Thus, prices below average incremental cost can promote allocative efficiency and the LTIE in the presence of externalities.

2. Prices Below Average Incremental Cost Can Promote Competition

17. Pricing an input like wholesale broadband service below average incremental cost also can promote competition among suppliers of retail broadband services. A lower wholesale price will encourage competing suppliers of retail broadband services to reduce the prices they charge, thereby promoting more intense retail competition.¹⁴

3. Less Than Full Cost Recovery Can Promote the LTIE

18. The ACCC observes that the building block model NBN Co proposes “is designed to allow a regulated business to recover the costs required to operate in an efficient manner and to

¹⁴ See Mark Armstrong and John Vickers, “The Access Pricing Problem with Deregulation: A Note,” *Journal of Industrial Economics*, 46(1) (March 1998): 115-121.

undertake new investments.”¹⁵ Full recovery of costs is important when services are supplied by private enterprises. However, full cost recovery may not promote either the LTIE or the efficient use of the infrastructure when services are supplied by a government enterprise. The LTIE may be better served, for example, if prices are set to recover all efficient future costs, but not historic costs.

19. To attract the investment required to finance its operations, a private firm must convince investors that it will secure sufficient revenue to cover all relevant costs, including the cost of compensating investors for the capital they supply. If a private firm is not expected to generate revenue that exceeds all relevant costs (including investment costs), private investors are unlikely to finance the firm’s operations. Consequently, a private firm must generate sufficient revenue to cover all relevant costs if it is to operate as a profitable, unsubsidized enterprise.
20. In contrast, a government enterprise can continue to operate even when the revenue it recovers from its customers is less than the total cost it incurs to serve the customers. This can be the case, for example, if the revenue the government enterprise generates covers its ongoing future costs, but does not cover its historic costs. A government enterprise can continue to operate under such circumstances if the government supplies the financing that private investors decline to supply.
21. There are two ways in which the government of Australia can ensure that NBN Co continues to deliver wholesale broadband services even when its revenue does not cover all historic and future costs. First, the government can effectively write off a portion of its investment, thereby accepting a lower equity value of NBN Co. Second, the government can employ tax revenue to finance a portion of the cost of supplying wholesale broadband services. For example, tax revenue might finance all historic costs whereas revenue from NBN Co’s customers might cover all efficient future costs. When the government of Australia supports NBN Co in one or both of these ways, NBN Co will not need to recover all historic and future costs from the revenue it secures from its customers. Consequently, the prices of wholesale broadband services can be reduced, which will permit lower retail prices of broadband services.
22. Government financing that permits lower prices for wholesale broadband services is particularly likely to promote allocative efficiency when the demand for the services is

¹⁵ ACCC (2022), p. 22.

relatively sensitive to their prices. In the presence of such sensitivity, lower prices would substantially expand broadband adoption, thereby securing both the private benefits and the many beneficial externalities that broadband adoption generates.

23. Relatively low prices for wholesale broadband services also can promote the efficient utilization of the broadband infrastructure. Efficient utilization entails expanding sales of wholesale broadband services whenever the associated social benefit exceeds the corresponding incremental cost. Such efficient utilization is facilitated by reducing the prices of wholesale broadband services toward, or potentially even below, average incremental cost.

B. Broadband Subsidies are Common

24. Governments around the globe subsidize broadband deployment and adoption. The Australian government has promoted broadband primarily through its equity and debt financing of NBN Co (approximately \$49 billion (AUD)),¹⁶ but also by distributing grants for infrastructure hardening and by funding such programs as the Mobile Black Spot Program and Regional Broadband Schemes (approximately \$2.4 billion (AUD) in the past two years).¹⁷ This funding is considerable. However, this funding would be less than some other governments have devoted to promoting broadband even if the funding in Australia were comprised entirely of grants and entailed no equity investments in NBN Co. To illustrate, the United States has committed more than \$142 billion (AUD) of new funding to subsidize broadband deployment and adoption in just the past two years.¹⁸

¹⁶ NBN Co reports total government equity financing to be \$29.5 (AUD) billion and total government debt financing to be \$19.5 billion (AUD). NBN Co also reports repaying \$6.3 billion (AUD) of this debt. See NBN Co., 2021 Annual Report for the Fiscal Year Ended June 30, 2021, p. 145, <https://www.nbnco.com.au/content/dam/nbn/documents/about-nbn/reports/financial-reports/nbn-co-annual-report-2021.pdf>.

¹⁷ Department of Infrastructure, Transport, Regional Development and Communications, Government of Australia: (i) 2020 Annual Report for the Fiscal Year Ended June 30, 2020, p. 5; (ii) 2021 Annual Report for the Fiscal Year Ended June 30, 2021, pp. 8, 15, 16. Available at https://www.infrastructure.gov.au/department/annual_report.

¹⁸ This total includes \$7 billion (AUD) from the Consolidated Appropriations Act of 2020, \$95 billion (AUD) from the Infrastructure Investment and Jobs Act of 2021, \$10 billion (AUD) from the Emergency Connectivity fund, and \$30 billion (AUD) from the Federal Communications Commission (FCC)'s Rural Digital Opportunity Fund. See: (i) Diana Goovaerts, "Finding the Money: A US Broadband Funding Guide," <https://www.fiercetelecom.com/special-report/u-s-government-funding-sources-for-broadband>; and (ii) FCC, "Auction 904: Rural Digital Opportunity Fund," <https://www.fcc.gov/auction/904>.

25. Substantial broadband subsidies also prevail in Europe. The European Union’s Gigabit Society plan seeks to make 100 Mbps broadband connections available to all European households by 2025.¹⁹ The EU’s Digital Decade plan seeks to make Gigabit speeds available to all households by 2030.²⁰ France estimates that \$30 billion (AUD) in public and private funds will be required to meet relevant EU directives and France’s own broadband goals, which include making 30 Mbps broadband service widely available by 2022.²¹ France has committed more than \$5 billion (AUD) to its Très Haut Débit plan, which seeks to extend optical fiber to all subscribers by 2025.²² Spain’s Digital 2025 plan envisions 100 Mbps broadband service throughout the country by 2025 at an estimated cost of approximately \$29 billion (AUD) in public funds (\$22 billion (AUD) of which will be financed by various EU programs) and \$74 billion (AUD) in private funds.²³

C. Summary

26. In summary, lower retail prices promote expanded broadband adoption. Less than full recovery of historic and/or future costs permits lower prices for wholesale broadband services, which facilitate lower retail prices and more intense retail competition. Less than full cost recovery also can promote the LTIE and the efficient use of the broadband infrastructure. Government subsidization of broadband deployment and adoption is common throughout the world.

¹⁹ European Commission, “Support for Broadband Rollout,” <https://digital-strategy.ec.europa.eu/en/policies/broadband-support>.

²⁰ European Commission, “Support for Broadband Rollout,” <https://digital-strategy.ec.europa.eu/en/policies/broadband-support>.

²¹ European Commission, “Broadband in France,” <https://digital-strategy.ec.europa.eu/en/policies/broadband-france>.

²² European Commission, “Broadband in France,” <https://digital-strategy.ec.europa.eu/en/policies/broadband-france>.

²³ European Commission, “Broadband in Spain,” <https://digital-strategy.ec.europa.eu/en/policies/broadband-spain>.

Additionally, Canada has committed \$4 billion (AUD) to its Universal Broadband Fund, which is a component of the “High-Speed Access for All” program, which is estimated to cost approximately \$9.4 billion (AUD). See “High-Speed Access for All: Canada’s Connectivity Strategy,” <https://ised-isde.canada.ca/site/high-speed-internet-canada/en/canadas-connectivity-strategy/high-speed-access-all-canadas-connectivity-strategy>.

IV. Revenue Cap Regulation Should Not Replace Price Cap Regulation

27. NBN Co's proposed variation to the SAU identifies conditions under which caps on the prices charged for individual services will be superseded by a cap on the revenue that NBN derives from its core services. Specifically, the proposal envisions that revenue cap regulation will effectively replace price cap regulation if the revenue that NBN Co generates under price cap regulation exceeds a specified critical level of cost. Revenue cap regulation should not replace price cap regulation because the latter form of regulation generally is preferable to the former.

A. Price Cap is Preferred to Revenue Cap Regulation

28. Price cap regulation generally is preferred to revenue cap regulation for at least five reasons. First, revenue cap regulation can encourage elevated prices and diminished levels of output. Second, revenue cap regulation can encourage a price structure that diverges fundamentally from the price structure that maximizes consumer welfare. Third, revenue cap regulation can encourage reduced levels of service quality. Fourth, revenue cap regulation of wholesale broadband services can discourage innovation by retail suppliers of broadband services. Fifth, revenue cap regulation can encourage large and unpredictable variation in wholesale prices, which can discourage low, stable prices for retail broadband services.
29. Before explaining these conclusions in detail, it is useful to review the key difference between price cap regulation and revenue cap regulation. Price cap regulation can be viewed as placing a ceiling on the prices (or on a weighted average of the prices) charged for the regulated services (e.g., core wholesale broadband services).²⁴ Revenue cap regulation can be viewed as placing a ceiling on the total revenue derived from the sale of the regulated services. Thus, price cap regulation constrains prices, but does not directly

²⁴ Price cap regulation can impose an individual cap on each regulated service. Alternatively, price cap regulation can impose a single cap on a weighted average of the prices charged for the regulated services. The weights employed to calculate the weighted average typically are the shares of total regulated revenue accounted for by each of the regulated services. Formally, suppose the regulated enterprise supplies n regulated services. Let R_i denote the revenue the enterprise derives from sales of its i th service ($i \in \{1, \dots, n\}$). Also let p_i denote the price of the i th service. In addition, let $R = \sum_{j=1}^n R_j$ denote the enterprise's total regulated revenue. Then the weighted average of the enterprise's prices under price cap regulation is $\sum_{i=1}^n \frac{R_i}{R} p_i$.

constrain revenue. In contrast, revenue cap regulation constrains revenue, but does not directly constrain prices. The five primary reasons why price cap regulation of wholesale broadband services is preferable to revenue cap regulation in Australia are now explained in detail.

B. Price Cap Regulation is Preferred for Five Reasons

1. Revenue Caps Encourage High Prices and Low Output

30. Revenue cap regulation can encourage the regulated enterprise to set high prices and limit the consumption of its services. This incentive arises because an enterprise can limit its revenue in two distinct ways: it can set relatively low prices for its services or it can set high prices and sell relatively few units of its services.²⁵ The latter means of limiting revenue can be particularly profitable because reduced sales typically entail reduced production costs. Indeed, the incentives that revenue cap regulation can provide for elevated prices and diminished levels of output can be so strong as to induce a regulated enterprise to set higher prices than it would set if it operated as an unregulated, profit-maximizing monopoly.²⁶ Consequently, revenue cap regulation of wholesale broadband services could seriously discourage the widespread adoption of broadband in Australia by encouraging high wholesale prices, and thus high retail prices, for broadband services.

2. Revenue Caps Can Violate the Inverse Elasticity Principle

31. Revenue cap regulation also can encourage a price structure that diverges fundamentally from the structure that maximizes consumer welfare while ensuring a normal profit for a regulated monopoly supplier.²⁷ It is well known that these welfare-maximizing prices generally reflect the inverse elasticity principle. This principle states that the extent to

²⁵ The revenue derived from a service is the product of the price of the service and the quantity of the service that is sold. This product can be low either if the price of the service is low or if relatively little of the service is sold.

²⁶ For formal proofs of this conclusion, see (i) G. A. Comnes, S. Stoft, N. Greene, and L.J. Hill, "Performance-Based Ratemaking for Electric Utilities: Review of Plans and Analysis of Economic and Resource-Planning Issues, Volume 1," *Lawrence Berkeley Laboratory Report* (November 1995), <https://www.osti.gov/servlets/purl/179242> ("Comnes et al. (1995)"); and (ii) Michael Crew and Paul Kleindorfer, "Price Caps and Revenue Caps: Incentives and Disincentives for Efficiency," in Michael Crew (ed.), *Pricing and Regulatory Innovations Under Increasing Competition* (Boston: Kluwer Academic Publishers, 1996).

²⁷ A normal profit is the minimum level of profit required to ensure a firm can attract the capital it needs to continue to deliver high-quality service to its customers.

which the price of a service exceeds the marginal cost of supplying the service should vary inversely with the price elasticity of demand for the service.²⁸

32. The inverse elasticity principle reflects the fact that when the demand for a service is sensitive to its price, consumption of the service declines considerably as the price of the service increases. To limit the associated relatively pronounced reduction in consumer welfare, the price of a service with relatively elastic demand should be held close to the marginal cost of supplying the service.
33. In direct contrast to the inverse elasticity principle, revenue cap regulation can encourage the regulated enterprise to set particularly high prices for services with relatively elastic demand and to set relatively low prices for services with more inelastic demand. This is the case because a given price increase induces a smaller increase in revenue the more elastic is the demand for the service, *ceteris paribus*.²⁹ Consequently, to ensure compliance with a binding cap on its revenue, a regulated enterprise can be motivated to set relatively low prices for services with relatively inelastic demand and relatively high prices for services with relatively elastic demand. Such a pricing structure entails a fundamental departure from the inverse elasticity principle, and so can generate substantial reductions in consumer welfare.³⁰

²⁸ See: (i) Frank Ramsey, "A Contribution to the Theory of Taxation," *Economic Journal*, 37(145) (March 1927): 47-61; and (ii) William Baumol and David Bradford, "Optimal Departures from Marginal Cost Pricing," *American Economic Review*, 60(3) (June 1970): 265-283. The price elasticity of demand for a service is the percentage reduction in the consumption of the service caused by a given percentage increase in the price of the service. See Jeffery Perloff, *Microeconomics: Theory and Applications with Calculus, Third Edition* (Boston, MA: Pearson, 2014): 29.

²⁹ To prove this conclusion, let p denote the price of a service and let $Q(p)$ denote the demand for the service at price p . Also let $R(p) = p Q(p)$ denote the corresponding revenue from the service, and let $\varepsilon = \left| \frac{\partial Q}{\partial p} \frac{p}{Q} \right|$ denote the (absolute value of the) associated price elasticity of demand. The rate at which revenue increases with price is $\frac{\partial R(p)}{\partial p} = p \frac{\partial Q}{\partial p} + Q = Q \left[1 + \frac{\partial Q}{\partial p} \frac{p}{Q} \right] = Q [1 - \varepsilon]$. Observe that $Q[1 - \varepsilon]$ (and thus $\frac{\partial R(p)}{\partial p}$) declines as ε increases.

³⁰ See, for example: (i) Mark Armstrong, Simon Cowan, and John Vickers, *Regulatory Reform: Economic Analysis and British Experience* (Cambridge, MA: MIT Press, 1994); (ii) Comnes et al. (1995); (iii) Chris Decker, Characteristics of Alternative Price Control Frameworks: An Overview, Regulatory Policy Institute Report Prepared for Ofgem, February 26, 2009, <https://www.ofgem.gov.uk/publications/characteristics-alternative-price-control-frameworks-overview-report-rpi-behalf-ofgem>; and (iv) Etienne Billeterie de Villemeur et al., "Optimal Pricing and Price-Cap Regulation in the Postal Sector," *Journal of Regulatory Economics*, 24(1) (July 2003): 49-62. Lantz concludes that "revenue caps are a rather bad idea in the area of incentive regulation." See Bjorn Lantz, "Hybrid Revenue Caps and Incentive Regulation," *Energy Economics*, 30(3) (May 2008): 688.

34. In direct contrast to revenue cap regulation, price cap regulation can promote a price structure that reflects the inverse elasticity principle. When an enterprise operates under price cap regulation that places a ceiling on a weighted average of the prices the enterprise charges for its services, the enterprise typically increases its profit by setting relatively high prices for services with inelastic demand and relatively low prices for services with elastic demand.³¹ By doing so, price cap regulation can induce a pricing structure that secures substantially higher levels of consumer welfare than does revenue cap regulation.

3. Revenue Caps Can Reduce Service Quality

35. Revenue cap regulation also can reduce an enterprise's incentive to deliver high quality services. This is the case because the demand for a service generally declines as its quality declines. The corresponding reduction in revenue can help to ensure compliance with a binding revenue cap. The associated reduction in sales (and service quality) can reduce production costs. Consequently, when it operates under revenue cap regulation, an enterprise can increase its profit as it ensures compliance with the regulation it faces by reducing the quality of its services. Broadband adoption in Australia is likely to be impeded by a reduction in the quality of wholesale broadband services.
36. Price cap regulation does not always provide ideal incentives for the provision of service quality, particularly when the level of the cap is not explicitly linked to the prevailing levels of service quality. However, reduced service quality does not directly facilitate compliance with the regulatory mandate under price cap regulation, as it can under revenue cap regulation. Furthermore, because increased service quality generally increases demand, increased quality can increase enterprise profit under price cap regulation when prices exceed marginal cost. Consequently, price cap regulation often delivers stronger incentives for enhanced service quality than does revenue cap regulation.³²

³¹ See, for example: (i) Ingo Vogelsang, "Price Cap Regulation of Telecommunications Services: A Long-Run Approach," in Michael Crew (ed.), *Deregulation and Diversification of Utilities*, (Boston: Kluwer Academic Publishers, 1989); (ii) Ingo Vogelsang, "Incentive Regulation and Competition in Public Utility Markets: A 20-Year Perspective," *Journal of Regulatory Economics*, 22(1) (July 2002): 5-27; and (iii) Jean-Jacques Laffont and Jean Tirole, "Creating Competition through Interconnection: Theory and Practice," *Journal of Regulatory Economics*, 10(3) (November 1996): 227-256.

³² See, for example: (i) Alrick Campbell, "Cap Prices or Cap Revenues? The Dilemma of Electric Utility Networks," *Energy Economics*, 4 (August 2018): 802-812; and (ii) Ricardo Raineri and Pablo Giaconi, "Price and Access Charge Discrimination in Electricity Distribution: An Application to the Chilean Case," *Energy Economics*, 27(5) (September 2005): 771-790.

4. Revenue Caps Can Discourage Innovation by Retail Suppliers

37. Revenue cap regulation of wholesale broadband services also can discourage innovation by retail suppliers of broadband services. Innovation that enhances the demand for retail broadband services enhances the demand for the underlying wholesale broadband services. Such retail innovation can thereby generate wholesale revenue in excess of the authorized cap on revenue.³³ Consequently, the regulated wholesale supplier must act to reduce revenue when it faces a binding cap on revenue. The supplier may find it most profitable to increase the prices it charges for its services. The price increases can reduce revenue by reducing the demand for wholesale broadband services. The reduced demand can also reduce costs and thereby enhance profit. A regulatory policy that induces a wholesale supplier to increase its prices in response to retail innovation reduces incentives for retail innovation. Reduced innovation harms consumers and limits the adoption of broadband services.
38. Price cap regulation limits the ability of the regulated enterprise to systematically increase the prices of its services. Furthermore, price cap regulation does not directly limit the regulated firm's revenue, and so does not introduce the same need to offset the impact of increased demand on revenue that revenue cap regulation entails. Consequently, price cap regulation can better encourage demand-enhancing retail innovation than can revenue cap regulation.

5. Revenue Caps Can Encourage Large Price Variation

39. Revenue cap regulation also can expose retail broadband suppliers to substantial and unpredictable variation in the prices of wholesale broadband services. As noted above, a regulated enterprise often can comply with a binding revenue cap either by setting low prices (which reduce revenue directly, holding sales constant) or by setting high prices (which can reduce revenue by reducing sales). A regulated enterprise also can ensure such compliance by alternating between very low prices and very high prices, since both can limit revenue effectively.

³³ Innovation by retail suppliers of broadband services can take many forms. For example, retail suppliers might enhance technical support for consumers or otherwise increase service quality. Alternatively, or in addition, the suppliers might develop particularly effective marketing campaigns that deliver valuable information to consumers and/or introduce new pricing structures or service bundles that enhance consumer welfare.

40. Retail broadband suppliers can find it challenging to ensure low, stable prices for their services when they face high or widely varying and unpredictable wholesale prices. Retail suppliers would be better able to consistently set low prices for their services if they were assured of relatively low, stable prices for wholesale broadband services. Price cap regulation typically is better able to deliver such assurance than is revenue cap regulation. This is the case because, unlike revenue cap regulation, price cap regulation places explicit limits on individual prices and/or a weighted average of prices. Therefore, price cap regulation typically will better foster low, stable prices for broadband services than will revenue cap regulation.

C. Price Cap Regulation Can Be Modified Over Time

41. Because price cap regulation outperforms revenue cap regulation on many dimensions, revenue cap regulation should not replace price cap regulation. This is the case even when it becomes apparent that NBN's revenue from core services will exceed the specified critical level of revenue that is deemed acceptable for NBN Co. At that point in time, a more stringent price cap should be applied rather than switching to revenue cap regulation. For example, rather than limit annual price increases to the rate of inflation (CPI), annual price increases might be limited to the rate of inflation less an X factor (CPI-X), as is common in price cap regulation plans. The X factor can be chosen to match NBN Co's expected revenue from core services with NBN Co's corresponding expected costs during the upcoming period of price cap regulation.³⁴ The X factor can be revised periodically as new information arrives concerning industry demand and cost conditions.

D. Summary

42. For at least the five reasons identified above, the prices of wholesale broadband services in Australia should be governed by price cap regulation rather than by revenue cap regulation on an ongoing basis. Revenue cap regulation is not without potential merit. However, Australia's wholesale broadband sector is not among the settings in which revenue cap regulation is advisable. Revenue regulation can have merit in settings where

³⁴ See, for example: (i) Jeffrey Bernstein and David Sappington, "Setting the X Factor in Price Cap Regulation Plans," *Journal of Regulatory Economics*, 16(1) (July 1999): 5-25; and (ii) David Sappington, "Price Regulation," in *The Handbook of Telecommunications Economics. Volume I: Structure, Regulation, and Competition*, edited by Martin Cave, Sumit Majumdar, and Ingo Vogelsang (Elsevier Science Publishers, 2002): 225-293.

it is desirable to discourage consumption of the regulated firm's service. To illustrate, environmental concerns might underlie a desire to reduce consumption of electricity produced by generators that employ fossil fuels. Because revenue cap regulation can encourage high prices (which discourage consumption) while ensuring the financial viability of the regulated firm, this form of regulation may merit some consideration in some electricity sectors.³⁵

43. However, expanded – not reduced – adoption of high-quality broadband services is desired in Australia. Consequently, for the reasons identified above, such expanded adoption is better motivated through the ongoing implementation of price cap regulation than through an eventual switch to revenue cap regulation.

V. Ensuring the Provision of High Quality Wholesale Broadband Services

44. To promote the ubiquitous adoption of broadband, retail consumers must anticipate receiving reliable, high quality broadband service. Reliable, high quality wholesale broadband service is an essential ingredient of high quality retail broadband service. NBN Co's proposal for ensuring high quality wholesale broadband service is deficient in at least three important respects. First, NBN Co proposes that base levels of service quality be negotiated with retail broadband suppliers, with no direct ACCC oversight. Second, NBN Co does not explain in detail how future levels of service quality will be determined when demand and costs are forecast for upcoming regulatory periods. Third, NBN Co does not propose a comprehensive set of penalties that NBN Co will incur if it fails to deliver all promised levels of service quality.

³⁵ See Eric Hirst, Eric Blank, and David Moskovitz, "Alternative Ways to Decouple Electric Utility Revenues from Sales," *Electricity Journal*, 7(6) (July-August 1994): 54-66. Revenue cap regulation may also help to ensure a stable, normal profit for an enterprise in settings where the demand for a firm's service is highly variable and unpredictable, where the firm has little ability to affect demand, and where the firm's costs do not vary substantially as its output changes.

A. ACCC Oversight is Necessary

1. Oversight of Service Quality Standards is Important

45. There is little reason to believe that negotiations between NBN Co and retail suppliers will necessarily lead to service quality standards that promote the LTIE. NBN Co's stature as a dominant supplier of wholesale broadband services can afford NBN Co undue influence in the determination of negotiated service quality standards. Consequently, the ACCC should be authorized to specify the minimum levels of service quality that NBN Co is obligated to deliver.
46. If NBN Co and retail broadband suppliers are inclined to do so, they can negotiate levels of service quality that exceed the minimum levels established by the ACCC (in return for higher payments from the retail suppliers to NBN Co). As long as such negotiations entail no coercion, they can help to promote the LTIE of broadband services by enhancing service quality in instances where the associated benefits exceed the corresponding costs.
47. Regulators often dictate service quality standards in other jurisdictions. To illustrate, state regulators in the U.S. specify in great detail the levels of wholesale service quality incumbent suppliers of telecommunications services must deliver to competing suppliers.³⁶ Regulators throughout the world also specify minimum levels of service quality that electricity suppliers must deliver.³⁷ In the telecommunications sector and more broadly, the levels of service quality that maximize profit typically differ from the levels that maximize consumer welfare.³⁸ Consequently, explicit regulation of service quality standards generally is appropriate.

2. Ongoing ACCC Oversight is Important

48. Ongoing ACCC oversight of service quality standards is appropriate throughout the entire term of the SAU. The levels of service quality that best promote both the LTIE and the efficient use of the infrastructure are likely to change over time as industry demand and

³⁶ See, for example, David Sappington et al., "Wholesale Pricing and Local Exchange Competition," *Info*, 6(5) (2004): 318-325.

³⁷ To illustrate, in Canada, the Alberta Utilities Commission's Rule 002 specifies the minimum levels of several dimensions of service quality that electric distribution companies must deliver. See AUC, "AUC Rules," <https://www.auc.ab.ca/rules/rules-home>.

³⁸ See Michael A. Spence, "Monopoly, Quality, and Regulation," *Bell Journal of Economics*, 6(2) (Autumn 1975): 417-429.

cost conditions change. Such changes often are difficult to predict accurately. Consequently, the LTIE is promoted by ensuring the ACCC can modify prevailing service quality standards (and associated compensation for NBN Co) as industry conditions change.

B. Formal Penalty Structures are Necessary

49. To ensure that all established service quality standards are meaningful, penalties for failure to meet each such standard must be specified and enforced. Absent such a comprehensive penalty structure, NBN Co may have insufficient incentive to achieve the established standards, thereby reducing the likelihood that retail consumers can count on receiving reliable, high quality broadband service.
50. NBN Co's provision of high speed FTTN service provides a case in point. The ACCC reports that a portion of NBN Co's FTTN customers recently were unable to achieve even "75% of their plan speed tier at any time of the day."³⁹ The ACCC also reports a recent increase in service quality complaints regarding "both the installation of new NBN services and fault rectification."⁴⁰
51. Penalties for sub-standard service quality should reflect the costs the sub-standard quality imposes on all relevant parties, including retail customers of broadband services. Such penalties provide incentives for NBN Co to meet established standards unless NBN Co's cost of doing so exceeds the associated benefits.⁴¹ In this event, the penalties that NBN Co pays for failure to meet established service quality standards can be employed to fully compensate those who are harmed by the sub-standard performance.
52. One form of penalty for sub-standard service quality is a reduction in the rate at which prices for affected wholesale broadband services are permitted to change over time. For example, if prices are initially authorized to change annually at the realized rate of inflation less an X factor under price cap regulation, prices for affected services might only be permitted to change at a rate that reflects a higher X factor. For particularly severe under-supply of quality, prices for affected services might be required to decline, regardless of the realized rate of inflation.

³⁹ ACCC, "Communications Market Report 2020-2021," December 2021, p. ix, <https://www.accc.gov.au/system/files/Communication%20Monitoring%20report.pdf> ("2020-2021 ACCC Communications Market Report").

⁴⁰ 2020-2021 ACCC Communications Market Report, p. x.

⁴¹ See David Sappington, "Regulating Service Quality: A Survey," *Journal of Regulatory Economics*, 27(2) (March 2005): 123-154.

C. Service Quality Performance Should be Reported Publicly

53. To ensure that specified penalties for sub-standard levels of service quality are imposed appropriately, realized levels of service quality should be monitored and reported regularly. Public reports of realized service quality performance can further enhance NBN Co's incentive to meet established service quality standards.
54. Service quality performance is monitored and reported publicly in other jurisdictions. To illustrate, New Zealand issues regular reports on broadband download speeds by provider and region as part of its Measuring Broadband New Zealand program.⁴² In the United States, the FCC issues annual reports on the broadband experiences of consumers under the Measuring Broadband America program.⁴³ The State of California also mandates the collection and dissemination of data on broadband infrastructure deployment and access.⁴⁴

D. Summary

55. In summary, to ensure levels of service quality that promote the LTIE in Australia, the ACCC should oversee the establishment of a comprehensive set of quality standards for wholesale broadband services. The ACCC also should ensure that established service quality standards are met by imposing and enforcing penalties for failure to achieve all established standards. Ongoing adaptation of service quality standards is important to ensure the standards continually promote the LTIE by reflecting current industry demand and cost conditions. NBN Co's service quality performance should be reported publicly on a regular basis.

⁴² "Measuring Broadband New Zealand, Summer Report, March 2022," https://comcom.govt.nz/__data/assets/pdf_file/0029/279803/MBNZ-Summer-Report-2022-24-March-2022.pdf. Some measures of broadband service quality are reported in Australia. However, these measures are not reported at the same level of granularity that they are reported in New Zealand.

⁴³ Federal Communications Commission, "Eleventh Measuring Broadband America Fixed Broadband Report," <https://data.fcc.gov/download/measuring-broadband-america/2021/2021-Fixed-Measuring-Broadband-America-Report.pdf>.

⁴⁴ State of California, "Executive Order N-73-20," <https://www.gov.ca.gov/wp-content/uploads/2020/08/8.14.20-EO-N-73-20.pdf>.

Public reporting of service quality performance also is common in other industries. To illustrate, in Canada, the Ontario Energy Board regularly reports the performance of each electric utility under its jurisdiction on twenty performance dimensions. Details are available at <https://www.oeb.ca/ontarios-energy-sector/performance-assessment/electricity-utility-scorecards>.

VI. Cost Allocation and the Provision of Non-Core Services

56. Serious concerns arise when a government enterprise operates both in unregulated, competitive markets and in regulated markets where little or no competition prevails. Nevertheless, NBN Co proposes to supply unregulated enterprise ethernet, business satellite, and satellite mobility services in addition to supplying regulated wholesale broadband services.⁴⁵

A. Government Enterprises Can Act Anticompetitively

57. Although a government enterprise may value profit, its focus on profit enhancement may not be as intense as the corresponding focus of a private enterprise. The difference in intensity can arise in part because a government enterprise often faces less discipline from capital markets.⁴⁶ Reduced discipline from capital markets can facilitate the pursuit of objectives other than profit maximization. These alternative or additional objectives can include expanded scale and scope of the enterprise, for example.⁴⁷
58. One might think that a reduced focus on profit enhancement would reduce the likelihood that a government enterprise acts to harm competitors and impede competition. However, this is not necessarily the case. To illustrate, an increased focus on enterprise scale and scope can induce a government enterprise to be particularly aggressive in limiting the success of competitors, or even driving them from the market.⁴⁸ Such aggression can take

⁴⁵ ACCC (2022), p. 31.

⁴⁶ See, for example: (i) Richard R. Geddes, "Agency Costs and Governance in the United States Postal Service," in J. Gregory Sidak (ed.), *Governing the Postal Service* (Washington, D.C.: The AEI Press, 1994): 114-140; and (ii) Richard R. Geddes, *Saving the Mail: How to Solve the Problems of the U.S. Postal Service* (Washington, D.C.: AEI Press, 2002).

⁴⁷ See, for example: (i) William Niskanen, *Bureaucracy and Representative Government* (Chicago, IL: Aldine-Atherton Publishers, 1971); and (ii) William Niskanen, "Bureaucrats and Politicians," *Journal of Law and Economics*, 18(3) (December 1975): 617-643.

⁴⁸ See, for example: (i) David Sappington and J. Gregory Sidak, "Incentives for Anticompetitive Behavior by Public Enterprises," *Review of Industrial Organization*, 22(3) (May 2003a): 183-206 ("Sappington and Sidak (2003a)"); and (ii) David Sappington and J. Gregory Sidak, "Competition Law for State-Owned Enterprises," *Antitrust Law Journal*, 71(2) (December 2003b): 479-523 ("Sappington and Sidak (2003b)").

many forms, including: (i) impeding competitors' access to vital inputs;⁴⁹ (ii) adopting (inefficient) technologies that entail particularly low costs of supplying competitive services;⁵⁰ (iii) setting particularly low prices for competitive services and otherwise expanding its operations into markets that are well-served by private, competitive suppliers;⁵¹ and (iv) allocating an unduly small share of common costs to the supply of competitive services or otherwise concealing under-performance or financial losses in competitive markets.⁵²

B. The ACCC Recognizes this Problem

59. The ACCC recognizes that NBN Co may have an incentive to exaggerate its cost of supplying core, regulated services while understating its cost of supplying non-core, unregulated services. The ACCC observes that “Without a rigorous cost allocation framework, there is a risk a regulated business may shift costs from competitive services towards core regulated services. This would provide a cost advantage for the business in the supply of competitive services and could promote anticompetitive behaviour or anticompetitive outcomes. It would also lead to prices for core regulated services being higher than the cost reflective level.”⁵³

C. The ACCC Must Be Able to Address this Problem

60. If, despite these concerns, NBN Co is permitted to supply non-core, unregulated services, the ACCC must be empowered to limit NBN Co's ability to employ the cost allocation process to impede competition in non-core markets and to raise the prices of core, regulated services. Specifically, NBN Co must be required to obtain explicit ACCC approval

⁴⁹ See Gregory J. Sidak and Daniel Spulber, *Protecting Competition from the Postal Monopoly* (Washington, D.C., AEI Press, 1996) (“Sidak and Spulber (1996)”).

⁵⁰ See Sappington and Sidak (2003a), for example.

⁵¹ See John Lott, “Predation by Public Enterprises,” *Journal of Public Economics*, 43(2) (November 1990): 237-251.

⁵² See Sidak and Spulber (1996), Sappington and Sidak (2003a), and Sappington and Sidak (2003b), for example. Common costs can be viewed as costs that “cannot be directly assigned to a particular product or service that are of joint benefit between regulated and non-regulated business units,” Law Insider, “Common Cost Definition,” <https://www.lawinsider.com/dictionary/common-cost>.

⁵³ ACCC (2022), p. 32.

for every element of the cost allocation methodology NBN Co proposes to employ.⁵⁴ Explicit ACCC approval should also be required for NBN Co's implementation of the authorized methodology. Furthermore, the ACCC, not NBN Co, should determine a reasonable time framework for the approval process.⁵⁵

VII. Conclusions

61. Broadband is a vital resource that has the potential to deliver enormous benefits to all Australian citizens. ACCC oversight of NBN Co's operations is required to ensure that broadband achieves its full potential in Australia. The ACCC should play a leading role in establishing, monitoring, and enforcing a comprehensive set of service quality standards. The ACCC should also oversee the design and implementation of NBN Co's cost allocation procedures.
62. Furthermore, the LTIE can be best served by setting prices for wholesale broadband services below the costs that NBN Co incurs in supplying these services. In addition, price cap regulation, not revenue cap regulation, should govern the prices of wholesale broadband services in Australia.

⁵⁴ The ACCC observes that under the proposed variation of the prevailing SAU, "The ACCC does not appear to have any role to approve the cost allocation manual or initiate changes to it" (ACCC, 2002, p. 32).

⁵⁵ The ACCC observes that under the proposed variation of the prevailing SAU, the ACCC would be required to decide on matters related to "the categorisation of new services and relevant cost allocations ... within 60 business days" (ACCC, 2002, p. 32).