An Expert Evaluation of the ACCC Cost Model and its Use in the Pricing of ULLS

Submitted to the
Australian Competition & Consumer Commission

March 2009

by

Dr. Robert G. Harris
Professor Emeritus
Haas School of Business
University of California, Berkeley

Table of Contents

I. Introduction, Qualifications and Purpose of Report

A. Scope of Assignment

1. Counsel to Telstra retained me to conduct an analysis and evaluation of the quality and reliability of the modeling assumptions, methods and input values of the Customer Access Network ("CAN") portions of recently released Australian Competition and Consumer Commission-Analysys Cost Model ("ACCC Model"). Counsel requested that I assess whether the ACCC Model accords with: (1) total service long-run incremental cost ("TSLRIC+") principles; and (2) the criteria specified in Section 152AH(1) of the Trade Practices Act 1974 (Cth) ("TPA") for determining the reasonableness of particular terms and conditions for the Unconditioned Local Loop Services ("ULLS").[1] In my evaluation of the ACCC Model, I drew upon my recent analysis and evaluation of the Telstra Efficient Access Model ("TEA Model"), as submitted to the ACCC in support of Telstra's current ULLS Undertaking. My evaluation of the TEA Model[2] is summarized in my Expert Report, "An Assessment of Telstra's TEA Cost Model for Use in the Costing and Pricing of Unconditioned Local Loop Services (ULLS)."[3]

2. I have made all the inquiries that I believe are desirable and appropriate to my expert opinion and no matters of significance that I regard as relevant have, to my knowledge, been withheld from the ACCC in relation to this report. I have reviewed and followed the Guidelines for Expert Witnesses in Proceedings in the Federal Court of Australia.[4] My qualifications are described below and my curriculum vitae is attached to this report.

---

[1] Letter from L. Norton Cutler to Robert G. Harris, February 26, 2009.

[2] Performed in collaboration with Dr. William L. Fitzsimmons, with whom I have worked on telecommunications costing, pricing and regulatory policy issues for more than 15 years.

[3] Submitted to the ACCC in the context of Telstra's current ULLS Undertaking, dated 4 November 2008, co-authored by Dr. William Fitzsimmons.

[4] Revised guidelines for expert witnesses, issued by Chief Justice M.E.J. Black, 5 May 2008.

3. I have reviewed relevant sections of the TPA and relevant submissions to and reports, determinations, and declarations by the ACCC.[5] I have based my assessment of the ACCC Model upon my review of these documents and my experience of more than three decades of building, evaluating and using regulatory cost models and over a decade of analyzing long-run incremental cost models in telecommunications. In addition to my review of the Analysys Cost Model Documentation ("ACMD"), I have also reviewed the Telstra report, "Initial Response to the ACCC's Cost Model" ("Telstra Initial Response"),[6] which presents a highly detailed examination of the ACCC Model. Based on my own review of the ACMD, I believe that the Telstra Initial Response accurately characterizes the ACCC Model and I concur with the opinions expressed in that report.

B. Qualifications of Dr. Robert G. Harris

1. I am a Professor Emeritus in the Haas School of Business, University of California, Berkeley. I earned a Bachelor of Arts and Master of Arts degrees in Multidisciplinary Social Sciences from Michigan State University and a Master of Arts and Doctor of Philosophy degrees in Economics from the University of California, Berkeley. At Berkeley, I served as Chair of the Business and Public Policy Group, as Founding Director of the National Transportation Policy Research Center, and as Co-Director of the Consortium for Research in Telecommunications Policy, a collaborative program of the University of California at Berkeley, the University of Chicago, the University of Michigan and Northwestern University.

2. At Berkeley, I taught courses at the undergraduate, MBA and Ph.D. levels, including Microeconomics (including cost and pricing principles); Business & Public Policy; Industry Analysis and Competitive Strategy; and Telecommunications Economics (including costing and pricing principles). For several years, I organized and taught a course on telecommunications economics for the staff of the California Public Utilities Commission, and a one-week course on

[5] See Appendix 1.

[6] Telstra Corporation Limited, April 1, 2009; submitted to Australian Competition and Consumer Commission.

telecommunications economics, policies and strategies for company managers and policy-makers from the United States and abroad. I have also taught telecommunications pricing principles and public policy at the Center for Telecommunications Management, University of Southern California. My academic research has developed cost models, analyzed the effects of economic regulation and antitrust policy on industry performance, and addressed the implications of changing economics and technology for public policies and competitive strategies in transportation and telecommunications industries.

3. In 1980, I was appointed to the Senior Executive Service of the United States by President Jimmy Carter. While on leave from the University in 1980-81, I served as a Deputy Director at the Interstate Commerce Commission, responsible for cost, economic and financial analysis. In that capacity, I was centrally involved in several major rule makings implementing the motor carrier and railroad regulatory reform acts of 1980 and directed the development of the Uniform Rail Costing System. I have also served as a consultant to the U.S. Department of Transportation, the U. S. General Accounting Office, the U. S. Office of Technology Assessment, the U. S. Department of Justice, the California Attorney General, the California Department of Consumer Affairs, the Minister of Planning of Japan and the Government of Mexico.

4. I have been involved in the construction, review, testing and application of TSLRIC+ and TELRIC+ cost models since 1995.[7] I have testified before Federal and state regulators in the United States regarding the use of those models in the pricing of "unbundled network elements." I have testified on telecommunications costing methods, pricing principles, competition policy and alternative regulation before the Federal Communications Commission ("FCC") and 27 state regulatory commissions in the United States. I have also testified before telecommunications regulatory authorities in Canada and Mexico and before the United States

[7] TELRIC is the acronym for total element long-run incremental cost methodology designed by the FCC for implementing the Telecom Act of 1996 in the United States. In effect, it is the same as the TSLRIC+ methodology discussed in this report. The FCC was differentiating between the total long- run incremental costs of a complete *service*, such as basic local service, and an unbundled network *element*, such as a loop.

Senate, the United States House of Representatives and the Joint Economic Committee of Congress on transportation, antitrust and telecommunications policy issues.

II. An Assessment of the Customer Access Network in the ACCC Model

A. TSLRIC+ Should Estimate the ACTUAL Economic Costs of a Hypothetical New Entrant

1. The use of TSLRIC+ estimated costs in the pricing of wholesale telecommunications services (such as ULLS) relies on a fundamental principle of regulatory economics: the best way to ensure economic efficiencies (allocative, technical and dynamic) and serve the long-term interests of end-users (LTIE) is by attempting to imitate markets that are workably competitive. In workably competitive markets, the profit motive drives actual and potential competitors to invest in the best available technology and operate efficiently to serve existing and expected demand for products and services. In a workably competitive market, efficient producers using the best available technology drive prices down toward long-run incremental costs.

2. In the case of a regulated market which is not workably competitive, regulators can attempt to imitate that workably competitive result by estimating the costs of a hypothetical new entrant, as acknowledged by this Commission.[8] Make no mistake though: while this principle involves a HYPOTHETICAL entrant, adherence to the underlying economic principle requires a good faith effort to estimate the ACTUAL costs of that hypothetical entrant. To accomplish this result, the valid use of TSLRIC+ requires that a cost model be based on and fully incorporate:

- All of the ACTUAL customers to be served by hypothetical entrant (typically all of the customers served by the incumbent);
- All of the ACTUAL demand of those customers, including all of the access lines and all of the usage volume;
- All of the ACTUAL, specific locations of those customers;

[8] Australian Competition and Consumer Commission: "Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking," Draft Decision (Public Version) November 2008 ("ACCC Draft Decision"), §102.

- The ACTUAL conditions in which those customers are located (including, for example, the distances of customers' houses and buildings from each other and pertinent access network equipment such as pillars; the location of streets and roads; the existence of pavement and topological features such as rivers and parks;
- The design, engineering, construction and operation of an optimized ACTUAL network capable of serving actual and forecast demand at actual locations;
- The ACTUAL recovery of the optimised costs of building that network; and
- The ACTUAL optimized costs of operating that network.

3. Simply put, the use of TSLRIC for pricing purposes is an economic concept, but the estimation of TSLRIC must be based on an engineering model of a "customer access network" ("CAN"). Indeed, notice the very terms that compose and constitute a CAN: Customer, Access, Network. A cost model that does not estimate the optimized cost of serving all Customers and their demand is NOT a TSLRIC cost model of the CAN. A cost model that "constructs" a hypothetical network that does not actually reach all customer locations could not provide Access to those customers, and is therefore not a valid TSLRIC cost model of the CAN. A cost model that does not use valid optimized engineering principles for the design, construction and operation of a realistic Network cannot estimate TSLRIC costs.

4. All too often, TSLRIC cost estimates are NOT estimates of the actual optimized costs of a hypothetical entrant, but the hypothetical costs of a hypothetical entrant.[9] There is all the difference in the world between the two approaches, and there is a simple test to tell the difference between the two. In the first case—the actual optimized costs of a hypothetical entrant—one could imagine that an entrant WOULD actually build and operate a network as "constructed" in the model. The TEA represents such a model: it represents a realistic, working network. In the second case, one could not even imagine an entrant actually designing a real

[9] This is a significant reason why one should be very cautious in the use of "international benchmarks": if regulators in other jurisdictions have based their pricing decisions on faulty cost models, those pricing decisions should hardly be emulated by this Commission. At minimum, the use of international benchmarks should include an examination of the basis on which those prices have been set.

network using the approach taken in the ACCC Model and would never actually build a network as constituted by the model, for the most fundamental of reasons: it would not work!

5. The hypothetical entrant whose costs are estimated in a proper TSLRIC cost model assumes that the entrant would have certain advantages that an actual entrant would not have:

- One assumes that all customers, customer locations and customer demand are known, so the model assumes that the network is ideally scaled to serve that demand. In competitive markets, entrants must make investment decisions with imperfect information about future demand (with long-lived assets, far in the future demand). As a consequence, TSLRIC assumes just the right level of capacity—not too much, not too little.

- One assumes that the hypothetical entrant is able to realize all of the economies of scale, scope and density because a proper TSLRIC cost model assumes that it will meet 100% of the demand for the CAN. Even in competitive markets, competitors do not necessarily operate at minimum efficient scale, which can raise their costs even if they are operating efficiently and with the best available technology.

- One assumes that 100% of capacity (which is serving 100% of the demand) is the best available technology. In reality, there is no competitive market in which all (or even most) of the capacity is the best available technology. By the very nature of technological change, the capacity in any given industry features a mix of technology vintages, from oldest to newest. So, making this assumption in a TSLRIC model has the effect of reducing estimated costs below what one would expect to observe in a workably competitive market.

- One assumes that the hypothetical entrant designs, builds and begins to operate a network serving all customers simultaneously. In reality, entrants can spend years analyzing, deciding, planning, designing and building large-scale plants, facilities or networks: they do not "appear" in a moment of time. All of these activities, which necessarily precede having actual working capacity generating revenues by providing services, are part of the costs of entry. By assuming these costs do not exist, TSLRIC cost models understate the real economic costs of entry.

6. One makes these "simplifying" assumptions for the purpose of estimating the costs of a hypothetical entrant, realizing that they have the effect of reducing estimated TSLRIC costs below what could possibly be achieved in the real world. Having started with these assumptions, though, it is imperative that TSLRIC cost model be based on actual data (or, at

minimum, reasonably good estimates), realistic conditions and a network design that this hypothetical entrant could actually build and operate. Otherwise, the cost model is a completely fictional exercise and its estimates of costs are inaccurate.

7. As I will explain in subsequent sections, unlike the TEA cost model, which does estimate the optimized actual costs of a CAN built by a hypothetical entrant, the ACCC Model does not. Instead, the ACCC Model "constructs" a purely hypothetical "network" which could not serve the actual demand of all actual customers, at all actual locations, under actual existing conditions. Moreover, it is not an engineering model of the CAN: indeed, it fails to explain or exhibit any network design and engineering standards. Thus, while the ACCC Model purports to include a CAN, the more descriptive term of the model is CAN'T: it can't reach all customers and serve all location-specific demand; it can't actually provide access to connect customers to a viable operating network; and the network in the Model can't actually work because it violates key principles of network engineering and design.

8. In short, the CAN portion of ACCC Model depends on unreliable data, uses sampling techniques that bias results; does not and could not serve the demand of all existing customers at all actual locations; fails to use realistic network engineering design standards; and uses economic inputs and assumptions that violate TSLRIC+ rationale and are unrealistic and logically inconsistent.

B. CAN Customers in the ACCC Model

1. A valid TSLRIC Cost Model must be based on accurate and reliable customer demand or customer location data, because the whole point of a TSLRIC CAN model is to estimate the optimized cost of building a Network that would provide Access to all Customers. If actual customer-location-demand data are not available, then, at minimum, the customer-location-demand data used in the model should be carefully constructed and validated. The ACCC Model is fundamentally and irreparably flawed because it neither uses actual customer-

demand-location data nor does it make any effort to validate the data on which the Model is built. The Cost Model Documentation admits as much:

> "For a bottom-up model of this kind, ideally, one would have knowledge of the location of every access line required in Australia and the services demanded at each location. An access network could then be designed to serve these locations. Analysys does not have access to such a database, so has had to design a reasonable proxy."[10]

2. This is quite a remarkable admission, given that (1) a TSLRIC cost model is no better than the customer-location-demand data on which it is built; and (2) ACCC-Analysys did have access to a comprehensive database that includes all Telstra customers, their actual demand and their actual locations. Indeed, the use of actual customer, demand and location database is one of the main strengths of the TEA Cost Model.[11] Moreover, not only did ACCC-Analysys choose to build their cost model on inferior data, the ACMD offers no indication that they have tested or validated their estimates of customer, demand and location by comparing it to the actual data on which the TEA model is based (or any other actual customer-location-demand data).

3. Instead, the ACCC Model is founded on data which Analysys admits has serious limitations:

> "The G–NAF provides basic geographical data for the location analysis, but this data has shortcomings for the requirements of the model. Although it provides a set of entries (or addresses) and corresponding locations, it does not provide any real indication of demand at these addresses."[12]

---

[10] ACMD, page 27.

[11] The ACCC Draft Decision is incorrect in claiming that the TEA is based on the actual existing Telstra network: it is not. The network in the TEA is based on actual existing customer locations, switch and pillar locations and ESA boundaries, but the model then uses a set of logical network design principles and rules to optimize each local distribution network to reach those customers and meet that demand. The size of that optimized network is 35% smaller (as measured by trenching miles) than Telstra's existing network.

[12] ACMD, page 27.

> "Section A.1 describes the G–NAF database and its shortcomings as a location database, in terms of its location data and its ability to identify business addresses."[13]

> "The Geocoded National Address File was used as our primary source of locations, but this data set required some pre-processing since it was intended as a database of addresses rather than locations. For this and other reasons, it included far more entries than there were addresses in Australia.[14]

> "It contains approximately 12.6 million entries in all, but the Australian Bureau of Statistics (ABS) indicates far fewer residences and registered businesses…"[15]

4. Because G-NAF has too many addresses, Analysys reduces that number by 2.8 million addresses to generate a database of 9.8 million addresses. Eliminating 2.8 million addresses hardly deals with the underlying problem; indeed the "cure" of eliminating address is almost certainly worse than the "disease" of too many addresses. The basic problem is that the underlying databases do not include actual customer locations. No amount of filtering can fix that basic flaw. In any case, the ACCC Model makes no attempt to validate the "filtered" data of "locations." Although it would have been far better to use the actual customer location data from the TEA model, the least one should expect is an effort to compare the "filtered" (i.e. manufactured) locations in the ACCC Model to real locations.

5. Moreover, the errors introduced into all subsequent phases of the ACCC Model by these inaccurate addresses are not random: they are statistically biased toward reducing cost, because the incidence of geo-coding errors is higher in rural than urban areas. By "filtering" out these errors, the Model builds on a false premise: there are fewer locations in the database than Telstra serves. Because of economies of density, the cost of building a CAN in rural areas is considerably higher than in urban or suburban areas. Thus, the flawed process of filtering

[13] ACMD, page A1.

[14] ACMD, page 18.

[15] ACMD, page A5.

customer locations understates the cost of providing ULLS in subsequent phases of the ACCC Model.

6. Even though actual customer locations and demand are the basis of the TEA Model, Analysys-ACCC chose not to use that data. As a consequence, the ACCC Model has no source of customer demand data by location. Lacking such a fundamental building block of a TSLRIC model, they "construct" demand estimates, in the aggregate, for Exchange Service Areas (ESA) from a data source that has no location information.[16] If one were building a manufacturing plant, then such area-wide demand would be useful, because products can be shipped from the plant to customers (or intermediate points such as warehouses and retail stores). But there is a fundamental difference between a manufacturing plant[17] and a Customer Access Network for ULLS. The very purpose of a CAN is to connect each and every customer at each respective customer location, and be capable of serving demand at each of those locations. Because the ACCC Model is based on aggregate demand across an ESA, it cannot know where a hypothetical network should go to serve actual customer-location-specific demand. In short, the ACCC Model does not actually provide access to all of the customers it should.

7. Moreover, the demand data used in the ACCC Model cannot even distinguish business customer demand from residential customer demand on a location-specific basis:

> "Identifying business addresses does not appear to be possible using the G–NAF on its own… Our assumption is then that each registered business of a particular type in an ESA will have a site of that type located within the ESA. We acknowledge that using registered businesses does not equal business locations where a business has multiple sites."[18]

[16] The G–NAF provides basic geographical data for the location analysis, but this data… does not provide any real indication of demand at these addresses." Lacking real demand data, the modelers "have chosen to allocate high demand to addresses randomly within geographical areas likely to be served by high demand.." ACMD, page 27.

[17] Or other goods-producing facilities such as mines or refineries.

[18] ACMD, page A9.

8. In spite of this inherent limitation, Analysys-ACCC proceeds to create a customer demand database that is even less reliable than its location database. It is quite surprising that the ACCC would choose to manufacture location demand data when they could have used the actual customer-location-demand data that is the foundation of the TEA model. At the very minimum, they should have compared the Model's manufactured customer demand data to Telstra actual customer location data to test the validity of the process: they did not.

C. CAN Access in the ACCC Model

1. Customer-location-specific demand is such a critical factor in network planning because the size of the network is based upon the amount of capacity needed at each network segment: one cannot use network capacity running along one street to serve demand located on another street. So, the basic deficiency in the ACCC Model – the lack of actual or reasonably accurate customer-location-specific demand – is further exacerbated by a grossly over-simplifying assumption embodied in the ACCC Model: all addresses whose Geo-coordinates are within 3 metres of each other are assumed to represent a single location. Admittedly, this assumption has an amazingly simplifying effect on location-specific demand: the ACCC Model consolidates all types of communities with a single address (e.g. office parks, retirement communities and trailer parks) into a single location. It also grossly understates the extent of the network needed to actually provide access to customers in those environments, thereby understating TSLRIC cost estimates. This understatement is further magnified because, while the network "constructed" in the ACCC Model could not actually reach all of the customers in a given ESA, it divides by all of the access lines of those excluded customers (i.e. those who the ACCC Model does not actually connect) in the calculation of unit costs.

2. Despite claims by ACCC-Analysys that the Model has "street awareness," some of the most critical steps in network design in the Model are done with no street or geography awareness. In the ACCC Model's clustering algorithms, distribution areas, pillars and serving

pits are designed with no street awareness.[19] In an attempt to remedy this basic flaw, the ACCC Model uses "filtering" methods to deal with at least some of the obvious deficiencies. But instead of repairing the deficiencies, the filtering only makes matters worse. The lack of street awareness in the clustering algorithm generates many anomalies: some of the customer locations in the distribution area cannot be readily connected to the pillar, because there are no roads or other rights of way directly connecting the customers "assigned" to the pillar.[20] Rather than address and remedy the underlying problem—poor distribution area network design—the ACCC Model removes these "anomalies"[21] from the Model whenever the road distance of the link required to connect two locations is more than 2.5 times the airline distance between the two locations.[22] This process effectively eliminates the real world conditions with which network engineers must deal and a TSLRIC model should incorporate—topological and man-made features such as highways, railways, parks, playing fields, hills, ravines and open spaces. In no sense can such a model be considered optimized, ACMD claims of optimization notwithstanding. Indeed, the Model fails the most minimal test of a CAN: to provide access to all of the customers as and where they are actually located. By eliminating these self-generated "anomalies," the Model greatly understates the amount of network capacity required to provide access to all customers, thereby causing a downward bias in the Model's estimates of TSLRIC.

3. There is yet another fundamental flaw in network design, the effect of which is that the ACCC Model again fails to provide access to many actual customer locations. The Distribution Point ("DP") cluster design employed by the Model (a) maps addresses to the <u>center</u> of the

[19] "Since the first stage of the network design algorithms, specifically the clustering algorithms, are not street-aware, some filtering of anomalies is required." ACMD, page 34.

[20] These anomalies occur because "two points can be stated as being linked despite the absence of direct road between them," requiring "exceptionally long links which would never be used in reality." ACMD, page 34.

[21] It bears emphasizing that these "anomalies" were of the Model's own creation: the Model "locates" customers without taking account of streets and roads.

[22] The Model eliminates these anomalies from the calculation of the p-function.

street; (b) cannot distinguish between addresses on opposite sides of the street; and (c) provisions only one distribution cable down any street. There are two methods of providing access to customers on both sides of a street: either (1) run cable down both sides of the street and include the necessary trenching; or (2) run the cable down one side of the street and the cost of boring beneath the street at every other house.[23] The ACCC Model does neither. Instead, having mapped addresses to the center of the street, the Model has no way to actually reach the center of the street (or, if we assume that they mean for the trench to run alongside the street, the Model has no way to reach the other side). While the Model does provide for cabling to connect the DP's, there is no provision for the lead-ins necessary to connect the customers' actual premises because the Model does not provision lead-ins from the property boundary to the home. Thus, the Model does not provide access to customers where they are actually located, so it fails the basic test of a TSLRIC customer access model.

4. In the aggregate, the use of fibre in the ACCC Model grossly understates TSLRIC. While ULLS service is available from Telstra to roughly 95% of customers in Band 2, the Model uses copper to serve only 60% of the distribution areas in Band 2. The Model deploys fibre in the main network when cable length exceeds 6900 metres. Problematically, the length of cable required in the ACCC Model is often exaggerated because it follows no known engineering rules with its indirect and haphazard cable routing.

5. However, while the amount of cable in the Model is often excessive, the entire cost of this fibre, including trenches and large pair gain systems, is <u>excluded</u> from the cost of the CAN. The cost of serving all building terminals of at least 40 lines is also removed from the Model, since the Model serves those customers with fibre. However, the Model includes all access lines—including those "served" by fibre, in the calculation of unit costs substantially magnifying

[23] Every other house because a pit typically serves four houses, two on the same side of the street as the trench and cable connecting the pits, two houses on the other side of the street. This is the approach taken in the TEA Model, because it is more efficient than trenching along both sides of the street. It is also the approach used by Telstra when it is reinforcing or expanding its network to serve new demand.

the understatement of costs. This is a huge bias: the costs of providing a main cable network to 40% of the customers in the Model (those furthest from the exchange building) are excluded from total costs, but all of those access lines are included in calculating average unit costs (since the average cost per copper access line is set to equal the total cost of copper services divided by total number of copper AND fiber access lines).

D. CAN <u>Network</u> in the ACCC Model

1. As noted earlier, TSLRIC is an economic concept, but when done correctly, it is based on an engineering model.[24] The ACCC's Model fails on this account because neither the documentation, nor the model, nor any accompanying documents present or explain the network design and engineering standards used in the Model. This failure of the ACCC Model to comply with basic engineering standards stands in stark contrast to the TEA Model, which thoroughly explains the engineering principles used in the design of the TEA model of the CAN.[25] Moreover, the engineering principles and network design standards employed by the TEA model were not created solely for the purposes of a TSLRIC model. They represent the actual best practices and best available technologies in use today by Telstra and other leading network engineers.

2. In contrast, the ACCC Model follows no comprehensive set of logical engineering principles. In many cases, the network "designed" in the Model violates basic engineering principles. I will highlight a few examples of this fundamental deficiency below; the Telstra Initial Response offers a full discussion of these issues.

3. To begin at the most basic level, any network engineer understands that one must design a network in light of the conditions in which customer locations are actually situated.

[24] One can also construct cost models using accounting data or by conducting statistical analysis of cost data. While accounting data and statistical analysis can be useful in building a TSLRIC model, the foundation of TSLRIC is an engineering model of the network in question.

[25] "Access Network Dimensioning Rules, Long run incremental cost modeling input," Network & Technology Fundamental Planning, Telstra Confidential Document, submitted to ACCC, ULLS Undertaking.

The ACCC Model, however, creates clusters of addresses (as a "proxy" for actual customer locations), then "connects" those clusters by using minimum spanning trees, with no regard for actual environmental conditions. As a consequence, the links of the spanning trees frequently cut through houses, businesses, creeks, railway lines, and other real world obstructions. This may be an interesting line-drawing exercise, but it certainly does not produce a workable Customer Access Network and it greatly understates the estimate of TSLRIC for a CAN that should account for these realities of network design.

4. In the absence of engineering standards, these clusters then connect back to the exchange in an ill-defined "daisy-chain" design and haphazard array of multiple 400-pair copper cables. In many cases, the Model deems (but with no clearly stated principle) the routes to be too long or too expensive; if so, the Model substitutes fibre for copper and removes the costs of the fibre from the cost estimates. Even worse, the Model routinely ignores basic capacity and distance limitations of the network it is "constructing," whenever it is easier "to deploy a node to a higher capacity than this 'practical capacity' in order to arrive at a more efficient trench network."[26] With no engineering principles or standards to guide it, the Model features the use of pillars, cable pairs and pits that would—according to the Model—be serving demand in excess of their capacity limitations. Thus, the CAN in the ACCC Model cannot actually serve all of the locations currently served by ULLS required and thereby understates TSLRIC costs.

5. The ACCC Model offers no engineering standards or even documentation of the methods by which the Model places pits, joints and manholes, even those these are essential components in the construction of a CAN. Evidently, the Model merely assumes that buildings on both sides of the street can be served by a pit placed to minimize its distance from the pillar, without regard to whether that point would physically allow access to all of the lead-ins serving customer locations. Similarly, the Model omits any of the costs associated with running lead-ins from the middle or other side of the street, which then magically connect into the

[26] ACMD, page C-3.

conduit, because the Model does not include pits at the "final drop point" ("FDP") to provide conduit access.[27] These are egregious omissions from the ACCC Model. Like the other flaws in the Model, they have the unquestionable effect of understating the estimated TSLRIC costs of the CAN and ULLS.

6. Finally, a fundamental problem arises from the interaction of the CAN and the Core (Interexchange) Network ("IEN") in the Model. In the real world, there is typically a small degree of sharing between the CAN and the IEN.[28] Whereas the IEN is a very high density network that consolidates large volumes of traffic and moves it from exchange to exchange, the CAN, by its very nature a low density network, provides many individual access lines to connect many customers often spread over considerable distances. In the absence of any rational engineering or network design principles, the ACCC Model "designs" an IEN that maximizes the opportunity for sharing with the CAN.[29] The links—sometimes featuring very substantial cables—pass through residential neighborhoods with no regard for engineering standards, capacity constraints or practical limitations, and little regard for neighbors' sensibilities . While the Model Documentation does not explain the rationale for this odd routing of "big pipes" through residential areas, there can only be one explanation: to maximize the "sharing" of trenching between the IEN and the CAN. As we shall see in the next section, the understatement of TSLRIC costs through this device doesn't stop there: not only does the ACCC Model have an unrealistically high level of trench sharing between the IEN and the CAN, but the Core (IEN) bears all of the costs of those shared trenches. The Cost Model Documentation offers no explanation—much less rationale—for this exclusion, but it directly contradicts well-established economic principles of costing.

---

[27] ACMD, page 38.

[28] In the TEA Model, there is 5% CAN trenches are shared with the IEN.

[29] The ACCC Model assumes 100% trench sharing between the CAN and the Core Network whenever they are located within 4 km of any local exchange building, no matter what that means for network design and operability.

III. Economic Inputs and Assumptions in the ACCC Model

A. The Lack of Logical Consistency in the ACCC Model

1. As explained in the Harris-Fitzsimmons Report, it is critically important that a TSLRIC cost model incorporate logically consistent economic assumptions that are also consistent with the underlying rationale for TSLRIC.[30] The economic assumptions in the ACCC Model are not consistent with the economic principles of TSLRIC and are logically inconsistent with each other. In this Section, I will address several of the most serious mistakes and inconsistencies and explain why, in each and every case, the economic assumptions and methods in the Model have the effect of understating estimated TSLRIC costs.

B. The Model Understates Network Installation Costs

1. As explained in ¶ II.D.6. above, the design of the CAN in the ACCC Model is driven by an effort to maximize the sharing of trenching between the Core Network and the CAN. When one observes the routing of huge capacity Core Network links winding their way through residential neighborhoods and doubling back on themselves, there are good reasons for questioning the network design methodology in the Model. However, even putting that issue aside, the treatment of these shared costs in the Model is wrong as a matter of economics: it fails to include ANY of the shared costs of the shared trenching in the costs of the CAN. Instead, the Model assumes that all of the shared trenching costs are born by the Core Network. It is inconsistent with TSLRIC principles to design a network to overstate the sharing that could be realistically achieved by a hypothetical entrant. It is even worse to assume that the CAN bears none of the costs of the shared network facilities. This mistake significantly understates the TSLRIC costs of the CAN, including ULLS.

[30] "An Assessment of Telstra's TEA Cost Model for Use in the Costing and Pricing of Unconditioned Local Loop Services (ULLS)," (co-authored by Dr. William Fitzsimmons), dated 4 November 2008; Section 2.5.

C. The Model Misuses Future Services in Operation (SIO)

1. The ACCC model tries to estimate costs over a number of years and thus must incorporate reasonable forecasts of future line counts. SIO counts are critical in the calculation of unit costs (e.g. the cost per ULLS line) because the unit cost per line equals total cost divided by the number of lines over the life of the assets in the Model. The Commission's own data shows that Telstra has been losing access lines at an accelerating rate and industry forecasts predict further losses to competitors in the future:[31]

> "Fixed lines in Australia peaked at 11.6 million in 2004, falling by 740,000 between 2004 and 2007—a decline of six percent."[32]
>
> "Figure 3: Australian fixed lines and percentage change year-on-year" shows the rate of line loss is accelerating.[33]
>
> "… as the Australian communications sector develops, both FMC [Fixed-Mobile Convergence]and services encouraging Access FMS [Fixed-Mobile Substitution] will become more prominent in the medium term… as more traffic goes mobile, the mobile network will become increasingly important <u>at the expense of the fixed network</u>."[34]

2. The ACCC Model does assume that Telstra will lose SIO's over the forecast period (2009-2012). However, the Model wrongly assumes that, even though the SIO count drops over time, the Asset Volume ratios remain static, causing the asset base in the Model to decline each year over that period. This is wrong as a matter of economics. If the CAN is losing customers, then the fixed costs of the network "built" at the beginning of the period will remain constant, but will be spread over fewer access lines, causing unit costs to rise as total costs remain constant,

---

[31] While the total size of the Australian telecommunications market continues to grow, Telstra is losing market share at a rate greater than market growth, so it faces continued decline in SIO.

[32] Australian Communications and Media Authority:"Fixed-Mobile Convergence and Fixed Mobile Substitution in Australia," July 2008, page 14.

[33] Australian Communications and Media Authority:"Fixed-Mobile Convergence and Fixed Mobile Substitution in Australia," July 2008, page 15.

[34]Australian Communications and Media Authority:"Fixed-Mobile Convergence and Fixed Mobile Substitution in Australia," July 2008, page 29.

but SIOs decline. In this respect, the ACCC Model has it backwards: it assumes that the size of the CAN shrinks as customers leave the network. Many of the components of the CAN are fixed for the long term and are not fungible; a cable or pit or pillar used to serve customers on one street cannot serve customers on another street when the first set of customers leave the network.

3. In the "good old days," Telstra could "build it and they will come."[35] Given the rapid development of competition and the promise of even greater competition and further (probably accelerating) fixed line losses, that is simply no longer the case. Investment in a fixed network is increasingly risky precisely because Telstra must build to meet current demand,[36] even though there is every reason to believe customers will continue to leave its network in the future. For that very reason, the CAN in a valid TSLRIC model should calculate unit costs by dividing the total fixed costs of the network by a declining number of SIOs. The ACCC Model fails to do so, thereby understating its cost estimates of the CAN.

D. Economic Lives, Depreciation & Capital Recovery

1. As a forward-looking model, the asset lives used in a TSLRIC model should rely on economic, not physical lives. The risks of technological obsolescence and loss of market share to new competitors and new modes of communication are substantial and should be reflected both in the economic lives of assets and in the method of capital recovery. Because the front-loaded investment in the CAN is such a substantial portion of the total costs of providing access services, including ULLS, the method and rate by which those costs are recovered over the <u>lives of the assets</u> is critical to estimating TSLRIC costs. In assessing the risks of early obsolescence or loss or market share to a Fibre to the Node ("FTTN") Network, the ACCC has recently stated that

[35] From the movie, "Field of Dreams," released in Australia 31 August 1989.

[36] In order to meet its Universal Service Obligation: The Telecommunications (Consumer Protection and Service Standards) Act 1999 (Cth), sec. 9, 12C.

> "In any case, the ACCC considers that deployment of FTTN in any significant way is unlikely during the period covered by the final determination."[37]

2. Because the period of the final determination is only a few years, that is the wrong period to consider investment and capital recovery risks. The correct period for assessing and incorporating investment risk is the lives of the assets used to construct the CAN, as long as 40 years. The risks of technological obsolescence, especially high for the unconditioned copper loops defined by ULLS, will increase with the passage of time: the longer the asset lives, the greater the risk. Likewise, the continued decline in access lines and the potential for stranded investment also grow over time. The ACCC Model does not incorporate these growing risks over the length of CAN asset lives; it thereby underestimates TSLRIC of the CAN and ULLS.

3. Not only does the ACCC Model not incorporate these risks, it uses a method of capital cost "recovery" that ensures that the investment costs of the CAN—and ULLS—will never be recovered. It uses a "tilted annuity" for recovery of the depreciation of capital investment, effectively "back-loading" capital cost recovery.[38] This methodology pushes recovery into the future when the risk of recovery grows, exponentially. Moreover, if the ACCC were to actually follow this methodology over the lives of the assets, it would ensure that in the future ULLS prices would rise to levels unsustainable in the market.[39]

4. Of course, there is little chance that the ACCC would ever authorize Telstra to charge the substantially higher ULLS prices needed to recover back-loaded capital cost recovery. Rather, the ACCC will likely continue to do what it has done historically: "reset" the prices every 2-3 years, always pushing "cost recovery" further into the never-arriving future. Thus, "tilted annuity" or "back-loading" are misnomers and fundamentally mischaracterize this approach; under this method, capital costs are never recovered. Thus, the approach in the ACCC Model

[37] ACCC Final Decision, Primus ULLS Arbitration, paragraph 466.

[38] ACMD, page 119.

[39] The ACCC also argues for the use of a "tilted annuity" in the use of the TEA. ACCC Draft Decision, page 123.

directly contradicts economic principles of capital cost recovery, causing it to substantially understate TSLRIC costs.

IV. The ACCC Model and the Long-Term Interests of End-Users

A. The Long Term Interests of End Users

1. I am instructed that Subsection 12AB(2) of the Trade Practices Act requires that ULLS prices meet the following objectives:

> *(c) the objective of promoting competition in markets for listed services;*
>
> *(d) the objective of achieving any-to-any connectivity in relation to carriage services that involve communication between end-users;*
>
> *(e) the objective of encouraging the economically efficient use of, and the economically efficient investment in:*
>
> > *(i) the infrastructure by which listed services are supplied; and*
> >
> > *(ii) any other infrastructure by which listed services are, or are likely to become, capable of being supplied.*[40]

2. I have been further instructed that The Competition Tribunal has offered guidance in its interpretation of the phrase "long term interests of end-users":

> *Having regard to the legislation, as well as the guidance provided by the explanatory Memorandum, it is necessary to take the following matters into account when applying the touchstone – the long-term interests of end-users:*
>
> ** End-users: "end-users" include actual and potential [users of the service] …*
>
> ** Interests: the interests of the end-users lie in obtaining lower prices (than would otherwise be the case), increased quality of service and increased diversity and scope in product offerings. …[T]his would include access to innovations … in a quicker timeframe than would otherwise be the case …*

[40] Trade Practices Act of 1974, Subsection 12AB(2).

> * *Long-term: the long-term will be the period over which the full effects of the … decision will be felt. This means some years, being sufficient time for all players (being existing and potential competitors at the various functional stages of the … industry) to adjust to the outcome, make investment decisions and implement growth – as well as entry and/or exit – strategies.*[41]

3. Accomplishing these objectives by adopting forward-looking cost-based prices will promote efficient and lasting competition, while adopting below-cost prices will deter innovation and investment in infrastructure. The objectives required by the statute are furthered by prices that reflect the underlying cost of building and operating the network facilities necessary to provide ULLS or competitive facilities. Setting ULLS prices below the cost of building and operating facilities may promote contrived competition, but it will discourage investment by existing companies and entrants and, thereby, undermine the development of real and lasting facilities-based competition.

4. In the remainder of this section of the report, I will assess use of the ACCC Model in the pricing of ULLS in light of these statutory and judicially interpreted objectives. I will explain why valid estimates of TSLRIC in the pricing of ULLS will ensure that these objectives will be achieved. As explained in my earlier report, the TEA Model does generate valid and reliable estimates of TSLRIC+.[42] Therefore, basing ULLS prices on the costs estimated by the TEA would achieve these objectives.[43] However, because the ACCC Model generates substantially downward-biased estimates of TSLRIC , the use of the Model for pricing ULLS directly contradicts these objectives and will indeed cause harm to the long-term interests of end users (LTIE).

---

[41] Seven Network Limited (no 4) [2004] ACompT 11 at [120].

[42] "An Assessment of Telstra's TEA Cost Model for Use in the Costing and Pricing of Unconditioned Local Loop Services (ULLS)," (co-authored by Dr. William Fitzsimmons), dated 4 November 2008.

[43] If the user input variables to the Model are logically consistent and with a reasonable range.

B. The Use of TSLRIC+ in the Pricing of ULLS

1. The telecommunications sector of the Australian economy is moving along the path to workably competitive markets, through the development of both intra-modal and intermodal competition. This transformation to competitive telecommunications markets will best serve the LTIE if public policies promote, to the maximum extent, innovation and investment in these competing networks. In the interim, policies should enable the use of Telstra's existing facilities in the most efficient manner possible, through resale and use of those facilities by competitors (such as ULLS). The pricing of these facilities is critical to promoting the development of efficient competition. Prices that are too low may promote short-run competition, through resale or use of Telstra's facilities, but those prices will also reduce the incentives for network investment, delaying—perhaps indefinitely—the emergence of full-fledged facilities-based competition.

2. In this regard, the ACCC has articulated policies mandating that Telstra make ULLS available to competitors at TSLRIC-based prices. Its 2007 statement on ULLS pricing principles notes that:

> "The ACCC has historically been of the view that a TSLRIC+ approach is consistent with the price that would prevail if an access provider faced effective competition, and that it usually best promotes the long-term interests of end-users."
>
> "Further, the ACCC has historically been of the view that a TSLRIC+ pricing approach is consistent with the legislative matters discussed above at 2.2 [relevant sections of the TPA]."
>
> "The Australian Competition Tribunal has also expressed its general agreement with the TSLRIC+ pricing methodology…"[44]

3. The ACCC recently reiterated its position on the use of TSLRIC+ in the pricing of ULLS:

---

[44] "Unconditioned Local Loop Service (ULLS): Final Pricing Principles," Australian Competition and Consumer Commission, November 2007, pp. 9-10.

> "The ACCC is required to have regard to the ULLS pricing principles in an arbitration and considers that it should in this arbitration determine access prices for the ULLS in accordance with those principles. The ULLS pricing principles require that ULLS access prices reflect the TSLRIC+ of providing access to the ULLS."[45]

> "As discussed previously, the ACCC considers that access charges that represent the forward-looking costs of an efficient provider best promote competition. The ACCC's pricing principles make this clear in the adoption of a TSLRIC+ methodology. This is because, over the long run, forward-looking efficient costs lead to conditions which allow the access provider and access seekers to compete in downstream markets on their relative merits."[46]

4. I note, however, that in its Draft Decision, the Commission indicates it may not follow its <u>own</u> pricing principles in the current Telstra ULLS Undertaking.[47] I agree with the submission of Unwired that this change in the pricing principles would provide disincentives for actual and potential competitors to invest in telecommunications infrastructure in Australia:

> "The Commission has revealed in its ULL decision an approach to pricing principles that it will vary the application of the principles if the existing principles would result in increased ULL prices. This is an unfortunate development, both as it provides incorrect incentives to inform build/buy decisions in actual infrastructure (e.g. the copper loops, wireless or HFC) and in adjunct infrastructure (e.g. DSLAMs and backhaul transmission)."[48]

5. Unfortunately, pricing principles notwithstanding, the ACCC has consistently priced ULLS below economically efficient costs, evidently motivated by promoting competition in the provision of broadband services solely through the use of ULLS, even if at the expense of competing network facilities-based competition and the LTIE. In this respect, I agree with Unwired:

---

[45] ACCC Final Decision re Primus ULLS Arbitration, ¶46.

[46] ACCC Final Decision re Primus ULLS Arbitration, ¶321.

[47] "A key implication from recognition of a pragmatic application of TSLRIC is that while estimates of costs in such models provide important information, they cannot be considered conclusive in determining an appropriate access price that meets the reasonableness criteria." ACCC Draft Decision, page 36.

[48] Unwired Australia Pty Ltd. Submission to ACCC in response to Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking- Draft Decision November 2008 and Draft MTAS Pricing Principles Determination November 2008, page 4.

> "Unwired is concerned that the Commission has been significantly under-pricing the ULL service. We do not necessarily believe that the price proposed in Telstra's undertaking is appropriate, but that the Commission is making time inconsistent decisions that appear to be motivated by policy intent. "[49]

6. Based on my reading of its Draft Decision, the ACCC apparently has decided to promote competitors who use Telstra network facilities such as ULLS and has ignored stimulating competition among networks by incenting competitors such as Unwired to build their own competing network. The ACCC has apparently selected the level of ULLS prices which will create more ULLS competition without concern about the real TSLRIC cost. Thus it appears that the ACCC will use whatever pricing or costing methodology will generate that result. This would explain why, after previously rejecting the use of international benchmarks unless great care is exercised to determine that they are valid benchmarks,[50] the Draft Decision now embraces international benchmarks, almost without question, evidently because those "benchmarks" are consistent with the price it intends to set.[51] In this respect, I agree with Unwired that such reasoning reflects

> "A bias in regulatory decision making to promote one kind of facilities based competition (based on ULL) versus services based competition or competition from alternative infrastructure."[52]

[49] Unwired Australia Pty Ltd. Submission to ACCC in response to Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking- Draft Decision November 2008 and Draft MTAS Pricing Principles Determination November 2008, page 6.

[50] Re Vodafone Network Pty Ltd & Vodafone Australia Limited, [2007] ACompT 1, at 68-69 (11 January 2007); Re Optus Mobile Pty Limited & Optus Networks Pty Limited, [2006] ACompT 8, at 122 (22 November 2006); ACCC, Access Pricing Principles – Telecommunications: A Guide, at 12 (July 1997); ACCC Final Decision on Optus' 2004 Undertaking, at 124.

[51] ACCC Draft Decision, page 42.

[52] Unwired Australia Pty Ltd. Submission to ACCC in response to Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking. Draft Decision November 2008 and Draft MTAS Pricing Principles Determination November 2008, page 1.

> "This continued bias is unwarranted. Whether competition develops from services based resale or pseudo-facilities based through ULL should be an empirical question determined by access seekers. It should arise as a consequence of build/buy decisions informed by a set of access prices that are consistent between services and mimic costs. The Commission should not be making decisions to encourage service providers to invest in certain kinds of facilities because it supports a pre-determined Commission model."[53]

7. As suggested by the comments of Unwired, however, ULLS prices below economically efficient costs serve only the interests of those who buy ULLS from Telstra, even as they harm LTIE and companies who are attempting to compete with Telstra and competitive-access seekers by building their own networks and investing in the telecommunications infrastructure of Australia. This highlights the critical conflict between ULLS prices that serve the short-term interests of competitive access seekers (STIC) and those that serve the LTIE. My reading of the record of ULLS pricing shows a "bias in regulatory decision making"[54]: the ACCC has chosen to promote STIC at the expense of LTIE. The use of the ACCC Model for pricing ULLS would extend that bias and cause even further harm to LTIE and facilities-based competitors.

8. This bias has already had harmful effects on network investment, facilities-based competition and LTIE in Australia. To cite one prominent example, Optus has chosen to compete by using the Telstra network rather than investing in its own hybrid fibre-coaxial network. In the United States, wireline telephone companies face vigorous competition on two major fronts: from mobile carriers offering increasingly price competitive voice and data service offerings; and from "cable" companies offering bundles of voice, broadband and video programming services. This vigorous "intermodal" competition has driven broadband connections to 60% of U.S. households.[55] As of June 2007, cable companies served 66 million households over their HFC networks, which represented 52% of U.S. households with

---

[53] Unwired Australia Pty Ltd. Submission to ACCC in response to Assessment of Telstra's Unconditioned Local Loop Service Band 2 monthly charge undertaking- Draft Decision November 2008 and Draft MTAS Pricing Principles Determination November 2008, page 5.

[54] Unwired, op cit page 1.

[55] "Price War Erupts For High-Speed Internet Service," Wall Street Journal, September 2, 2008.

broadband access. DSL providers served 46 million, or 36% of households with broadband.[56] More recent reports indicate that cable HFC networks are gaining market share at the expense of DSL providers:

> "the tide turned dramatically in cable's favor for the first time during the last quarter. Cable companies picked up 75% of the new customers, sending the phone companies into a scramble. As bandwidth-hungry applications like video downloads grow, customers prefer the generally faster speeds cable offers. Cable companies have also been marketing more aggressively in recent months, analysts say."[57]

9. Moreover, this head-to-head facilities-based competition is driving heightened service quality and price competition between cable companies and phone companies:

> "'Phone companies can't just sit back and let cable companies take that much of the broadband market, or they will eventually cede everything,' says John Hodulik, an analyst at UBS. Winning broadband customers has enormous strategic consequences for both cable and phone companies. It gives them a foot in the door to sell other services, such as pay-TV and phone service. Mr. Hodulik says customers are most apt to get phone and TV services from the same company that provides them with their broadband connection. And broadband services are also the most profitable of the bundled services."[58]

10. In light of this growing competition between HFC and DSL technologies in the U.S., and considering the increase in broadband connections in Australia in the past six years,[59] it is quite remarkable that Optus has invested so little in its HFC network. Instead, Optus has chosen to compete by buying ULLS from Telstra—even in areas where its own HFC network passes consumers' homes. Thus, nearly half of all Optus broadband customers are served on Telstra's network, rather than its own HFC network:

---

[56] "Trends in Telephone Service," Industry Analysis and Technology Division, Wireline Competition Bureau, Federal Communications Commission: August 2008.

[57] "Price War Erupts For High-Speed Internet Service," Wall Street Journal, September 2, 2008.

[58] Ibid.

[59] From 3.5% to 23.5% of households: OECD Directorate for Science, Technology and Industry, *Broadband subscribers per 100 inhabitants*, June 2008.

> "This quarter, Optus saw continued ULL growth, with 414,000 ULL subscribers, up from 400,000 a quarter ago. As at 31 December 2008, Optus achieved a key milestone by completing the target build of 366 exchanges with a coverage footprint of 2.9 million premises."[60]

11. Most telling, SingTel Optus' own statements admit that it is not even seriously evaluating or considering the business opportunities involved in expanding and upgrading its own HFC network. For example, SingTel Optus admits that it has not even analyzed the feasibility of connecting Multi-Dwelling Units to its HFC since July 2003, just before ULLS became commercially availability. Evidently, the price of ULLS is so low that Optus does need an analysis to know that it is cheaper to buy than build: capital investment in facilities-based competition has literally been priced out of the market. By pricing ULLS below economic costs, the ACCC has caused Optus to climb down the "ladder of investment,"[61] delayed the benefits of facilities-based competition to telecommunications end-users and deprived the Australian economy of substantial investment and job creation in building telecommunications facilities.

12. There are a number of differences between the U.S. and Australia that may partially explain the huge difference in broadband penetration between the two countries (60%+ in the U.S. versus 23.5% in Australia. However, it is well worth noting that DSL penetration in the two countries is quite similar (approximately 20% of all households). Most of the difference in broadband penetration between the two countries is due to enormous success of HFC networks in the U.S., which serve over 30% of total households, versus the very low and declining percent of Australian households with broadband access over HFC networks

13. To reverse this trend, I recommend that the Commission base its pricing decision in the current Telstra ULLS Undertaking on its long-standing, frequent-stated and correct pricing principles, namely that TSLRIC+ is the proper standard for pricing ULLS to serve the LTIE. Of

---

[60] Singapore Telecommunications Limited And Subsidiary Companies, "MANAGEMENT DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION, RESULTS OF OPERATIONS AND CASH FLOWS FOR THE THIRD QUARTER AND NINE MONTHS ENDED 31 DECEMBER 2008."

[61] For an expanded discussion, see Telstra's Supplementary Submission, "Competing infrastructure in Band 2 areas: the implications of SingTel Optus' HFC network for ULLS pricing," Public Version, 17 March 2009.

course, the effect of this standard on competition, investment, innovation and LTIE depends completely on the proper implementation of the standard, namely, the valid estimation of TSLRIC+. If and only if prices are based upon reasonable and reliable estimates of TSLRIC, will ULLS prices serve the LTIE. Then and only then will competitive access seekers have the proper incentives to use ULLS and invest in complementary equipment (DSLAMs) when it promotes economic efficiency, but not promote rent-seeking behavior in the regulatory arena nor deter investment in facilities-based intermodal competition.

14. As explained in Sections II and III, the flaws and biases in the ACCC Model produce cost estimates of TSLRIC+ that substantially understate the forward-looking costs of a hypothetical, efficient entrant. It is especially noteworthy that all of the errors of omission and commission in the Model work in only one direction: they bias TSLRIC cost estimates downward. Moreover, many of the flaws in the Model are systemic: there are no reasonable remedies within the inherent confines and limitations of the Model. Therefore, use of the Model for ULLS pricing would harm the LTIE. More broadly, unless and until ULLS prices reflect the true economic costs of providing copper loops, the ACCC will harm network innovation and investment, facilities-based competition, economic growth and the long-term interests of end-users.

Robert G. Harris

ROBERT G. HARRIS

PhD, MA, Economics,
University of California, Berkeley

Economic Consultant

BA, MA, Social Science,
Michigan State University

Dr. Robert Harris is a professor emeritus in the Haas School of Business at the University of California, Berkeley. A founder of the Law & Economics Consulting Group, Dr. Harris was a member of LECG's Board of Directors and served as managing director of its Telecommunications Practice. He has testified as an expert witness before congressional committees on antitrust, regulatory policy, and telecommunications legislation; the Federal Communications Commission; the US Department of Justice; 27 state regulatory commissions; and national regulators in Canada, Australia, and Mexico. Dr. Harris has also testified in state and federal courts, arbitration, and mediation on class certification, relevant market definition, competitive effects, liability, damage causality, and economic damages in a wide range of industries. He has published more than 50 academic articles and dozens of reports analyzing competition, public policies, competitive strategies, and technological change.

PROFESSIONAL HISTORY

Present : *Economic Consultant.*
Consultant to telecommunications service providers and equipment vendors on industry analysis and competitive strategy; technological innovation and new product introductions; mergers, acquisitions, and corporate restructuring; market entry and competitive dynamics; price analysis and pricing models; cost models and costing; public policy analysis; and advocacy.

Expert testimony on wireline and wireless telecommunications, emerging technologies, competition policy and transportation policy before US Congress, state legislatures, FCC, DOJ, ICC, CRTC, and regulatory commissions of 27 states.

Expert testimony before state and federal courts in business litigation regarding antitrust, competition, price fixing, monopolization, collusion, mergers, contracts, fair trade, patents, trade secrets, and copyrights.

1977–1997 (active) now *Professor Emeritus*, Walter A. Haas School of Business, UC Berkeley. Taught undergraduate, MBA and doctoral courses in managerial economics; business and public policy; industry analysis and competitive strategy; antitrust economics; telecommunications economics, policy, and strategy. Leadership role in School and campus governance: Chair of the Business & Public Policy Group, Member of the Executive Committee of the School, Chair of the Policy & Planning Committee (elected by faculty) and Director of Executive Education; active service to academic journals, professional societies and government. Academic research on antitrust and regulatory policy, technological innovation, competitive strategy, telecommunications, and transportation; published in journals of business, economics, law, management, and public policy. Speeches and presentations to academic societies, university seminars, and workshops, professional, and trade associations, public policy forums, and corporate conferences.

1993–2006 *Founder* and *Director*, LECG, LLP, Emeryville. Played key role in growth of LECG, development of professional staff from 50 to 400 and expansion from one to thirteen offices worldwide; served on Board of Directors, Executive Committee and Operations Committee; served as Managing Director of Telecommunications Practice, 1993 to 2000.

2001 *Executive Vice President*, Kivera, Inc., Oakland, CA. Leadership role in privately funded software development company offering navigational and location-based services for Internet, intranet, and wireless applications; responsible for strategic planning, strategic alliances, business development, product management, sales, and marketing.

1981–1993 *Founder* and *President*, EconomInc, Berkeley, CA. Consulting in telecommunications, transportation, strategy and public policy; expert testimony in regulatory proceedings and business litigation.

1980–1981 *Deputy Director*, Cost, Economic & Financial Analysis, Interstate Commerce Commission, Washington, DC. Appointed to Senior Executive Service by President Jimmy Carter, 1980; managed staff of 160 analysts; played instrumental role in the implementation of Congressional acts deregulating railroad and motor carrier industries. Played leadership role in development of Uniform Rail Costing System, for use in determination of maximum rate reasonableness.

CONSULTING EXPERIENCE

Consulting to business and industry

- Pacific Telesis: sale of public communications line of business; spin off of wireless properties (AirTouch); development of corporate strategy for advanced services.
- Pacific Bell: pricing structure of local exchange and enhanced services; competitive strategy; broadband deployment and entry into video program distribution; new product introduction; development of corporate strategy for changing state regulatory policy from rate of return to price regulation; reciprocal compensation arrangements among local carriers.
- U S WEST: acquisition of cable TV distribution systems and formation of Media One
- US WEST Communications: regulatory policy, costing and pricing principles; local competition and interconnection; development of corporate strategy for changing state regulatory policy from rate of return to price regulation; reciprocal compensation arrangements among local carriers.
- Ameritech: price regulation; local competition policy; development of corporate strategy for changing state regulatory policy from rate of return to price regulation; entry into long distance services; reciprocal compensation arrangements among local carriers
- IBM: implications of networked computing for market structure and competitive dynamics in the property casualty insurance industry.
- Lucent: implications of emerging competition in local exchange telephone services for switching equipment and related equipment markets.
- Nortel: adoption of ISDN; effects of acquisition or sale of assets on competition in advanced telecommunications desktop equipment (smart-phones, screen-phones).

- Bell Communications Research: public benefits of basic and applied research and development projects and leading-edge telecommunications technologies.

- BellSouth Corporation: effects of rate of return versus incentive regulation for adoption of new digital technologies in local telephone service; corporate restructuring of wholesale, retail businesses; implications of the Internet for local and long distance telephone service.

- BellSouth Communications: development of corporate strategy for changing state regulatory policy from rate of return to price regulation.

- Telus: implications of broadband deployment by local exchange telephone carriers for competition in Canadian market for video program distribution.

- AGT and Stentor Companies: Canadian interconnection and local competition policy.

- Iusacell: Mexican interconnection and local competition policy.

- Southern New England Telephone: development of corporate strategy for changing state regulatory policy from rate of return to price regulation.

- CNW Railroad: corporate restructuring (joint ventures, merger, acquisitions and sale of assets).

- Southern Pacific: route rationalization analysis (economic model for branch line abandonments); pricing of joint trackage rights.

- American Presidents Intermodal: economics of joint venture or strategic alliance with major rail carrier; implications of rail mergers for competition in intermodal traffic.

Consulting to government agencies

- COFETEL: Mexican Commission on Federal Telecommunications: third party expert (COFETEL constituted a group of three experts, one chosen by Cofetel, one chosen by Telmex and one chosen by mutual consent of the parties to determine the price cap system for the basket of controlled services applied to Telmex during the 2003-2006 period).

- Economic Planning Agency, Japan: comparative analysis of telecommunications policy reforms in Japan, USA and UK.

- California Corporation for Economic Development: analysis of benefits of regulatory reforms in the adoption of new technologies in telecommunications.

- California Department of Consumer Affairs: industry analysis; technology innovation and adoption; telecommunications policy.

- California Office of Attorney General: resale price maintenance and distribution policies in video game consoles and games; pricing of infant formula; consolidation of grocery retailing industry and emergence of club stores.

- Interstate Commerce Commission: rail rate regulatory policy; rail merger policy; rail costing methodologies; branch line abandonment policy and process.
- Office of Technology Assessment: role of regulatory policy in technological innovation and adoption in the telecommunications industry.
- U.S. Department of Justice: competitive analysis of office equipment market.
- U.S. Department of Transportation: railroad line consolidation and rationalization; railroad merger policy; freight transportation regulatory policy.
- U.S. General Accounting Office: surface freight transportation policy.

EXPERT TESTIMONY IN REGULATORY PROCEEDINGS

Testimony presented on behalf of:

- Pacific Bell (SBC/AT&T): incentive regulation; pricing of new products and services; public benefits of broadband deployment; pricing of business communications services; methods of cost allocation for multi-use public networks; public benefits of LEC entry into long distance telephone services; implications of broadband deployment by local exchange telephone carriers for competition in market for video program distribution; service quality regulation; reciprocal compensation for interchanged Internet access traffic; review and modification of New Regulatory Framework; competition in broadband distribution services; effects of digital convergence and VOIP on market for telecommunication services; competitive effects of acquisition of Ameritech.
- US WEST (Qwest): incentive regulation; costing methodologies for unbundled network elements and wholesale pricing of local telephone service and pricing principles; local competition and interconnection policy; public benefits of LEC entry into long distance telephone services; reciprocal compensation for interchanged Internet access traffic.
- Ameritech (SBC/AT&T): price regulation; pricing of local exchange telephone services local competition policy; reciprocal compensation to competitive local exchange carriers; reciprocal compensation for interchanged Internet access traffic.
- Telstra: assessment of TSLRIC cost models for using in setting prices of Unconiditioned Local Loop Service for DSL.
- GTE (Verizon): effects of WorldCom-MCI merger on competition in long distance services and Internet backbone services; pricing of local exchange telephone services.
- Bell Atlantic (Verizon): conversion from rate of return to price regulation; competitive implications of FCC telephone and cable price regulation.
- NYNEX Mobile Services: FCC spectrum auction rules.

- BellSouth (AT&T): conversion from rate of return to price regulation; local competition and interconnection policy; competitive effects of WorldCom acquisition of MCI in Internet backbone services; competitive effects of WorldCom acquisition of SPRINT long distance services and Internet backbone services.

- Southwestern Bell (AT&T): conversion from rate of return to price regulation; local competition and interconnection policy; reciprocal compensation for interchanged local traffic and Internet access services; provision of UNE's.

- U S West New Ventures: effects of FCC resale policies on competition in mobile communications services.

- PCS Primeco: competitive dynamics in mobile communications: implications of industry consolidation for bidding processes in spectrum auctions.

- Bell Atlantic Mobile Services: implications of FCC spectrum auction rules for competitive bidding and competition in mobile communications services.

- United States Telephone Association: reform of FCC price cap regulation.

- RBOC's MFJ Task Force: public benefits of judicial relief from MFJ manufacturing restriction for research & development, technological innovation and adoption.

- AGT and Stentor Companies: Canadian interconnection and local competition policy.

- Iusacell: Mexican interconnection and local competition policy.

- GTE Wireless: economic benefits of Federal pre-emption of state regulation of prices of mobile communications services.

- SPRINT: public benefits of emerging technologies in telecommunications.

- UPS: implications of emerging information technologies for competitive dynamics in express package delivery services.

- Western Coal Traffic League: railroad pricing for bulk commodities.

- Southern Pacific Railway: competitive effects of railroad mergers; pricing of joint trackage rights; competitive access to essential intermodal facilities.

- Santa Fe Railroad: competitive effects of railroad mergers and competitive access to essential port facilities.

- American Presidents Line: competitive effects of railroad mergers; competitive access to essential intermodal facilities.

Testimony presented to Legislative Bodies & National Regulatory Agencies:

Joint Economic Committee, U.S. Congress

Commerce Committee, Judiciary Committee, U.S. Senate; Commerce Committee, U.S. House of Representatives; U. S. Department of Justice; Interstate Commerce Commission; Federal Communications Commission; National Telecommunications and Information Administration; Canadian Radio-Television and Telecommunications Commission; Mexican Secretariat of Transportation and Telecommunications; Mexican Federal Telecommunications Commission; Ohio State Legislature; State Assembly of California; State Senate of California; Australian Consumer & Competition Commission

Testimony presented to State Public Utility Commissions:

Arizona, California, Colorado, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Minnesota, Montana, Nebraska, Nevada, New Mexico, Ohio, Oregon, Pennsylvania, Tennessee, Texas, Utah, Virginia, Washington, Washington DC, West Virginia, Wisconsin, Wyoming

EXPERT TESTIMONY IN ANTITRUST, MERGERS, INTELLECTUAL PROPERTY, AND COMMERCIAL LITIGATION

Conducted economic analyses of market structure and competitive dynamics; costs, prices and pricing practices; market entry and exit; mergers, acquisitions and restructuring; causation and quantification of economic damages; and effects of technological innovation and adoption; offered testimony in arbitration, mediation and state and Federal courts:

Telecommunications and information services

- Pacific Bell: resale of telecommunications equipment and services; provision of collocation facilities and unbundled network elements to independent providers of DSL services; provision of access to operational support systems for resale of local exchange telephone services.
- SW Bell: pricing of terminating access to competitive local exchange carriers.
- AirTouch: retail sale of mobile communications services through kiosks in warehouse and club stores; competition with other distribution channels.
- Good Guys: competition in retail sales of mobile communications handsets and services among alternative channels of distribution.
- GTE Wireless: pricing of mobile communications services for resale.
- Siemens-Rolm: after-market servicing of telecommunications equipment (PABXs).

- Allied Signal: on-line transaction services for the mass transit industry.

High Technology Manufacturing & Software

- CISCO Systems: analysis of competition and monopolization in optical switching equipment industry.
- SONY Entertainment: effects of software emulation on competition and innovation in video game consoles and game software.
- Ascend Communications: effects of merger with Cascade Communications on competition in markets for carrier-class Internet access equipment.
- Advanced Fiber Communications: effects of intellectual property violations on competition digital loop carriers systems (for local telephone services).
- SUN Microsystems: effects of Microsoft acquisition of WebTV on competition in the markets for servers, server operating systems and Internet device operating systems (Java, WCE).
- QualCom: implications of technological innovation for competition in mobile communications handsets and components
- Bio-Rad: effects of IP violations on competition in the market for diagnostic equipment for manufacture of integrated circuits from silicon wafers.
- Advanced Micro Devices: semiconductor industry (CPUs for PCs).
- Bio-Rad: biotechnology equipment for monoclonal antibody research.
- Intel: competition in the market of digital-analog converters.

Entertainment, publishing, and advertising

- Universal Studios: motion picture production and distribution rights.
- UA Theatres; Fox-Festival Theatres; Syufy Theatres; Act One Theatres: distribution and theatrical exhibition of first-run movies.
- TCI: implications of interactive TV technologies for competition in cable services and in-home entertainment.
- Fox Films: premium cable television distribution of feature length films.
- United Artists: effects of merger of premium cable movie channels on fees paid to film production companies.

Construction services and building products

- PG&E: impact of bid-rigging in electrical systems installation, nuclear power plant.
- Luminoptics: technological innovation and adoption in the market for lighting ballasts for commercial and industrial buildings.
- Shell Oil et al: pricing of fabricated pipe and fittings for oil refineries, power plants, pulp mills and other continuous flow production facilities.
- Class Action: damage analysis of price-fixing in furnace pipe & fittings industry.

Distribution services

- Albertson's: effects of merger with American Stores on competition in grocery retailing.
- Hahn Development: regional shopping center development and retail leasing.
- Yamaha: wholesale and retail distribution of musical instruments.
- Goody: wholesale distribution of personal care products.
- California AG: retail distribution of replacement tires; vertical restraints in retail sale of video game consoles and games; grocery chain mergers.

Health care services

- California Vision Care Plan, Arizona Vision Care Plan: competition in benefit plans for optometric vision care services; competition in the market for optical goods.

Transportation services

- Kaiser Steel: contract motor carriers in steel manufacturing and distribution.
- Litton: inland waterway carriage and dock services for iron ore.
- Florida East Coast Railway: pricing of through-train services and vertical restrictions in the rail freight industry.

TEACHING

Undergraduate Courses, UC Berkeley:

- Political, Social and Legal Environment of Business
- Telecommunications Economics & Policy
- Business and the Global Economy

Graduate Courses, UC Berkeley:

- Business and Public Policy (MBA Core Course)
- Microeconomic Analysis for Managerial Decisions (MBA Core Course)
- Industry Analysis and Competitive Strategy
- Telecommunications Economics, Policy & Strategy
- Antitrust Law (School of Law, with L. Sullivan, with Thomas M. Jorde)
- Ph.D. Course in Antitrust Economics (Department of Economics)

The Executive Program, University of California, Berkeley:

- Industry Analysis & Competitive Strategy
- Competitive Strategies in Telecommunications and Information Services
- Strategies for Effective Public Policy Advocacy
- Managing Business-Government Relations

Telecommunications Executives, University of California, Berkeley

- Organized and taught one-week course in telecommunications economics, competition, corporate strategy and public policy for executives from telecom users and service providers, equipment vendors and public officials.

Executive Education, Center for Telecommunications Management, University of Southern California

- Half-day seminars in telecommunications economics, competition, corporate strategy and public policy for executives of leading telecommunications service providers and suppliers, from North America, Europe, Asia and Latin America.

On-site executive education

- Pacific Bell: organized and taught ten-week seminar for 300 mid-upper level managers on emerging technologies & competitive strategies in telecommunications.
- Deutsche Telecom: organized and taught one-week course on U.S. telecommunications industry developments and regulatory policies.
- California Public Utilities Commission: one-week course in telecommunications economics & public policy, taught to Commission staff ten times.

- Ministry of Post & Telecommunications, Japan: seminar series on U.S. telecommunications industry developments and regulatory policies.

SELECTED PUBLICATIONS & PRESENTATIONS

Telecommunications Policy

"Telecommunications Policies in Japan: Lessons for the U.S.," presented to Advanced Workshop in Regulation and Public Utility Economics, Monterey, CA, July 1988; presented to Telecommunications Policy Research Conference, October 1988; *California Management Review* 31(3), Spring 1989.

"Telecommunications Services as a Strategic Industry: Implications for United States Policy," *Competition and the Regulation of Utilities*, Michael A. Crew (ed.), Kluwer Academic Publishers: Boston, 1990.

"Gaining Competitive Advantage through Strategic Public Policies: The Case of Japanese Telecommunications," invited lecture, National Economists Club, Washington, D.C., June 1988; *Economics and the Public Interest*, Richard T. Gill (ed.), Mayfield Publishing: Mountain View, CA, 1991.

"Strategic Uses of Regulation: The Case of Line-of-Business Restrictions in Communications," with Robert A. Blau, presented to Academy of Management, Miami, FL, August 14, 1991; *Research in Corporate Social Performance and Policy*, James E. Post (ed.), JAI Press, 1992.

“Price Cap Reform for Local Telephone Access,” with William A. Blasé, Public Utilities Fortnightly, 1994.

“ISDN in the United States: Strategies for Success: Part I - The Diffusion of ISDN,” with Luis A. Enriquez, *New Telecom Quarterly*, 1994. Reprinted in *Blue Sky: New Horizons in Telecommunications.*

"Competition and Unbundling in Local Telecommunications: Implications for Antitrust Policy," with Gregory L. Rosston and David J. Teece, *Telecommunications Policy Research Conference Proceedings,* EAL Press, 1994.

“ISDN in the United States: Strategies for Success: Part II - The Deployment and Adoption of ISDN,” with Luis A. Enriquez, *New Telecom Quarterly*, 1995. Reprinted in *Blue Sky: New Horizons in Telecommunications.*

"State Regulatory Policies and the Telecommunications/Information Infrastructure," presented to Workshop of the National Research Council, Washington D.C., October 1993; *The Changing Nature of Telecommunications/Information Infrastructure*, National Academy Press, 1995.

"The Emergence of Competition in Local Exchange Service," with Lori S. Lent, International Engineering Consortium, *Annual Review of Communications*, 1995-96.

"Competition and Public Policies in Telecommunications: A Survey of U.S. Developments," presented to Conference on Privatization and Deregulation in the US, UK and Japan, Economic Planning Agency of Japan, Tokyo, 1995; *Conference Proceedings*.

"Meddling Through: Regulating Local Telephone Competition in the United States," *Robert G Harris* and *C Jeffrey Kraft*; *Journal of Economic Perspectives*; 1997.

Antitrust Policy

"Passing on the Monopoly Overcharge: A Comprehensive Policy Analysis," with Lawrence A. Sullivan, *Pennsylvania Law Review* 128(2), December 1979.

"Passing on the Monopoly Overcharge: A Response to Landes and Posner," with Lawrence A. Sullivan, *Pennsylvania Law Review* 128(5), May 1980.

"More on Passing On: A Reply to Cooter and to Viton and Winston," with Lawrence A. Sullivan, *Pennsylvania Law Review* 129(6), June 1981.

"Market Definition in the Merger Guidelines: Implications for Antitrust Enforcement," with Thomas M. Jorde, *California Law Review* 71(3), March 1983. Reprinted in *Antitrust Policy in Transition: The Convergence in Law and Economics,* Fox and Halverson (eds.), American Bar Association, 1984.

"Antitrust Market Definition: An Integrated Approach," with Thomas M. Jorde, *California Law Review* 72(1), January 1984. Reprinted, *Corporate Counsel's Annual*, Matthew Bender, 1985. Reprinted, *Antitrust Anthology*, A.I. Gavil (ed.), Anderson Publishing, 1995.

"Horizontal Merger Policy: Promoting Competition and American Competitiveness," with Lawrence A. Sullivan, *Antitrust Bulletin*, January 1987.

Regulatory Policy

"Suppliers of Last Resort: Economics of Self-Supply in Common Carrier Industries," with Robert A. Meyer, *Quarterly Review of Economics and Business* 19(4), Winter 1980.

"Regulation: A Long Term Perspective," *Business Environment/Public Policy: The Field and Its Future*, Edwin M. Epstein and Lee E. Preston (eds.), St. Louis, 1982.

"Public Regulation of Market Activity: Institutional Typologies of Market Failures," with James M. Carman, *Journal of Macromarketing,* Spring 1983.

"Public Regulation of Market Activity: Regulatory Responses," with James M. Carman, *Journal of Macromarketing*, Spring 1984.

"Public Regulation of Market Activity: Regulatory Failures," with James M. Carman, *Journal of Macromarketing*, Spring 1986.

"The Political Economy of Regulation," with James M. Carman, *Business & Society*, S.P. Sethi and C. Falbe (eds.), Lexington Books: Lexington, 1987; republished in *Scaling the Corporate Wall: Readings in Social Issues of the Nineties*, S. Prakash Sethi, Paul Steidlmeier and Cecilia M. Falbe (eds.); Prentice-Hall: Englewood Cliffs, 1991.

"Structural Adjustment through Industry Deregulation: The U.S. Experience in Telecommunications and Transportation," Pacific Economic Cooperation Conference on Structural Adjustment, Kyoto, Japan; *PECC Conference Proceedings,* 1991.

Technological Innovation and policy

"R&D Expenditures by the Bell Operating Companies: A Comparative Assessment," invited paper, Twenty-Third Annual Conference, Michigan State University Institute of Public Utilities, Williamsburg, Virginia, December 9, 1991; *MSU Public Utility Conference Proceedings*, 1993.

"New Plans for Joint Ventures," with David Mowery, *American Enterprise,* Sept/Oct 1990.

"Strategies for Innovation: An Overview," with David C. Mowery, *California Management Review* 32(3), Spring 1990, Co-Editor of Special Issue, "Strategies for Innovation."

"The Implications of Divestiture and Regulatory Policies for Research, Development and Innovation in the U.S. Telecommunications Industry," presented to Telecommunications Policy Research Conference, September 1988; *Telecommunications Policy*, April 1990.

Transportation policy

"Economics of Traffic Density in the Rail Freight Industry," *Bell Journal of Economics* 8(2), Autumn 1977.

"Simple Analytics of Rail Costs and Disinvestment Criteria," *Transportation Research Record* 687, 1978.

"Economic Analysis of Light Density Rail Lines," *The Logistics and Transportation Review* 16(1), Winter 1980.

"Determinants of Railroad Profitability: An Econometric Study," with Theodore E. Keeler, *Economic Regulation: Essays in Honor of James R. Nelson,* William G. Shepherd and Kenneth D. Boyer (eds.), Michigan State University Press, 1981.

"The Financial Performance and Prospects of Railroads in the South and Southwest," with Curtis M. Grimm, *Texas Business Review,* November/December 1982.

"Potential Benefits of Rail Mergers: An Econometric Analysis of Network Effects on Service Quality," with Clifford Winston, *Review of Economics and Statistics* 65(1), February 1983.

"Structural Economics of the U.S. Rail Freight Industry: Concepts, Evidence and Merger Policy Implications," with Curtis M. Grimm, *Transportation Research* 17A(4), July 1983.

"Vertical Foreclosure in the Rail Freight Industry: Economic Analysis and Public Policy Prescriptions," with Curtis M. Grimm, *ICC Practioners' Journal*, July 1983.

"Revitalization of the U.S. Freight Industry: An Organizational Perspective," with Curtis M. Grimm, *International Railway Economics*, K. Button & D. Pitfield (eds.); Crower: London, 1985.

"The Effects of Railroad Mergers on Industry Productivity and Performance," with Curtis M. Grimm, invited paper, Transportation Research Board, National Academy of Engineering, January 1986; *Transportation Research Record* 1029, 1986.

"A Qualitative Choice Analysis of Rail Routings: Implications for Vertical Foreclosure and Competition Policy," with Curtis A. Grimm, *The Logistics & Transportation Review*, March 1988.

Selected presentations

Principles of Imputation, Costing and Pricing of Interconnection and Essential Facilities," Sub-Secretariat of Telecommunications, Government of Mexico (with Dr. Richard Emmerson).

"The Strategic Implications of Interactive Broadband Telecommunications Networks for Competition and Public Policy," National Communications Forum.

"Competitive Implications of Vertical Relations between Equipment Vendors and Telecommunications Services: Lessons from the French Experience," with Joanne Oxley, International Telecommunications Society.

"Obtaining Competitive Intelligence and Creating Competitive Advantage through the Public Policy Process," with Steven Harris, Society for Competitive Intelligence.

"Market Definition and Market Power in the Sports and Entertainment Industry," invited presentation, Antitrust Section, American Bar Association.

"The Effects of Public Policies on ISDN Deployment and Adoption in the U.S.," International Telecommunications Society.

"Assessing the Future of Telecommunications in the Global Economy," invited address, California Telephone Association, Monterey, CA.

"Applications of Incentive Regulation: An International Comparison," invited presentation, Conference of California Public Utilities Counsel, Long Beach, CA.

"The Role of Telecommunications in Regional Economic Development," invited address, Rocky Mountain State Leaders Conference, Billings, Montana.

"Is Public Policy Meeting the Needs of Consumers?" invited panelist, Conference on Telecommunications Technologies and Policies, Center for Communications and Information Science & Policy, University of Pennsylvania.

"Telecommunications as a Strategic Industry," invited address, New England Council, Boston.

"Fiber to the Customer: A Public Policy Perspective," Western Communications Forum.

"State Regulatory Reform: Recent and Future Trends," Conference on State Telecommunications Regulation.

"Strategic Lessons from Deregulated Industries," Strategic Management Society, San Francisco.

"Price Cap Regulation and Economic Forecasting," National Forecasting Conference, Bell Communications Research.

"The Strategic Implications of Telecommunications Deregulation in Europe," invited presentation, Strategic Management Society, Amsterdam.

"Telecommunications Deregulation: Implications for the California Economy," California Foundation for the Environment and the Economy, Carmel.

"A Comparison of U.S. and Japanese Policies toward Information Technologies," International Public Economics Association, Tokyo.

"Information Technologies, Public Policy, and Regional Economic Development," Conference on Regional Development in Japan, Hokkaido University, Sapporo.

"The Implications of Line-of-Business Regulation for Diversification Strategy & Enterprise Structure," Strategic Management Society, Boston.

"The Economic Consequences of Deregulation," Emerging Issues Program, Conference of National State Legislative Leaders, Los Angeles.