

BROADCASTING AND TELECOMMUNICATIONS LEGISLATIVE REVIEW

APPENDIX 1

TO

**SUBMISSION OF CANADIAN NETWORK OPERATORS CONSORTIUM INC. TO
THE BROADCASTING AND TELECOMMUNICATIONS LEGISLATIVE REVIEW
PANEL**

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*International Comparisons
of
Broadband Competition, Pricing, Performance and Regulatory Models
A Report Prepared for the Canadian Network Operators Consortium*

Martyn Roetter, D. Phil (Oxon)

MFRConsulting, Boston, Massachusetts 02116, USA

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This report was prepared for the Canadian Network Operators Consortium Inc. (CNOC) in connection with its participation in the Broadcasting and Telecommunications Legislative Review panel process. All results, findings and any errors, are entirely the responsibility of the author.

Executive Summary

The analyses and evidence reviewed in this report compare the outcomes of selected broadband markets (fixed wireline and mobile wireless) with reference to their consequences for retail customers in several of the most developed economies in North America, Europe, and the Asia/Pacific region. These countries represent wide variations in regulatory models and market structures. Comparisons between these broadband markets and the body of evidence presented and assessed in Section 2 of this report produce twelve key findings:

1. Canadian subscribers pay significantly, and in some cases substantially (two to three times), higher prices for fixed wireline and mobile wireless broadband services capable of handling the volume of traffic generated by their use of popular applications and services than broadband subscribers in “best-in-class” jurisdictions.
2. Moreover, there are substantial variations in fixed wireline and mobile wireless broadband prices within Canada, which may reflect variations in the effectiveness of competition in local or regional markets across the country and demonstrate the sensitivity of the outcomes experienced by retail customers to the number of effective competitors providing retail broadband services.
3. The best performing countries in these comparisons include several markets characterized by a balanced hybrid model of regulation. In these models, broadband services are supplied by a small number of significant competing facilities-based operators whose rivals also include Competitive Services Providers (CSPs) adding value to, and dependent to varying degrees upon connectivity via wholesale services which operators deemed to have market power are obliged to provide.
4. Competition in the provision of mobile wireless and fixed wireline broadband services is becoming increasingly interdependent, because they are primarily complementary rather than competitive or substitutable. The effectiveness of competition on one platform (fixed wireline or mobile wireless) affects competition on the other platform¹.
5. Competitive Services Providers, which add value to wholesale network services, compete against each other and large facilities-based network

¹ Service providers (major operators and CSPs) are increasingly pursuing strategies and implementing operational models so as to exploit the competitive advantage of offering both fixed wireline and mobile wireless broadband services to customers from a single source, as compared to providers which are mobile wireless-only, or even more unenviably fixed wireline-only.

operators by delivering innovative features and entrepreneurial operational models².

6. The impact on the major network operators of their wholesale customers involves much more than the market share or number of retail subscribers the latter capture directly. All broadband customers benefit from this impact, through the responses of the major network operators as they introduce new or modified pricing policies and service offerings so as to limit and rollback the inroads of these other competitors in the retail market.

7. The widespread deployment of NGANs (Next Generation Access Networks), both fixed wireline and mobile wireless to meet customers' growing demands for bandwidth, capacity and coverage requires expensive investments in new technology (fiber and more dense radio networks, including the exploitation of higher frequency bands). The high cost of these investments provides commercial justification for infrastructure sharing^{3,4}.

8. Measures adopted in several jurisdictions to improve outcomes for customers in the provision of both mobile wireless and fixed wireline broadband services involve initiatives to stimulate and ensure more effective competition in these markets, including mandated wholesale access, and secondarily incentives to foster and processes to facilitate more rapid and extensive investment in NGA infrastructure.

9. Market forces are most effective in enabling improvements in the performance of broadband markets when multiple paths to market entry and expansion in the provision of retail services are available, in which CSPs inevitably depend to varying degrees on wholesale services for connectivity.⁵

² CSPs target needs, which the major network operators are slow or reluctant to address, but turn out to be very popular once they are introduced into the market, and they pay attention to customer segments of low priority to, or ignored by these operators.

³ This trend has so far become more widespread among mobile wireless than among fixed wireline operators, Bell Mobility and TELUS being an example in Canada. Regulators do not oppose, or where necessary by local laws, even approve these initiatives subject to obligations to avoid any reduction in competition as a result of discrimination against parties not directly involved in the sharing.

⁴ Examples of infrastructure sharing approved by regulators can be found in Appendix 1 (Country Examples) to the GSMA (GSM Association) report, "Mobile Infrastructure Sharing," <https://www.gsma.com/publicpolicy/wp-content/uploads/2012/09/Mobile-Infrastructure-sharing.pdf>

⁵ The number of competing facilities-based providers at any location is inevitably limited to a small number by the finite capacity of essential resources such as spectrum and physical access paths as well as by the economic infeasibility of deploying multiple transport paths to small communities. In contrast the number of sources (historically, today and in future) of innovative network-delivered services and applications, which require wholesale connectivity, is much larger.

10. A regulatory model including wholesale obligations on operators can be implemented with no negative and potentially positive consequences for investment in network infrastructure⁶.

11. The best practices found in Europe and the Asia/Pacific region to ensure effective competition in broadband markets include the following initiatives in varying degrees and combinations:

- (a) Imposition of wholesale obligations on network operators when and where competitive forces are judged to be ineffective;
- (b) Approval of co-financing of network investments^{7,8}, subject to finding there is no reduction in competition and customer choice as a result;
- (c) Facilitated access to passive infrastructure (ducts/poles, towers);
- (d) Procedural and regulatory measures to decrease the cost and time required to deploy fiber cables in the final drop of the local loop (from the junction box or street cabinet to customers' premises) and minimize administrative burdens in general;
- (e) Public funding for new wholesale-only networks deployed by private operators or local authorities or public-private partnerships;
- (f) Regulatory approaches aimed at stimulating deployments of wireless broadband in areas where the deployment of fixed wireline infrastructure is uneconomic and/or impractical such as:
 - o Conditions in new spectrum licenses requiring rural coverage first⁹;
 - o Reducing the cost of an operator's deployment of new wireless technologies by permitting more active as well as passive infrastructure sharing between mobile wireless operators¹⁰.

12. The most practical path towards increasing and overcoming the demonstrable weakness of competition in Canada's broadband market

⁶ As explained in more detail in Section 3 of this report this finding is corroborated in analyses by the CRTC and Ofcom (UK), as well as by other sources, noting in particular that rates for wholesale services can be compensatory and provide a reasonable rate of return for the infrastructure owner.

⁷ Broadband services providers are encouraged to reach agreements to share the costs of deploying new network infrastructure, provided they do not impair competition. Sometimes but not always these arrangements, in which in several countries local authorities participate, receive contributions from public funds to stimulate the pace of deployment of new network technologies, especially in underserved and the least economically attractive areas, and reduce the risks for any one investor.

⁸ Provided there is no reduction in existing or foreseeable competition and customer choice as a result

⁹ This condition is applied to operators that have already acquired large customer bases in the more profitable areas in a country but have been slow to invest in less profitable rural areas – it is not meant to require that a smaller service provider or entrant should first have to provide service in rural areas.

¹⁰ Footnote 7, *ibid*.

– in both the fixed wireline and mobile wireless segments – lies in the application of fair and reasonable mandated wholesale provisions.

These wholesale provisions should not be limited to setting economically justifiable prices, but must include other conditions, such as timing of order processing, installations and repair for wholesale customers that is equivalent to that offered to retail customers. The wholesale rules should also be forward looking, anticipating the arrival of new network technologies, and follow the principle of technology-neutrality. Wholesale conditions should be established for new essential infrastructure as it is deployed, not after years of litigation and negotiation, so as to avoid unreasonable or competitively harmful delays in the ability of CSPs to offer services that are comparable in performance with the retail services of network operators. The non-price aspects or non-price terms and conditions in agreements and the resulting operating arrangements for the use of wholesale services between operators and CSPs are of critical importance, if the latter are to be responsive to the demands and expectations of retail end-users and able to compete fairly for their custom. They are an integral part of the framework for wholesale provisions¹¹.

The applicability of the best practices being followed in other countries to Canada's broadband market has to reflect Finding 1 that the ineffectiveness of competitive forces in Canada is a national phenomenon. The weakness of competition in the Canadian broadband market is nationwide and not confined to specific locations or segments of the population, although its impact is geographically uneven (Finding 2 above). Hence wholesale provisions have to be applied nationally, in both fixed wireline and mobile wireless broadband markets, to stimulate and maintain effective competition throughout the Canadian broadband market.

1.2 Review of Regulatory Approaches¹²

1.2.1 Introduction

In an earlier era, telecommunications networks were driven by voice (narrowband) traffic, and mobile wireless communications services (now the major source of revenues and profits) were in their infancy. Market structures were dominated by monopolies or quasi-monopolies, mostly state-owned operators, with the notable exceptions of private operators in the US and Canada. Drastic measures were then

¹¹ Australian Competition and Consumer Commission, "Telecommunications Final Access Determination inquiries — non-price terms and conditions," <https://www.accc.gov.au/system/files/NPTCs%20discussion%20paper%20-%20Word%20-%20October%202014.pdf>

¹² Among other sources the discussion in this section draws in particular upon analyses presented in a recent report by the US Federal Communications Commission (FCC): "International Broadband Data Report," <https://www.fcc.gov/reports-research/reports/international-broadband-data-reports/international-broadband-data-report-4>,

taken in many countries in the 1980s and 1990s from the US to Brazil and the UK to restructure markets by privatizing (or in the US breaking up) incumbent monopolies and opening markets to entrants, primarily but not exclusively in the emerging realm of mobile wireless telephony, so as to unleash more powerful forces of competition and innovation.

Today the dynamics of the telecommunications sector are driven by broadband, mobile wireless connections, and recognition of the critical roles of network-based or online applications and services for business, government, and personal activities. These roles extend throughout the economy and influence our social and private lives much more broadly and intimately than telephony did in the last century.

This situation gives rise to controversy revolving around regulatory and antitrust concerns because networks, especially access network elements and transport facilities to small and/or remote communities constitute potential bottlenecks or essential facilities and infrastructure for the delivery of online content, applications and services. There are two areas of concern:

1. Operators with market power in the provision of connectivity may exploit this power to charge unreasonably high prices to connect customers who have no feasible alternative supplier;
2. Vertically integrated operators who also provide services and applications as well as connectivity may unfairly and anti-competitively favour their offerings or those of privileged partners over competing offerings from other third party or so-called over-the-top (OTT) providers, thereby inhibiting innovation in this domain and distorting customers' freedom of choice.

Essential access components of networks are restricted in the number of independent paths that can be deployed, because they involve the use of limited resources such as spectrum as well as space in ducts or on poles installed on or under rights-of-way. Other network elements such as transport facilities serving small communities, which only require limited capacity for traffic to and from other parts of the country, are also non-duplicable for economic reasons. As a matter of economic sustainability there can also only be a very small number of viable terrestrial infrastructures (one or two for fixed wireline access, or one for fixed wireless access,¹³ or in the case of mobile wireless networks three or four for access in dense areas) and perhaps only one for low capacity links to small isolated communities¹⁴.

¹³ Fixed wireless networks are typically deployed where no wireline facilities offering comparable broadband speeds are deployed for reasons of topography and/or economic sustainability.

¹⁴ Satellite links can be and are also used to connect remote communities, but they are less well suited to handling real time interactive broadband communications applications than terrestrial networks. As noted, fixed wireless networks are typically deployed where no wireline facilities offering comparable broadband speeds are available. Thus, they are not substitutable with fixed

These sector-specific factors shape the regulatory models for telecommunications that have been proposed and implemented. These models are diverse, even though in principle they are all designed to pursue the same basic goals of ensuring that:

- ✓ Markets for network services are sufficiently attractive that business plans and investment proposals designed to support the deployment of new and improved broadband networks to deliver these services to meet growing demands are “bankable,” i.e. attractive to potential sources of financing,
- ✓ Competition in the provision of network services is robust, so that customers will benefit from being able to choose between alternative providers whose success - and hence the incentives which drive their business decisions - depends on delivering high quality services at prices that are attractive and affordable, as well as open to and accepting of innovations from multiple sources, and
- ✓ Innovation in the development and provision of the services and applications offered over broadband connections from a wide range of providers flourishes without anti-competitive interference from the operators of essential facilities.

This report assesses the various regulatory models in operation, or evolving, in a number of countries around the world, and the outcomes in their respective broadband markets from the perspective of customers, i.e. the prices and performance of broadband services offered at the retail level. Regulation is only one among many factors or influences upon the evolution of a broadband market and the outcome for customers. So the question of whether or how much influence the regulatory models have had or seem to be having on these outcomes is also addressed.

In addition, this report presents findings as to whether, and if so how, Canadian customers may benefit from changes to the current regulatory model in Canada, taking account of experiences in other jurisdictions. These findings make use of the best available empirical data and insights from international comparisons of broadband market outcomes developed in a number of independent analyses by separate groups with no common agenda. These findings are remarkably consistent regarding the relative outcomes of the broadband markets in Canada and the US. They also delineate the justification and conditions for wholesale obligations designed to expand the number of competing retail broadband service providers, as well as measures to stimulate investment in new and improved broadband

wireline facilities. Accordingly, the focus of this report is on the regulatory and competitive environments relating to fixed wireline and mobile wireless broadband platforms and services, rather than partially complementary satellite and fixed wireless services.

networks to meet customers' growing demands and expectations more effectively and efficiently.

1.2.1 Categorization and Analysis of Regulatory Models¹⁵

At the highest level of generalization, two basic regulatory models are found in the fixed wireline broadband market, namely: (i) A model based on facilities-based competition, and (ii) A model including open access regulations or wholesale obligations on network operators, the owners of facilities (infrastructure). Most countries exhibit a hybrid of these two basic frameworks. Moreover there are significant variations in the actual approaches adopted by regulators in implementing the same model.

The facilities-based competition model relies on competition between the incumbent telecommunications operator and other operators (e.g. cable). The number of operators active at any location or throughout any country with significant market shares varies from a minimum of two in the case of fixed wireline access up to four or sometimes more in the case of mobile wireless access. In contrast the open access regulatory model involves the use of mandated wholesale access to the incumbent's network and in some instances to the networks of other fixed wireline operators deemed to exercise SMP (Significant Market Power), in order to increase service-based competition by encouraging market entry at the retail level.

Under either model, investment in fixed wireline broadband networks may be predominantly market, or also to a noticeable extent state-aid-driven, depending on

¹⁵ This discussion focuses on regulation of wholesale access in the fixed wireline broadband arena. An equally detailed discussion of regulation of wholesale access in the mobile wireless broadband context is desirable, since one of the findings in this report is that the two segments (fixed wireline and mobile wireless) of the broadband market are complementary, so that what happens in one increasingly has an effect on the other on both the supply and the demand sides. However at the highest level of generalization the two basic regulatory models in the mobile wireless and fixed wireline broadband contexts are the same. Also the conclusions presented later in this report regarding the requirements for pro-competitive, fair and reasonable wholesale provisions apply in terms of principles (e.g. with respect to reasonableness of rates, quality of service, timeliness of the availability of wholesale services when a new network technology is introduced etc.) to both mobile wireless and fixed wireline broadband networks, although the technical and other details of what they should cover will inevitably be different. On the mobile wireless side the question of mobile wireless roaming charges is very contentious, and central to the ability of retail mobile wireless services providers with limited or no network facilities of their own to compete on a fair and reasonable basis – see “Telecom Order CRTC 2018-99,” <https://crtc.gc.ca/eng/archive/2018/2018-99.pdf> in which wholesale data roaming rates charged by the national operators were set at around CDN\$14/GB. This rate is substantially higher than the wholesale data roaming rates charged in Europe as of Q3 2017 which have fallen considerably in recent years – see “International Roaming BEREC (Body of European Regulators for Electronic Communications) Benchmark Data Report April-September 2017,” especially Figures 53-59, https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/8011-international-roaming-berec-benchmark-data-report-april-2017-september-2017.

the extent to which governments subsidize network deployment. Table 1¹⁶ associates a number of countries in North America, Europe and Asia/Pacific with the basic regulatory framework that applies in their fixed wireline broadband markets.

Table 1: Basic Regulatory Models by Country

Country	Primarily facilities-based competition	Significant open access regulation
North America		
Canada	√	
USA	√	
Europe		
Austria		√
Belgium		√
Czech Republic		√
Denmark		√
Estonia		√
Finland		√
France		√
Germany		√
Ireland		√
Netherlands		√
Norway ¹⁷		√
Italy		√
Spain		√
Sweden		√
Switzerland ¹		√
U.K.		√
Asia/Pacific		
Australia		√
Japan		√
South Korea	√	
New Zealand		√

A central question investigated in this report is whether there is evidence of a clear differentiation in broadband market performance between regulatory models sufficient to demonstrate the superiority of one model over the other, in terms of the speeds and retail prices of broadband services offered to customers. In the event of a finding that such is not the case, then explanations for observable divergences in broadband market performance must include consideration of other factors that influence and may affect and even outweigh the impact of the basic regulatory

¹⁶ Adapted from FCC, "International Broadband Data Report," *ibid*.

¹⁷ As of January 2019 the only European countries in this list not members of the European Union

model, accompanied by recognition that there is no single path to achieving superior broadband outcomes. These other factors may lie in:

- More detailed aspects of how the regulatory models are implemented in different countries, and/or
- Other government policies that influence the deployment of broadband networks and the pricing of broadband services, and/or
- Variations in the strategies and capabilities of the competing broadband services providers who participate in the various national markets as well as
- Specific factors in national or regional environments, which affect the dynamics of the broadband market directly or indirectly (e.g. geography, demographics and income distributions etc.), and
- The initiatives of specific individual operators or services providers with substantial market power.

In practice there are substantial variations between countries in the implementations of the regulatory model within each basic framework. For example, in the category of facilities-based competition, the US Federal Communications Commission (FCC) initially imposed an unbundling obligation on traditional wireline services and facilities (e.g., digital subscriber line (DSL)). But it then eliminated these requirements for wireline broadband Internet access service providers in 2005, and also declined to impose unbundling requirements on certain incumbent local exchange carrier (LEC) next-generation networks. Furthermore wholesale obligations were never imposed on cable operators. Telephone companies in the US pointed to this asymmetry as justification for the removal of their wholesale obligations when it became obvious that the two formerly separate categories of operator were competing directly for broadband customers.

Canada also introduced unbundling requirements for DSL, fiber-to-the-node (FTTN) also called fiber-to-the cabinet and fiber-to the premises (FTTP), as well as for cable operator infrastructures. Canada's fixed wireline wholesale obligations are formally rather extensive, including a decision by the CRTC (Canadian Radio-television and Telecommunications Commission) to link mandated wholesale access to FTTP access facilities with the future deployment of disaggregated wholesale HSA (High-speed access) services¹⁸. However the reality encountered by would-be users of wholesale broadband services is problematic, particularly with regard to HSA over fiber to the premises networks, where substantial gaps in availability have been identified¹⁹.

¹⁸ CRTC TRP 2015-326, <https://crtc.gc.ca/eng/archive/2015/2015-326.htm>

¹⁹ "An application by Canadian Network Operators Consortium Inc. pursuant to sections 24, 32 and 47 of the *Telecommunications Act* and part 1 of the *Canadian radio-television and Telecommunications Commission rules of practice and procedure*," <http://www.cnoc.ca/wp-content/uploads/2017/03/CNOC->

Facilities-based competition between incumbent telecommunications and cable operators remains the dominant characteristic of Canada's broadband market. Furthermore in submissions (referenced in Section 2.2 below) to the Canadian Competition Bureau's Market Study Notice: Competition in Broadband Services these operators incorrectly (as discussed in Part 2 of this report) characterize the platform competition between them as sufficient for ensuring overall effective competition in retail markets.

South Korea, a country with very different institutional and other relationships between the private and the public sectors than North America relied at first on facilities-based competition between the incumbent and two entrants to achieve a high rate of broadband penetration²⁰. Initially, DSL was classified as a relatively unregulated service, and the two entrants provided broadband service through cable modems using cable facilities leased from the Korea Electric Power Corporation (KEPCO), a state-owned utility. However, once the incumbent had surpassed the entrants to become the dominant market leader, South Korea then shifted to a regulatory regime that imposed open access and related requirements on the incumbent's older copper-based access network. Another significant factor in the development of the broadband market and facilities-based competition in South Korea has been the government's subsidization of network deployments by cable and DSL entrants as well as the incumbent telecommunications operator. This state-aid driven approach has continued with the subsequent establishment of major national public funding programs for the deployment of NGA (Next Generation Access) fiber networks. The influence and institutional ability of the South Korean government to intervene directly in the business decisions of network operators (including for example their pricing) is significantly greater than (and beyond what would be considered tolerable except in extreme circumstances) in North America.

There are also noteworthy variations within the category of countries with significant open access regulations, not only as between the regions of Europe and Asia/Pacific, but even within the European Union, although EU member states are bound by a common regulatory framework and other directives. Nevertheless implementation by individual EU member states is characterized by different

Application-for-Transitional-FTTP-Access-Final.pdf, <http://www.cnoc.ca/wp-content/uploads/2017/03/CNOC-Application-for-Transitional-FTTP-Access-Final.pdf>; and the more recent (November 2018), "An application by Canadian Network Operators Consortium Inc. before the Canadian Radio-television and Telecommunications Commission in the matter of pursuant to part 1 of the *Canadian Radio-television and Telecommunications Commission rules of practice and procedure* to review and vary *Review of wholesale wireline services and associated policies*, Telecom Regulatory Policy CRTC 2015-326 and *Follow-up to Telecom Regulatory Policy 2015-326 – Implementation of a disaggregated wholesale high-speed access service*, including over fiber-to-the premises access facilities, Telecom Decision CRTC 2016-379, <http://www.cnoc.ca/wp-content/uploads/2018/11/CNOC-Application-to-R-and-V-TRP-2015-326-and-TD-2016-379-20181107-with-Attachments-Final.pdf>

²⁰ Sujin Choi, "Facilities to Service Based Competition, Not Service to Facilities Based, for Broadband Penetration and Investment: A Comparative Study between the United States and South Korea," <https://ssrn.com/abstract=1989168> (downloadable from this site)

national approaches to access pricing and other wholesale obligations, for both legacy networks and NGA networks. National regulators have some discretion to adapt the common EU legal framework for open access regulations to local market conditions and the national policy goals of their respective countries. In Germany and the UK, the incumbent's wholesale access obligations are based on the type of network technology. Wholesale access to legacy (copper loops) networks is straightforward while access to advanced networks (fiber loops) is more difficult or restricted²¹. The intent of Ofcom's emerging regulatory approach in the UK²² is to encourage service providers other than the incumbent Openreach (BT) to deploy competitive fiber networks in areas, which generate sufficient revenues that competing fiber access networks can be economically viable. Ofcom distinguishes between competitive, potentially competitive, and non-competitive areas²³. Competition in this context refers to facilities-based competition. In particular geographic areas with three competing fixed networks available to the majority of premises, which it is estimated will be economically viable for about 40% of UK households, are likely to be considered as competitive on this basis. Ofcom states explicitly that where and when facilities-based competition is ineffective wholesale provisions will be in force, and perhaps additional measures will be introduced to ensure vulnerable customers are protected.

Japan developed a similarly differentiated approach to the open access regulatory model. The Japanese regulator extended wholesale access obligations to the incumbent's fiber infrastructure, but the unbundling requirements initially established for fiber allowed the incumbent to offer access terms and conditions that were viewed as less effective in promoting service-based competition than those for copper local loop.

For their part Australia and New Zealand adopted open access regimes for fiber NGA networks that differ from those in Japan and Europe (although the UK has recently moved in the same direction). Both countries chose to make the deployment of publicly funded national fiber access networks conditional on a strong form of open access requiring structural separation of network ownership and wholesale operations from the provision of retail services.

In Europe the UK regulator Ofcom has adopted a policy similar to that of Australia and New Zealand. In March 2017, the incumbent BT agreed to Ofcom's requirements

²¹ Ofcom justifies this differentiation as a means to encourage parties other than the incumbent BT to invest in their own fiber access networks in locations with the greatest revenue potential, helped by facilitated access to BT's extensive network of ducts and poles - "Wholesale Local Access Market Review: Statement – Volume 1 Markets, market power determinations and remedies," https://www.ofcom.org.uk/data/assets/pdf_file/0020/112475/wla-statement-vol-1.pdf

²² Ofcom's approach to future regulation, "Regulatory certainty to support investment in full-fibre broadband," https://www.ofcom.org.uk/data/assets/pdf_file/0025/116539/investment-full-fibre-broadband.pdf

²³ Footnote 22, *ibid.* Section 4, "Reflecting varying competitive intensity in different geographic areas

for the legal separation of its network division²⁴, Openreach. Openreach will become a distinct company within BT with its own Articles of Association so that in principle it will be obliged to make decisions in the interests of all its downstream clients. Ofcom hopes that this change will enable greater competition between communication providers that will lead to an accelerated rollout of fiber closer to end-user premises. In a related proposal, BT's competitors will gain improved access to BT's duct and pole infrastructure to lay their own fiber cables (passive infrastructure access). This development will complement existing remedies based on wholesale active products.

The extent of facilities-based competition is another aspect of the variations found across countries with an open access regulatory model. In Europe, the cable network footprint ranges from no presence in several countries to nearly ubiquitous (over 95 percent) coverage of households in a few others. However cable deployment is generally limited to densely populated urban areas, and to a lesser extent some suburban areas²⁵. Facilities-based competition from cable operators is recognized as one of the main drivers of NGAN rollout in a number of European countries, such as the Netherlands. Interestingly national regulators in some EU member states have decided to move from a policy of uniform nationwide access pricing to geographically differentiated access regimes in which access prices and wholesale obligations vary according to the intensity of prevailing facilities-based competition in local geographic markets.

Open access regulatory models also exhibit differences in the access price and other non-price access terms and conditions, such as the minimum number of lines competitors can lease. In principle the lower the access price, the greater the incentive (or the lower the entry barrier) for new providers targeting the retail market, whereas conversely a high access price tends to discourage retail entry, and if high enough may effectively operate as if a facilities-based competition model is operating.

The EU regulatory framework has extended open access regulations to fiber-based NGA networks in EU member states. Arguably this framework imposes much more comprehensive obligations on NGA²⁶ networks as compared to regulatory policies in the leading broadband markets in Asia.

²⁴ Ofcom, "International Communications Market Report 2017," https://www.ofcom.org.uk/data/assets/pdf_file/0032/108896/icmr-2017.pdf

²⁵ BEREC report, "Challenges and drivers of NGA rollout and infrastructure competition," https://berec.europa.eu/eng/document_register/subject_matter/berec/reports/6488-berec-report-challenges-and-drivers-of-nga-rollout-and-infrastructure-competition

²⁶ Next-generation access (NGA) networks are defined as new, or upgraded, access networks that can allow substantial improvements in broadband speeds, typically being able to provide actual speeds in excess of 24Mbps. NGA networks can be based on a number of technologies such as fiber-to-the-cabinet, DOCSIS 3.0 cable and fiber-to-the-premises/home/building (FTTP/H/B).

The Digital Agenda presented by the EC (European Commission) forms one of the seven pillars of the Europe 2020 Strategy, which sets objectives for the growth of the European Union by 2020. The Digital Agenda sets out targets for NGA coverage by 2020 of download rates of 30 Mbps for all of its citizens. At least 50% of European households should be subscribing to Internet connections above 100 Mbps by 2020²⁷.

In 2017 the EU conducted a mid-term review of its Digital Single Market programme. It found that 35 proposals and initiatives had been published, such as the WiFi4EU scheme which will support the installation of Wi-Fi coverage in places that are the center of community life (local municipalities, libraries, health centers). The EU has also extended its thinking beyond 2020 to address longer term broadband needs and has talked of a 'Gigabit society' in which by 2025 all schools, transport hubs and main providers of public services as well as digitally intensive enterprises should have access to internet connections with download/upload speeds of 1 Gbps. In addition, all European households, rural or urban, should have access to networks offering a download speed of at least 100 Mbps, which can be upgraded to 1 Gbps, and all urban areas as well as major roads and railways should have uninterrupted 5G wireless broadband coverage.

The EU aims to achieve this very ambitious outcome by introducing incentives for investments and measures to reduce the costs of NGA deployment (e.g. by encouraging joint investments and the sharing of civil infrastructure). Member States have now transposed the Cost Reduction Directive²⁸ into national law. This directive aims to reduce costs by making it easier to share and re-use any infrastructure that can deliver broadband services. In addition to facilitating access to physical infrastructure, the directive is also aimed at coordinating civil works more efficiently ("dig once", for example), and simplifying the procedures for granting construction and installation permits.

A variation of regulation within Europe is found in Switzerland, which is not a member of the EU. The Swiss model promotes infrastructure sharing and co-investment arrangements for fiber-based NGA networks based on partnership agreements between the incumbent operator and local utilities, as an alternative to mandatory fiber wholesale access obligations. Within the EU France has also established a regime for co-financed fiber deployments in less densely populated regions²⁹.

²⁷ Study on Broadband Coverage in Europe 2017, <https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017>

²⁸ Directive 2014/61/EU of the European Parliament and the Council, <https://ec.europa.eu/digital-single-market/en/news/directive-201461eu-european-parliament-and-council>

²⁹ "The French Broadband Programme: a network of opportunities," <https://www.ashurst.com/en/news-and-insights/insights/the-french-broadband-programme-a-network-of-opportunities/>

Public funding or subsidization of broadband networks is a significant aspect of public policy in many jurisdictions, in addition to the extent and types of wholesale obligations, which vary within as well as between the basic regulatory models. In the open access model, public funding for broadband deployment tends to be closely linked to open access requirements, most strikingly in the context of the structural separation arrangements for both Australia's and New Zealand's publicly-funded national fiber access networks already referenced. In addition, under EU guidelines on national state aid projects for broadband deployment, network operators are generally obligated to provide wholesale access to service providers for a period of at least seven years. In Europe and elsewhere, many publicly funded municipal networks also operate based on an open access model.

Australia provides a sobering example of the potential pitfalls of government-subsidized broadband development. The Australian government budgeted A\$43 billion (about US\$40 billion) for its government-owned and operated National Broadband Network (NBN) launched in 2009. The project was eventually scaled back after repeated delays and cost overruns that caused the budget to grow to A\$72.6 billion in four years³⁰. One lesson to be drawn from the NBN's lack of progress is that to be successful such a venture should be presented and developed as a key part of a country's infrastructure for the long term, and pursued within a framework for planning and implementation that is as independent as possible from the ebbs, flows, timing and inevitably fluctuating short term pressures of electoral politics.

All countries in Europe use public subsidies to drive broadband investment, including some examples generally regarded as leaders in broadband performance, notably in Scandinavia. In the case of Sweden, a package of measures adopted in 2000 to promote broadband development included funding for a national backbone network. In addition, municipalities and community-owned local utilities have become the most important alternative operators in the Nordic countries and the Netherlands by directly investing in the deployment of fiber networks. Sweden uses municipal networks to drive investment in advanced broadband networks. Municipal networks have been deployed in the great majority of Swedish municipalities, and accounted for just over 20% of fixed wireline broadband investments in 2015³¹.

³⁰ The NBN project is very controversial in Australia and there is an ongoing blame game about responsibility for its failure to meet the hopes and ambitions expressed when it was first announced in April 2009 to provide terrestrial fiber network coverage for 93% of Australian premises by the end of 2020. Fixed wireless and satellite coverage would serve the remaining 7%. The NBN's progress has been plagued by lack of transparency and political infighting during a period of turbulent politics and a rapid succession of governments, even while Australia's economy has been flourishing as one of the most successful in the world.

³¹ A Completely Connected Sweden by 2025 – a Broadband Strategy, <https://www.government.se/496173/contentassets/afe9f1cfeaac4e39abcdd3b82d9bee5d/sweden-completely-connected-by-2025-eng.pdf>

In countries with a facilities-based competition model, South Korea's subsidization of broadband deployment, already discussed, differentiates its approach from the US and Canada. The US has adopted a deregulatory and largely market-driven broadband strategy, while Canada's model has a less laissez faire approach, all of which contrasts to South Korea's combination of a facilities-based competition model linked to a strong state-aid driven effort to encourage broadband investment. Interestingly despite the differences in their basic regulatory models, South Korea's broadband strategy is comparable to Japan's in that the governments of both countries have pursued an active interventionist strategy to foster broadband development.

2. International Comparisons of Broadband Performance and Pricing

2.1 Key Results

- Several independent analyses using different methodologies find consistently that customers in Canada and the US are paying significantly higher prices for broadband services – both fixed wireline and mobile wireless – than their counterparts in several other countries³².
- There is no evidence that these higher prices are justified by materially superior performance of the broadband services available in Canada or the US compared to elsewhere.
- These results contradict the claim made in some submissions to the Canadian Competition Bureau's Market Study Notice: Competition in Broadband Services, referenced in the following Section 2.2 that the current broadband market structure and regulatory obligations on operators in Canada are generating effective competition in the retail market that benefits customers.

2.2 Introduction – Legitimacy of International Comparisons

The findings and claims of the relative standings of national broadband markets in terms of their success, and hence assessments of the relative merits of the regulatory models they represent are controversial. The telecommunications incumbents and leading cable operators in the US and Canada have frequently argued that they deliver superior results. They claim that they are or will only be inhibited in their performance and discouraged from making continuing necessary investments if significant wholesale obligations are imposed on them. At times when

³² Appendices 1 and 2 to this report rebut the claims made in two other sources provided by TELUS that to the contrary Canadians enjoy very reasonable or even by international benchmarks superior prices for their broadband connections. One (by NERA Economic Consulting) is based on an analysis of broadband plans that does not represent customers' choices in the real world, while the other is based on an Affordability Index calculated by the Economist Intelligence Unit (EIU), which also does not accurately reflect conditions in today's broadband market in Canada or in comparable developed economies.

such wholesale obligations are or have been in place these large operators have argued they would deliver better results if the obligations were removed or substantially weakened.

The large operators also state that the broadband markets in which they operate benefit from healthy competition, thanks to their two distinctive alternative fixed wireline technology platforms. Furthermore, they sometimes refer to wireless-based broadband services (mobile terrestrial and satellite) as effective additional sources of competition in the provision of broadband services, at least for some customers. They assert that the competitiveness of mobile or other wireless with fixed wireline broadband services will become more widespread thanks to emerging 5G networks with expectations of offering substantially higher speeds than today's principal wireless technology (4G LTE), thereby ensuring that competition in broadband markets is bound to increase in future without the need for any new or more extensive regulatory interventions to achieve this outcome. However, as discussed later in Section 2.3.3 of this report, mobile wireless and fixed wireline broadband services are complementary to each other rather than competitors. The leading fixed wireline broadband suppliers in Canada are also major providers of mobile wireless broadband services. One observable trend is growth in the offering of bundled (fixed wireline and mobile wireless) services to customers to meet their preference for receiving both from one supplier, encouraged by the discounts offered compared to the cost of paying for two stand-alone services as well as the convenience of having all applications accessible whether using one or the other platform³³.

The relationship or interaction between mobile wireless and fixed wireline broadband services is not increasing the overall intensity of competition in the broadband market. In the Canadian environment this interaction tends to reinforce the entrenched positions of members of the leading fixed wireline network operators who are also major mobile wireless operators.

Statements by large operators that competition in the Canadian broadband market is strong are meaningless absent evidence to demonstrate that such is the case. Competition is a means to an end – affordable, ideally universally accessible high quality broadband services – not an end in itself. The end is to achieve the best possible outcome for the supply and operation of broadband services for the benefit of customers as well as the pursuit of a country's economic and social goals, in recognition of the role of broadband as an essential part of modern infrastructure³⁴.

³³ Verizon's recent announcement of a restructuring of its businesses around customers instead of around network technology (wireless and wireline) is further evidence of this trend – "Verizon to reorganize business segments," <https://www.reuters.com/article/us-verizon-segments/verizon-to-reorganize-business-segments-idUSKCN1NA1DW>

³⁴ Access to the internet, which requires access to broadband, is increasingly viewed as a human right UN Human Rights Council, – *Report of the Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression, Frank La Rue*, <https://digitallibrary.un.org/record/772915?ln=en>

Hence the question to be addressed and answered on the basis of the best available evidence is whether the relative levels of performance of different national broadband markets demonstrate the superiority of any, and if so of which particular combination or combinations of regulatory model and other factors in fostering broadband outcomes that produce the best results for customers.

Several submissions in response to the Canadian Competition Bureau's Market Study Notice: Competition in Broadband Services claim that broadband competition in Canada is intense in its current market structure³⁵. This claim is irrelevant and devoid of probative value unless accompanied by credible evidence that this "competition" delivers results demonstrating its effectiveness as a means to deliver superior and even "best in class" outcomes for Canadian customers in terms of metrics such as prices, performance and quality of services, and the supply of a rich set of innovative features and capabilities over time. No such evidence has been produced³⁶, while this report contains a wealth of information that refutes it.

Analyses that try to make "apples to apples" comparisons of broadband prices and performance across countries are very difficult. The demand factors that generate different broadband prices and offerings vary widely from one country to another. These analyses have to account for factors such as the:

1. Different costs of deploying and operating broadband networks within and across diverse national territories or topographies;
2. Demographic differences that affect demand for broadband service;
3. Multiproduct bundling in broadband pricing;
4. Variations in broadband services offerings in each country; and
5. Availability and quality of complementary content and applications, which also affect broadband demand.

The influence of and interactions between these variables mean that the structuring of fully "apples to apples" comparisons may be an impossible task. Nevertheless

³⁵ For example, Giganomics, "Report on Regulation of Fixed Wireline Wholesale Access to High-Speed Networks in Canada and Other Countries," prepared for Cogeco Communications Inc., Quebecor Media Inc., on behalf of its affiliate, Videotron Ltd., Rogers Communications Canada Inc., and Shaw Communications Inc. [http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapi/Giganomics_Consulting_Inc--Report_August_30_2018.pdf/\\$file/Giganomics_Consulting_Inc--Report_August_30_2018.pdf](http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapi/Giganomics_Consulting_Inc--Report_August_30_2018.pdf/$file/Giganomics_Consulting_Inc--Report_August_30_2018.pdf); BCE Canada Inc., "Comments on Market Study, Notice on Broadband Services," [http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapi/BCE_Inc_Comments_on_Market_Study_Notice_on_Broadband_Services.pdf/\\$file/BCE_Inc_Comments_on_Market_Study_Notice_on_Broadband_Services.pdf](http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapi/BCE_Inc_Comments_on_Market_Study_Notice_on_Broadband_Services.pdf/$file/BCE_Inc_Comments_on_Market_Study_Notice_on_Broadband_Services.pdf)

³⁶ Appendices 1 and 2 demonstrate the flaws in claims that have been made of the superiority of Canada's broadband market performance relative to international benchmarks.

unless the goal of planning and implementing policies based on evidence is abandoned, in favor of reliance on unsubstantiated assertions or assumptions regarding, for example, the virtues of market forces or the “invisible hand” on one side, or the superiority of much greater government control and involvement on the other, the effort to make these comparisons is justified, even if they can only be good but not perfect. Moreover there are guidelines for ensuring that the results obtained are as credible and reliable as possible. Among these guidelines are consideration of the findings of analyses which:

- (a) Originate from sources that do not have a specific axe to grind, and/or do not reflect an obvious ideological bias;
- (b) Present results that are broadly consistent from multiple independent sources using varied methodologies for collecting and analyzing data; and
- (c) Explain the methodology used to generate the data on which the findings are based in sufficient detail to show that they represent a professionally competent and objective approach, and the limitations inherent in the analysis are described.

The following sources of international comparisons of the retail prices, broadband performance in terms of speeds in a number of countries and their regulatory models have been reviewed for the purposes of this report:

1. Worldwide Price Comparison (cable.co.uk)³⁷
2. OECD Broadband Portal³⁸
3. Federal Communications Commission (US) – Sixth International Broadband Data Report³⁹
4. Nordicity Report - 2017 Price Comparison Study of Telecommunications Services in Canada and Select Foreign Jurisdictions, October 5, 2017 produced for Innovations, Science, and Economic Development Canada (ISED)⁴⁰.

³⁷ <https://www.cable.co.uk/broadband/deals/worldwide-price-comparison/>

³⁸ <http://www.oecd.org/sti/broadband/broadband-statistics/>

³⁹ FCC, “International Broadband Data Report,” *ibid*.

⁴⁰ Nordicity “2017 Price Comparison Study of Telecommunications Services in Canada and Select Foreign Jurisdictions,”
[https://www.ic.gc.ca/eic/site/693.nsf/vwapj/Nordicity2017EN.pdf/\\$file/Nordicity2017EN.pdf](https://www.ic.gc.ca/eic/site/693.nsf/vwapj/Nordicity2017EN.pdf/$file/Nordicity2017EN.pdf)

2.3 International Comparisons of Broadband Services

2.3.1 Review of Available Evidence for Fixed Wireline Broadband

The most recently compiled data are found in the cable.co.uk analysis, “Worldwide Price Comparison”. The coverage of this analysis is quasi-global (some 200 countries), which means it includes many countries much poorer and otherwise not usually considered as reasonable to compare to Canada. Hence Canada’s ranking reproduced below is not comparable to those found in other international comparisons, which cover at most some two dozen nations. Nevertheless, the regional assessment of the situation in Northern America in this work is striking:

“There are only four countries considered Northern America: Canada, the United States, Greenland and Bermuda. Conversely to what one might expect, this region is on the expensive side, with only Canada scraping into the top 100 cheapest in 97th place with an average broadband package price of \$57.66.

...coming in 119th place worldwide, one would expect American packages to be considerably cheaper. But while broadband in the United States is widely available and uptake is high, lack of competition in the marketplace means Americans pay far more than they should, compared to much of the rest of the world.”

A more relevant observation than Canada’s overall ranking in this global league table of broadband pricing is that it ranks below several members of the European Union (France, Italy, Germany, UK, Spain, Belgium, Austria, Denmark, Finland, and Sweden) as well as below South Korea and Japan, although higher than the US. This report converts all prices to US dollars using market exchange rates. The broadband prices on which these rankings are based reflect the average of prices in the offers found in each country, and do not create rankings which may differ between different packages according to the features they include or their performance e.g. speed.

A description of the data gathering methodology employed and the steps taken in generating this report, including its limitations, can be found at: <https://s3-eu-west-1.amazonaws.com/assets.cable.co.uk/broadband-speedtest/worldwide-broadband-price-comparison-methodology-2018.pdf>.

Cable also carries out global audits of download broadband speeds⁴¹. The results based on measurements taken between June 2017 and May 2018 ranked the US in 20th and Canada in 33rd place. Apart from the US the top 20 countries were all in Europe or Asia. The data for this audit was collected by M-Lab, a partnership between New America’s Open Technology Institute, Google Open Source Research, Princeton University’s PlanetLab and other partners.

⁴¹ <https://www.cable.co.uk/broadband/speed/worldwide-speed-league/>

OECD Broadband Pricing Data

The OECD Broadband Portal publishes statistics on broadband in its member countries. The latest data on pricing as of June mid-2017 which is available from the OECD as of December 2018, using both market and purchase power parity (PPP) exchange rates to convert prices in national currencies to US dollars, showed Canada in 32nd position out of 35 OECD countries for so-called “high users” (25 Mbps and above) of fixed wireline broadband – based on Rogers’ Ignite 30 service package - with the US occupying 33rd place (for prices converted to US\$, whether using market exchange or PPP rates) based on a service package from the leading broadband supplier, the cable operator Comcast.

FCC Fixed Wireline Broadband Data

The FCC’s Sixth International Broadband Data report includes both speed and price comparisons, in its Appendices B and C respectively.

Comparisons of Actual Broadband Speeds

Data on actual fixed wireline and mobile wireless broadband speeds gathered in speed tests by Ookla are presented for the US and 27 comparison countries giving a ranking of fastest actual speed (1st) to slowest (28th). Broadband speeds are often presented as either advertised speed or the actual speed. In this case actual speed data from Ookla are used for fixed wireline and mobile wireless international speed comparisons, which are collected primarily from software-based tests on an end user’s device using speedtest.net. The data are aggregated at the city level and include observations in 2014, 2015, and 2016 for cities in both the US and other countries. The following Table 2 is reproduced from the FCC report.

Table 2: Mean (Weighted) Fixed Wireline Download Speed by Country (2014-2016)⁴²

Country	2014		2015		2016	
	Rank	Mbps	Rank	Mbps	Rank	Mbps
Luxembourg	1	222.13	1	344.40	1	375.78
Japan	7	35.20	2	81.50	2	102.34
Iceland	6	37.32	8	45.96	3	90.36
South Korea	2	53.15	3	66.77	4	86.98
Switzerland	3	50.32	4	65.86	5	79.58
Sweden	4	47.77	5	58.14	6	73.81
Netherlands	5	45.20	6	56.54	7	67.54
Denmark	14	30.50	13	39.56	8	61.49
Spain	11	31.83	7	46.58	9	57.86
United States	15	28.09	11	40.38	10	55.07
France	21	22.02	16	33.59	11	54.80
Norway	9	33.85	10	42.12	12	54.71
Belgium	13	30.54	17	32.79	13	48.50
Finland	10	31.95	9	43.05	14	47.89
Portugal	12	30.97	14	36.70	15	46.14
New Zealand	18	26.40	19	32.07	16	44.99
Canada	20	22.85	20	31.88	17	44.29
United Kingdom	16	27.68	15	34.43	18	42.17
Germany	17	26.56	18	32.57	19	41.94
Ireland	8	34.16	12	40.09	20	40.28
Czech Republic	22	20.48	23	24.89	21	37.13
Estonia	19	24.86	21	28.71	22	35.05
Austria	24	16.63	22	28.48	23	32.58
Chile	26	14.50	26	15.16	24	24.38
Australia	25	16.13	25	18.49	25	20.12
Mexico	23	17.56	24	22.58	26	18.87
Italy	27	9.90	27	13.50	27	17.23
Greece	28	8.90	28	9.52	28	11.83

Source: Ookla SPEEDTEST intelligence data, © 2016 Ookla, LLC. All rights reserved. Published with permission of Ookla.

Note: City-year observations are collapsed to the country-year level and are weighted by the number of tests.

The US ranked 10th out of 28 countries in 2016 in terms of these actual download speeds (55.07 Mbps) weighted by the number of tests in each city. This ranking is an improvement from its ranking of 11th in 2015 (40.38 Mbps) and 15th in 2014 (28.09 Mbps).

Canada ranked below the US in these comparisons in 20th place in 2014 and 2015, and 17th in 2016 with a median weighted download speed of 44.29 Mbps in 2016, a substantial increase from 22.85 Mbps in 2014. The leading countries in this comparison included Japan and South Korea as well as several EU member states – Sweden, the Netherlands, Denmark and Spain - plus the non-EU nation Switzerland.

⁴² FCC, "International Broadband Data Report," *ibid*.

Comparisons of Broadband Pricing.

With respect to broadband prices the FCC is required to compare broadband pricing in communities of a population size, population density, topography, and demographic profile that are comparable to the population size, population density, topography, and demographic profile of various communities within the US. The FCC has ranked the countries by fixed wireline broadband prices from the least (1st) to the most expensive (i.e., 29th) according to three different methodologies. Rankings are first produced based on unweighted average prices for standalone fixed wireline broadband plans within certain download speed ranges, and mobile wireless plans within bands of data usage allowances. In an attempt to match the characteristics of the comparison communities and their broadband offerings more closely with those in the US, the FCC also presents country rankings using two additional methodologies: a broadband price index and a hedonic⁴³ price index. These additional indices try to better assess how the US market is performing relative to other markets after accounting for quality differences as well as market-level cost and demographic differences that are known to affect pricing, such as population density, income, and education levels.

The broadband price index - a weighted average Purchasing Power Parity (PPP) adjusted broadband price index - estimates what US consumers would expect to pay in each country for the broadband service that they consume today. In addition, the hedonic price index also allows adjustments for observable differences in broadband quality across countries (e.g., speed and usage limits), and generates prices for a set of standardized broadband plans in every country to produce a price index that accounts for all of these factors and is comparable across countries. This index estimates what the average U.S. consumer would expect to pay for their service in each country if that country had demographic, cost, and quality profiles similar to the US. One variation of the hedonic price index also takes into account the quality of the broadband content in each country.

A summary of the rankings of Canada and the US (out of 29 countries in all⁴⁴) by the FCC according to these three methodologies is shown in the following Table 3 developed from the results in its report:

⁴³ Hedonic is defined in the Merriam-Webster dictionary as “of, relating to or characterized by pleasure.”

⁴⁴ Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Latvia, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, UK, US

Table 3: Fixed Wireline Broadband Pricing: Ranking of Canada and US out of 29 Countries

Fixed Wireline Unweighted Broadband Price Index (PPP) for Stand-Alone Products				
Download Speed	Up to 10 Mbps	At least 10 and less than 25 Mbps	At least 25 and less than 100 Mbps	100 Mbps and above
Canada	6	7	20	24
US	8	18	18	26
Fixed Wireline Broadband Price Index (PPP)				
Broadband Package	Stand-Alone	Bundled	Overall	
Canada	24	25	24	
US	21	19	21	
Fixed Wireline Hedonic Price Index (PPP)				
See note	Model 1	Model 2	Model 3	Model 4
Canada	27	25	24	19
US	23	14	6	7

Note: Model 1: Unadjusted for demographics and content quality
Model 2: Adjusted for demographics but not content quality
Model 3: Adjusted for demographics and data usage
Model 4: Adjusted for demographics and content quality

Notably the only broadband pricing indices in which either Canada or the US (but never simultaneously) ranks in the top quartile of the countries in these comparisons is: (a) Canada in the slower speed categories for unweighted prices, and (b) the US in Models 3 and 4 of the hedonic price index, where Canada ranks in the bottom half (Model 4) or among the lowest (the other 3 models)⁴⁵. The prices for all the countries covered do not fall within a narrow range (say 10%), but vary by factors of two to three or more between the top and bottom of the rankings. Canada's low rankings represent significantly and sometimes substantially higher prices than broadband prices in other countries.

It is questionable whether, or the extent to which the hedonic price index (according to which the ranking of the US is significantly higher than in the other indices for two of the models) is legitimately relevant to an evaluation of the comparative impact of the pricing of broadband operators on consumer satisfaction. The factors that go into the calculation of this price index include significant components (e.g.

⁴⁵ However in the OECD analyses discussed below, which were undertaken after collaboration with the FCC, both the US and Canada rank below average among the larger number of countries (35) covered, even in hedonic models.

content quality) that in many cases fall outside the activities or purview of these operators.

Providers such as Netflix and other sources of over-the-top (OTT) content and applications have more to do with the quality and attractiveness of what is accessible over broadband links that influence the usage levels of consumers. The network operators themselves do not deserve credit for increasing end-users' pleasure as a result of the content that OTT providers generate and deliver. In any event use of this last index does not significantly improve the ranking of Canada in international broadband pricing comparisons.

The FCC report also refers to a collaboration with the OECD about international broadband pricing comparisons as follows (footnote 129, p.16): "In June 2015, the OECD, via a contract with Dr. Carol Corrado of Georgetown University in Washington, agreed to further refine the hedonic methodology using a more robust dataset. The initial findings were presented in a draft paper in June 2015 for initial review by OECD delegates, and a follow-up expert peer review of this work was conducted at the FCC in September 2015, with over 30 attendees from the FCC, U.S. Government, World Bank, and Canadian and Mexican regulatory officials collaborating on a set of final suggestions and observations for the authors to consider as they finalized the OECD analysis."

The OECD published this paper in July 2016⁴⁶. The results include prices for the 35 OECD countries in both market exchange and PPP US \$ over the period of 2011-2014 for several different modeling approaches. In every single case the estimated prices in both Canada and the US were higher than the OECD average, and substantially higher than the least expensive countries which usually included several wealthy Western European nations and South Korea. In contrast some other countries such as the UK and Mexico exhibited less consistency, with prices higher than the OECD average according to some models and lower than this average in others.

Fixed Wireline Broadband Pricing in the Nordicity Report

The Nordicity Report published on October 5 2017 compared prices for fixed wireline broadband services as of May 2017 among eight countries (Australia, Canada, France, Germany, Italy, Japan, UK, US) for five levels of performance of download speeds, namely:

⁴⁶ Carol Corrado and Olga Ukhaneva, "Hedonic Prices for Fixed Broadband Services: Estimation Across OECD Countries," https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=SEM2017&paper_id=99

- o Level 1: 3 to 9 Mbps;
- o Level 2: 10 to 15 Mbps
- o Level 3: 16 to 40 Mbps
- o Level 4: 41 to 100 Mbps
- o Level 5: Above 100 Mbps.

Nordicity's findings were as follows – Table 4 - for the ranking by PPP price among eight countries:

Table 4: Nordicity Rankings of Canada and US for 5 Levels of Fixed Wireline Broadband Service

Ranking	Level 1	Level 2	Level 3	Level 4	Level 5
Canada	2/8	7/8	5/8	6/8	7/8
US	8/8	8/8	8/8	8/8	8/8
Lowest (best) country	Italy	Germany	Germany	France	France

Nordicity also investigated the pricing in the same eight countries for three bundles of services:

- o Bundle 1: Fixed Wireline Telephony, Fixed Wireline Broadband Internet, and Mobile Wireless Telephony;
- o Bundle 2: Fixed Wireline Telephony, Fixed Wireline Broadband Internet, and Basic TV package;
- o Bundle 3: Fixed Wireline Telephony, Fixed Wireline Broadband Internet, Mobile Wireless Telephony, and Basic TV package.

The US and Canada were the highest priced markets for all three Bundled Services, Canada being the highest priced country for Bundles 1 and 3, and the US for Bundle 2. The lowest priced countries were Italy (Bundles 1 and 3) and France (Bundle 2). As in the FCC report the spread of prices between countries found by Nordicity is substantial. Hence Canada's low rankings cannot be dismissed as insignificant or immaterial for the purpose of establishing whether competitive forces in its broadband market are effective, on the grounds that the differences in prices between Canada and countries that are ranked much higher are trivial, and lie well within the margin of uncertainty associated with the imperfections of trying to perform "apple to apple" comparisons.

The Nordicity report also finds significant discrepancies in broadband pricing between different local markets for locations within Canada (see Tables C.3.1-5 on pages 85-89). These variations in pricing for the same level of service amount to over 40% in some instances. They may reflect varied levels of competitive intensity in local or regional markets, depending on the number of significant network operators competing for customers at different locations.

2.3.2 Review of Available Evidence for Mobile Wireless Broadband

Prices and performance of mobile wireless broadband services can be compared internationally just as they are for fixed wireline broadband. The picture of the ranking of Canada and the US in terms of mobile wireless broadband pricing is similar to that of their rankings for fixed wireline broadband pricing, although it is more challenging to justify the legitimacy of this finding for mobile wireless than for fixed wireline broadband. In mobile wireless markets there are arguably more significant differences in pricing structures than for fixed wireline services (e.g. the levels of charges in some countries for mobile wireless calls to landline versus mobile wireless numbers and for off-net versus on-net mobile wireless calls⁴⁷ are not the same, and regulatory fees and taxes also vary), which exacerbate the challenge of making legitimate or “like for like” comparisons.

Another typical objection to the validity of these comparisons is that the mobile wireless user profiles used to make the comparisons are not necessarily representative of the situations in some countries because of variations, notably at the high end, in the intensity and varied patterns of usage of mobile wireless networks from one country to another. These patterns may also be affected by diverse limitations on usage imposed by service providers (e.g. throttling speeds to a user once a volume cap is exceeded, or charging extra once a cap is exceeded, and/or applying zero rating⁴⁸ for the use of some services), as well as by different policies with respect to the carryover of unused data allowances from one month to another (and maybe even further into the future).

In terms of mobile wireless network performance the most commonly used measure is download speed. Open Signal provides international comparisons of this metric (<https://opensignal.com/reports/2017/02/global-state-of-the-mobile-network#speed-3g-lte>). As Open Signal explains in conjunction with this data from early 2017 overall download speed measurements vary considerably from country to country depending on their particular stage of 3G and 4G development. For instance a country with fast LTE speeds but low 4G availability might have a much lower overall speed than a country with moderate LTE speeds but a very high level of 4G availability. In other words, measurements of download speeds averaged at the national level are very dependent on the coverage of the latest generation of network technologies that has been achieved at the time the measurements are taken.

A more recent source of data on mobile wireless download speeds is Ookla’s Speedtest Global Index which is updated monthly - <http://www.speedtest.net/global-index#mobile> (accessed on December 30, 2018). In the November 2018 report Canada ranks highly in fourth position at 59.61 Mbps,

⁴⁷ These differences are not a source of distortion for services packages that include unlimited calls.

⁴⁸ Zero rating means that customers’ use of some services is not counted towards the capped monthly volume of data usage allowed in the plan to which they subscribe.

well ahead of the US in 41st position at 31.24 Mbps. The sources of the data used to compile the index, which are generated by users, are explained at <http://www.speedtest.net/global-index/about>.

FCC International Mobile Wireless Broadband Data

The FCC also presents country rankings in its International Broadband Data report for the prices of mobile wireless broadband services. Details of how the FCC attempted to compensate for the effects of differences between countries as just discussed that if not dealt with might call into question the legitimacy of these comparisons are provided on pp. 64-71 of the FCC report. Not all the 29 countries in the international comparisons have plans that fall into all the usage categories for which prices are compared, a phenomenon that is particularly apparent for shared (typically family) plans in which a data allowance is spread over 2 or more lines. In particular, shared plans are much more common and also tend to offer greater discounts over individual plans in North America, especially the US, than elsewhere. Nevertheless (see Table 5 below) Canada has a low rank among those countries that do offer shared plans.

As in the case of fixed wireline broadband, the FCC report compares mobile wireless prices internationally using three methodologies. The first is based on unweighted average prices for a number of plan categories defined by the data usage allowance. The second develops a single price index that takes into account the average price level across all their offerings within each product category of every provider of mobile wireless services. These average provider prices are then weighted by the market share of each of them to produce an average price per product category for each country. The single price index for each country is then calculated according to the estimated proportions of customers in the US who subscribe to each product.

The third model is a hedonic model comparable to that employed in the comparison of fixed wireline broadband pricing, which tries to account – with four variations – for differences between countries along dimensions such as demographics and the impact of geography on costs as well as the quality of mobile wireless broadband services and content.

Table 5 summarizes the FCC's results for mobile wireless broadband pricing in terms of the ranking of Canada and the US among the total of 29 countries. Again, all prices are expressed in US \$ using PPP exchange rates.

Table 5: FCC's Ranking of Canada and US for Unweighted Mobile Wireless Broadband Prices

	Mobile Wireless Unweighted Monthly Prices by Usage Allowance				
	Up to 2GB	Above 2 GB up to 5 GB	Above 5GB up to 10 GB	Above 10 GB	Shared (2+ lines)
Number of countries with plans for comparison	22	27	25	28	12
Country Ranking					
Canada	22/22	26/27	23/25	28/28	11/12
US	18/22	24/27	21/25	21/28	9/12
Mobile Wireless Broadband Price Index					
	Individual Plans		Shared Plans ¹	Overall ²	
Country Ranking (out of 29)					
Canada	28		23	25	
US	25		18	20	
Mobile Wireless Hedonic Price Index ³					
	Model 1		Model 2	Model 3	Model 4
Country Ranking (out of 29)					
Canada	29		26	7	23
US	25		20	17	10

Notes: 1. In countries without shared plans the shared product prices are calculated as the sum of individual plan prices; 2. Calculations of the prices paid by customers in terms of \$/GB used present the US in a more favorable light, with a ranking in 12th position, while Canada is still in the bottom quartile with a ranking of 22 according to this metric. 3. The four hedonic models take account respectively of the same factors as they do in the fixed wireline broadband pricing comparisons. Again, the result is that when an effort is made to account for the quality of content the ranking of the US improves considerably (Model 4). In contrast to fixed wireline broadband pricing rankings the application of the FCC's Model 3 (accounting for demographics and data usage), substantially improves Canada's ranking in the mobile wireless broadband market placing it at the bottom of the top quartile, but with prices that are still over one third higher than the "best-in-class."

OECD Mobile Wireless Broadband Pricing Data

The OECD produces mobile wireless services pricing data for three categories of user (low, medium, and high) comparing different countries using both market (or

actual) and PPP exchange rates. Table 6 summarizes the rankings of Canada and the US based on these data.

Table 6: Mobile Wireless Broadband Pricing Ranking of Canada and the US based on OECD Data

Country Ranking (out of 35)	High User, per month 900 Calls, 2GB		Medium User, per month 300 Calls, 1 GB		Low User, per month 100 Calls, 500 MB	
	PPP \$	Actual \$	PPP \$	Actual \$	PPP \$	Actual \$
Canada	32	33	29	32	31	33
US	28	32	30	33	33	34

Mobile Wireless Broadband Pricing in the Nordicity Report

The Nordicity report for broadband mobile (wireless) services reviews four levels of mobile wireless broadband service on a monthly basis (in addition to two levels of mobile wireless service that only include voice calls and texts and are not relevant to this review):

- o Package A -1,200 minutes of calls, 300 SMS text messages and 1 GB Data;
- o Package B - Unlimited minutes of calls and SMS texts and 2 GB Data;
- o Package C - Unlimited minutes of calls and SMS texts and 5 GB Data;
- o Package D - Family Plans with unlimited minutes of calls and SMS texts, and 10 GB data, with 3 lines

Table 7 shows the ranking of Canada and the US among the eight countries in this comparison for each Service Package.

Table 7: Nordicity's Rankings of Canada and the US for Mobile Wireless Broadband Pricing

	Package A		Package B		Package C		Package D	
	Ranking (out of eight countries except where noted)							
	2017 ¹	2016	2017	2016 ¹	2017	2016 ²	2017 ²	2016 ²
Canada	7/7	7	8	6/7	8	6/7	4/5	4/5
US	6/7	6	5	7/7	7	7/7	3/5	3/5

Notes: 1. Packages in this category were only available in 7 countries in this year. 2. Packages in this category were only available in 5 countries in this year.

In many ways for historical reasons the telecommunications market in Canada has more similarities with this market in the US than with any other country. Nevertheless, the Nordicity report highlights some striking differences in the

conditions of the Canadian market for mobile wireless services compared to the US. A major difference is that there are significant discrepancies in mobile wireless pricing within Canada itself, in contrast to the uniform pricing found across the US from national carriers (Verizon, AT&T, T-Mobile (USA), and Sprint). The pattern of inhomogeneity in mobile broadband pricing across Canada is even more striking than in the situation for fixed wireline broadband identified in the earlier discussion of the Nordicity report⁴⁹. As one example, according to Nordicity, monthly prices charged by multi-regional incumbents' (Bell, Rogers, TELUS) for Package C range from as high as about \$120 in Toronto and Vancouver to \$60-65 in Regina and Winnipeg, a pattern that is also found in the pricing of Package D. Hence customers in some locations in Canada are even worse off – and others less so – than appears from a comparison of average Canadian price levels with prices in countries with more uniform pricing levels throughout their territory.

2.3.3 Relationships between the Fixed Wireline and Mobile Wireless Broadband Markets

The fixed wireline and mobile wireless broadband markets are becoming increasingly interdependent and intertwined. This development is being fueled by several related factors, including the:

- o Prominent roles played by competitors who offer both mobile wireless and fixed wireline services (in Canada as well as elsewhere), and expansion of their offers of fixed wireline/mobile wireless bundles;
- o Attraction and convenience for customers of the ability to readily access content and applications on any device at any location, at any time with one subscription;
- o Complementarity between fixed wireless and fixed wireline media in which the former⁵⁰ provides broadband coverage in areas and environments for network deployment where it is uneconomic or impossible to deploy fixed wireline infrastructure, and

⁴⁹ The discrepancies in broadband prices across Canada are confirmed in the CRTC's 2018 Communications Monitoring Report - 2017 Communications Services Pricing in Canada, <https://crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2018/cmr2018-pri.pdf>

⁵⁰ In these situations broadband access is typically provided by fixed wireless systems, often (although not always) using wireless technology and equipment developed for mobile wireless applications so as to benefit in terms of costs from the enormous economies of scale of the global mobile wireless ecosystem.

- o Significant volumes of traffic from mobile wireless devices are transmitted via fixed wireline and not radio access networks when their users are stationary or nomadic within their homes, workplaces, or public buildings, with the in-building connection to the mobile wireless device being provided most commonly via Wi-Fi.

Hence for the most part mobile wireless and fixed wireline broadband services complement each other and are not competitors. In locations where conditions make the deployment of fixed wireline infrastructure NGAs very difficult or uneconomical wireless access may be the only feasible access technology. The complementarity between fixed wireline and mobile wireless broadband services can be distinguished from the competition and substitutability in the narrowband context between cellular and fixed wireline (i.e. landline) voice telephony. Growing numbers of households (now a majority in the US and Canada) no longer subscribe to the latter and are classified (misleadingly, since they still often subscribe to fixed wireline broadband services) as wireless-only households.⁵¹

The momentum of service providers towards integrating and combining broadband mobile wireless and fixed wireline services in their offerings is unmistakable. It is confirmed by the initiatives of network operators themselves. For example the UK-based multinational Vodafone, founded at the beginning of the mobile wireless era, is aggressively moving into the fixed wireline broadband segment through acquisition of fixed wireline operations and investments in fixed wireline assets in countries such as Germany and Spain⁵². The UK incumbent BT, which in 2006 had sold its mobile wireless operation, O2, when it was under great financial pressure, reentered the mobile wireless business in 2016 by acquiring the largest UK mobile wireless operator EE⁵³. In the US the largest fixed wireline broadband internet provider Comcast launched an MVNO service in 2017, using Verizon's network, so as to offer even richer bundles of services. US cable operators, in contrast to Canadian counterparts such as Rogers, have long hesitated to invest in acquiring mobile wireless spectrum and deploying mobile wireless networks – Comcast divested a regional wireless operation in the 1990s – but seem finally to have

⁵¹ https://www.washingtonpost.com/news/politics/wp/2018/01/07/most-adults-live-in-wireless-only-households-and-where-that-varies-is-important/?noredirect=on&utm_term=.7da0fa3bb080; https://www.thestar.com/business/tech_news/2017/05/04/households-hang-up-on-landlines-as-cellphones-dominate.html

⁵² “Delivering better quality broadband for the gigabit society”, <https://www.vodafone.com/content/index/what/technology-blog/deltaq-blog.html>; “Vodafone to acquire Liberty Global's operations in Germany, the Czech Republic, Hungary and Romania,” <https://www.vodafone.com/content/index/media/vodafone-group-releases/2018/vodafone-liberty-global-operations-germany-czech-republic-hungary-romania.html> (as of end-2018 this transaction is subject to antitrust review before final approval); “Spain: Vodafone, Masmovil Share FTTH,” <https://advanced-television.com/2018/09/06/spain-vodafone-masmovil-share-ftth/>

⁵³ “BT's acquisition of EE is complete,” <https://www.engadget.com/2016/01/29/bt-ee-acquisition-complete/>

decided that they need to fill this gap in their services portfolios, which they (e.g. Charter in addition to Comcast) are doing via the MVNO route.

2.3.4 Competitive Service Providers (CSP) including Mobile Virtual Network Operators (MVNOs)

It is a misconception that the entire or only value of CSPs (the generic term also includes MVNOs in the parlance of the mobile wireless market) lies in offering connectivity at lower retail prices than facilities-based operators. While low prices may at one time have been the principal selling point of many CSPs they do not now compete simply on the basis of offering connectivity at lower prices than the operators whose networks they run on. They address needs, desires and customer segments ignored or poorly satisfied by large operators, and they can act as entrepreneurial pioneers in launching and testing new features and operational models in the market. CSPs include providers whose cultures and origins are very different from those of incumbent operators and cable companies, for example computer services companies which take advantage of the capabilities of broadband for which they are wholesale customers to provide connectivity to cloud-based applications and services.

The most successful CSPs are truly value-added operations. In addition to being more sensitive to and knowledgeable about the needs and circumstances of specific customer segments they offer features that appeal to these various segments or groups of customers which they do not find in the offerings of the major operators, or which may only eventually become available if their viability in the marketplace is first demonstrated by an entrepreneurial CSP.

The CSP may also operate in ways that customers find are more responsive to their situations and priorities, and make relationships easier than having to cope with the business processes and customer service of the large operators. An additional driver for CSPs is that in a market with strong competition between operators, an operator may view them as a channel through which to bring customers preferentially to its network, recognizing that these customers would not be attracted by its mainstream offerings.

A sample of MVNOs which illustrates the innovations CSPs bring to the market, delivering offerings that some customers appreciate but might not otherwise be available from major network operators, or will only become available later includes:

1. America Movil's Mobile MVNO brands in the US with a total in 2018 of some 22 million customers, which address through both pricing and customer service the needs of Mexicans and Mexican Americans in the US who have strong ties to Mexico, exploiting this opportunity well before the practice of major US operators to offer plans with flat rate pricing within North America (i.e. including Mexico and Canada) was introduced.

2. The UK is well known for MVNOs, from the original Virgin Mobile launched almost 20 years ago to the more recent entry of China Mobile, under the CMLink brand name, targeting the Chinese community of some 430,000 as well as the more than 80,000 Chinese in the UK on student visas.

3. Telefonica, which owns the operator O2 in the UK launched its own MVNO giffgaff in 2009, which is distinguished by being an online-only proposition. Giffgaff ⁵⁴, which originated in the development group at O2, targets a lower-income, younger, but mobile-savvy niche of the market, offering SIM cards for an average of £10 (3 times cheaper than the standard large mobile wireless operators would offer). Giffgaff does not have a call center since its business model rests upon its customers, also known as community members, who help each other with any questions (and earn points if they do), are motivated to recruit new members (for a modest check of £5) and share ideas and strategies to help Giffgaff grow. As of early 2018 Giffgaff had some 2.7 million members.

4. Other examples of MVNO differentiation from the UK include a money transfer service to meet the needs of an ethnic community, a service that allows customers to cash in their unused data in exchange for savings on a range of devices and accessories, and a service that is connected to a retail chain's loyalty programme.

5. Australia offers the example of the MVNO amaysim, which has expanded beyond mobile wireless services, delivered through the Optus⁵⁵ network, to offer a range of home-related services including for example electricity and gas plans. As of 2018 amaysim had over 1.1 million subscribers.

Mobile network operators (MNO) themselves can specifically include MVNOs within their approaches to the market as Telefonica has done in the UK where the combined market share of MVNOs is currently around 14%. The MNOs are motivated to cooperate with independent MVNOs and to form, or acquire, their own MVNOs to bring customers onto their networks they would not otherwise attract. Even higher market shares of MVNOs than in the UK were reported a few years ago in some other European countries, e.g. the Netherlands (where 64 MVNOs held a

⁵⁴ See "The fascinating story of Giffgaff – a co-creation case study," <https://www.hackerearth.com/blog/innovation-management/the-fascinating-story-of-giffgaff-a-co-creation-case-study/>

⁵⁵ Amaysim and Optus (its host network) also provide a timely indication of how an MNO may today perceive the value of an innovative MVNO in a competitive market - <https://www.channelnews.com.au/breaking-news-optus-runs-ruler-over-amaysim-as-telcos-consolidate/>; <https://www.businesstimes.com.sg/companies-markets/singtel-said-to-tap-bank-of-america-for-pursuit-of-australias-amaysim>

41% market share), Germany (93 MVNOs with 40%), Denmark (35 MVNOs with 25%) and Austria (18 MVNOs with 25%)⁵⁶.

In the US the estimated total number of MVNO customers in the US is 47 million⁵⁷, for an overall market share of around 11%. Interestingly the two smaller operators – T-Mobile and Sprint – have a greater number of MVNO customers even in absolute terms than the two market leaders Verizon and AT&T. MVNO customers account for around 18% (T-Mobile) and 25% (Sprint) of their respective customer bases

CSPs also play noteworthy roles in the fixed wireline broadband market. For business customers IT (information technology) CSPs are building a plethora of services on top of wholesale broadband connectivity, based on their understanding of the needs of specific types and business and the shift of applications such as CRM (customer relationship management), finance and billing, ERP (enterprise resource planning) etc. from on-premises to cloud-based implementations. Business customers increasingly demand mobile wireless as well as fixed wireline access to these applications, which is another illustration of the complementarity of fixed wireline and mobile wireless broadband services.

Not all significant users of wholesale broadband services rely completely on them for connectivity to their customers. There are also examples of CSPs which operate their own facilities in some areas, but still depend to varying degrees on wholesale services in order to offer their customers the complete portfolio and geographic coverage of services they find necessary or valuable in order to be competitive. One unusual example is found in France, where a fourth national network operator – Iliad – has successfully established a significant position in both the fixed wireline⁵⁸ and later the mobile wireless market, with disruptive effects on prices and the service offerings available to French customers, obliging the three existing operators, which have both fixed wireline and mobile wireless networks to develop new strategies. Iliad was enabled to grow based on mandated wholesale access. Further details on Iliad are provided in Appendix 3.

As discussed later however the path followed in France of introducing a new national facilities-based operator, whether fixed wireline, mobile wireless or both, is not practical or realistic in the very different Canadian environment. More relevant for consideration in Canada, given the presence of local and regional operators, is how they can make use of wholesale services to improve their competitiveness in the services they offer within a reasonable time frame and at an acceptable level of risk in the locations they do serve, in order to attract and satisfy customers who are

⁵⁶ McKinsey & Company, "Virtually Mobile – What Drives MVNO Success," https://www.mckinsey.com/~media/McKinsey/dotcom/client_service/Telecoms/PDFs/February%202015%20-%20Recall%20papers/Virtually_Mobile_2014-06.ashx

⁵⁷ Source: Reports of major US MNOs plus estimate of Verizon's wholesale customers

⁵⁸ Iliad's investments in fiber access networks include both its own facilities (in the densest areas) as well as infrastructure in less dense areas that is co-financed with the incumbent Orange in an agreement approved by the regulator Arcep.

looking for economical national coverage and bundled services (fixed wireline and mobile wireless) from one source.

3. The Evidence from International Broadband Comparisons – Findings and Implications

The results of the international broadband comparisons covered in this report support the findings that:

- The prices paid by Canadians for broadband services - both fixed wireline and mobile wireless, including bundled services which combine the two - are substantially higher than those in several other countries with which Canada compares its society and economy;
- The performance of fixed wireline broadband services offered in Canada in terms of download speeds is at best in the middle of the pack among countries selected for comparison, although Canada compares favourably (more so than the US) on the metric of average mobile wireless download speeds.

The international comparisons from which these findings are derived have been criticized on the grounds that they may not capture all the causes of variations in broadband performance and pricing that lie beyond the power of network operators, regulators, and other national actors to influence⁵⁹. According to critics they may mislead policy makers if their results are used to support findings that ascribe discrepancies in broadband performance and pricing to differences in the effectiveness of competition in different national markets, and conclude that there is a market failure that should be fixed with the help of regulatory remedies.

Rebuttal to this dismissal⁶⁰ of the interpretation of the results presented in this report rests upon the use of several independent analyses, using varied

⁵⁹ See Section 2.2 *supra*

⁶⁰ The industry association US Telecom, which reflects the views of incumbent telephone operators, is an example of typical criticism ("New Analysis: U.S. Telecom Data highlights US Broadband Expansion, Competition and Usage" - <https://www.ustelecom.org/blog/new-analysis-ustelecom-data-highlights-us-broadband-expansion-competition-and-usage>). While admitting that the FCC's International Broadband Data report places the US in the middle of the broadband pack according to metrics such as deployment, adoption, speed, and price, US Telecom points to the multiple factors from population density to demographics, and variations in subsidies and market segmentation that may call into question the legitimacy of international comparisons. US Telecom also emphasizes that US consumers have the highest volumes of internet usage, a metric which as noted (assuming it is an indicator of relative merit) should be ascribed more to the roles of over-the-top content providers (such as Netflix) rather than to the performance of broadband operators. US Telecom also argues that international rankings are not very meaningful since there are groups of countries with "essentially minor differences." However the differences reported in this report between Canada and other countries are significant and even substantial, so the rankings of Canada are probative in this context.

methodologies, and carried out by separate teams, none of which are linked to or funded by Canadian operators or CSPs. They produce similar consistent conclusions about the state of broadband markets in Canada and the US. Serious attempts have been made in these analyses to account for the effects of intrinsic country-specific factors upon broadband markets for which network operators should not reasonably be held responsible. The findings with respect to broadband markets in Canada (and the US) remain essentially the same across all approaches to making the international comparisons as close to “apples to apples” as possible. There are no comparable credible results contradicting the finding that the prices of broadband services in Canada (and the US) are high^{61,62}, despite two claims to the contrary.

The finding of high broadband prices is inconsistent with the claim that the state of the broadband market in Canada is an outcome of effective competition. Moreover, the overall performance of the broadband services offered in these two countries is not superior to or even among the best-in-class globally. Canada’s high broadband prices cannot be justified by superior broadband performance delivered to customers.

Cumulatively the analyses reviewed for the purpose of this report provide a preponderance of evidence supporting the conclusion that the Canadian broadband market is producing outcomes for customers that are significantly inferior to those in several other countries in Europe and the Asia/Pacific region at a comparable stage of development. The logical inference is that the current and past level of competition in the Canadian broadband market is not delivering the desired or the best achievable outcome, so that intervention to change the structure and dynamics of this market to stimulate greater competition in the provision of broadband services at the retail level is warranted.

In theory there are two paths for the introduction of more vigorous competition or more competitors into Canada’s broadband market, wireless and fixed wireline. One

⁶¹ A report by NERA Economic Consulting commissioned by the incumbent TELUS - “An Accurate Price Comparison of Communications Services in Canada and Select Foreign Jurisdictions” - does conclude that Canadian broadband prices are lower than international benchmarks - http://www.nera.com/content/dam/nera/publications/2018/NERA_Price_Study_Report_Wed_Double_Page.pdf. However this conclusion is based on a methodology that does not reflect conditions in the real world broadband market and the choices of customers. Hence it has no probative value, as explained in Appendix 1 to this report.

⁶² One expert report submitted to the Competition Commission refers to the Economist Intelligence Unit’s (EIU) Internet Affordability Index which ranks Canada as #1 - Expert Report of Dr. Robert W. Crandall, Submission by TELUS Communications, Inc. to Competition Bureau Canada -Market Study Notice: Competition in Broadband Services, [http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/Appendix_A--Expert_Report_of_Dr_Robert_W_Crandall.pdf/\\$file/Appendix_A--Expert_Report_of_Dr_Robert_W_Crandall.pdf](http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/Appendix_A--Expert_Report_of_Dr_Robert_W_Crandall.pdf/$file/Appendix_A--Expert_Report_of_Dr_Robert_W_Crandall.pdf). Appendix 2 explains why this conclusion is irrelevant to an evaluation of the standing of the Canadian broadband market relative to other developed economies in light of the current and evolving demands and uses of broadband connections by Canadians and residents of these other countries.

path would see at least one new national facilities-based operator emerge in both market segments. The other path would remove obstacles and barriers identified to the entry or expansion of CSPs (MVNOs in the mobile wireless segment) in the broadband market. The first path is very expensive, would take a long time to implement, and would stand or fall on the progress of one major initiative. Even a company as powerful as Google has recognized the formidable obstacles in the way of achieving such an ambition in the US⁶³. There is an initiative to undertake a venture to introduce a fourth mobile wireless operator in Japan⁶⁴, but the circumstances are very specific to and contingent upon the motivations of the actors in Japan and their relationships with the Government. This Japanese initiative, although fueled by the Government's concerns about high mobile wireless broadband prices in Japan⁶⁵, is not realistically transferable to the Canadian environment, although it bears some similarity to Iliad's path in France (see Appendix 3) in which Iliad relied for several years on a national roaming agreement with an existing operator, while it deployed its own infrastructure in spectrum awarded by the regulator. Moreover, the Japanese initiative does not also reportedly encompass fixed wireless network deployment, yet wireline and wireless broadband networks are complementary to each other.

The alternative path towards more effective competition in Canada's broadband market lies in establishing pro-competitive wholesale provisions that are fair and reasonable to both operators and their wholesale customers (CSPs) providing retail services based on fixed wireline or mobile wireless broadband connections, or both), to enter the market and then to expand their businesses. As compared to the path of placing an inevitably very risky bet on the successful introduction of a new national facilities-based competitor this approach has the benefits of providing:

1. Openings for many potential and current retail services providers from diverse backgrounds (not all eggs will be in one basket), i.e. the flourishing of market forces and entrepreneurial initiatives;
2. Greater opportunities for existing smaller facilities-based operators (regional and/or currently fixed wireline-only or mobile wireless-only in some locations) to compete nationally and as providers of bundled (fixed wireline and mobile wireless) services should they choose to do so.

Thus, the most practical path towards increasing and overcoming the demonstrable weakness of competition in Canada's broadband market – in

⁶³ "Why Google Fiber failed: 5 reasons," <https://www.techrepublic.com/article/why-google-fiber-failed-5-reasons/>

⁶⁴ "Japan mobile wars: KDDI teams with newcomer Rakuten," <https://asia.nikkei.com/Business/Companies/Japan-mobile-wars-KDDI-teams-with-newcomer-Rakuten2>

⁶⁵ "NTT DoCoMo to lower mobile phone fees after government call for charges to be cut," <https://www.japantimes.co.jp/news/2018/11/01/business/corporate-business/ntt-docomo-lower-mobile-phone-fees-amid-calls-charges-cut/#.XCpSOS2ZPv0>

both the fixed wireline and mobile wireless segments – lies in the application of fair and reasonable mandated wholesale provisions.

These wholesale provisions should not be limited to setting economically justifiable prices, but must include other conditions, such as timing of order processing, installations and repair for wholesale customers that is equivalent to that offered to retail customers. The wholesale rules should also be forward looking, anticipating the arrival of new network technologies, and follow the principle of technology-neutrality. Wholesale conditions should be established for new essential infrastructure as it is deployed, not after years of litigation and negotiation, so as to avoid unreasonable or competitively harmful delays in the ability of CSPs to offer services that are comparable in performance with the retail services of network operators.

4. Concluding Observations

The significantly and in some cases substantially higher prices paid by broadband customers in Canada compared to their counterparts in several other countries are strong indicators of an unsatisfactory level of competition in the country's broadband market, in both segments of fixed wireline and mobile wireless services. These two segments of the total broadband market are complementary rather than competitive, and the attraction of bundled service packages (fixed wireline and mobile wireless) is likely to increase in future. Hence any lack of vigour in competition in either the fixed wireline or the mobile wireless market segment inevitably influences the intensity of competition throughout the broadband arena. Therefore, wholesale provisions designed to increase and ensure effective competition in the broadband market have to cover both fixed wireline and mobile wireless services, or their impact on competition will be stunted and increasingly ineffectual. The principles behind wholesale provision as outlined above are the same for both segments of the broadband market, although the technical and other details and nature of the wholesale services to be provided on fixed wireline and mobile wireless infrastructure are very distinctive. The necessity - because of the complementarity of the services they support - of applying wholesale provisions to both fixed wireline and mobile wireless networks is confirmed by the actions of large operators themselves. Many large operators offer both mobile wireless and fixed wireline broadband services, and in some cases are reorganizing their businesses in ways designed to improve their effectiveness in offering both services to the same customers.⁶⁶

The discrepancies in the prices charged for the same level of broadband service – both fixed wireline and mobile wireless – within Canada indicate that the effectiveness of competition or the degree of Canada's "ineffective competition" may vary significantly from one location to another, depending on the number and business decisions of the broadband services suppliers who serve customers at each

⁶⁶ "Verizon to reorganize business segments," *ibid*.

location. The extent of the improvement in broadband performance and pricing Canadians may experience as a result of the successful implementation of remedies to fix the current situation, which have to be applied nationally, will be greatest in areas where competition is currently weakest.

Canada's telecommunications policy includes three objectives among others, namely to⁶⁷:

1. Facilitate the orderly development throughout Canada of a telecommunications system that serves to safeguard, enrich and strengthen the social and economic fabric of Canada and its regions;
2. Render reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada;
3. Enhance the efficiency and competitiveness, at the national and international levels, of Canadian telecommunications.

The high level of broadband prices observed in Canada and the substantial differences between prices across the country suggest strongly that there is significant room for improvement over the current situation, and justification for initiatives designed to ensure that these objectives are pursued more effectively. The international comparisons and experiences evaluated in this report provide some insights and guidance regarding the types of remedy and their implementation which are likely to yield positive results, provided the lessons they offer are considered in light of Canada's particular circumstances.

As described in the preceding Section 3, the best path forward for improving the strength of competitive forces in Canada's broadband market and hence the outcomes for customers lies in establishing mandated wholesale provisions that are compensatory for operators and yet stimulate market entry and expansion by a variety of retail services providers or CSPs. This approach is consistent with the finding that among the countries in the international comparisons that are found to have the best outcomes are several with a balanced hybrid model of regulation. In these models significant wholesale obligations are imposed on network operators when and where facilities-based competition is deemed to be insufficiently vigorous.

Wholesale provisions can be established that have no negative effect upon investments that are desirable to ensure the efficient and effective deployment of broadband infrastructure for all Canadians. Under the right circumstances the use of wholesale services can justify more investment to meet customer demands generated by the innovative value-added or entrepreneurial applications and

⁶⁷ Canadian Telecommunications Policy, <https://laws-lois.justice.gc.ca/eng/acts/t-3.4/page-2.html>

services that CSPs offer by applying perspectives and ideas to the online broadband arena that come from outside the cultures of the traditional major operators. History is replete with examples of services and applications delivered over networks that originated from sources outside the network operators themselves. Use of these services and applications – from voice mail to facsimile and Netflix to online games, banking applications and Government services - has stimulated greater use of the operators' networks. The associated revenues have helped generate returns on these operators' investments.

As a secondary measure to improve the Canadian broadband market, following the example of several other countries, consideration should be given to determine how best to encourage and support co-financing of the deployment of NGAs in areas where the costs to any one investor alone, even a large operator, are unattractive. Mobile wireless operators in particular and in many countries outside North America are increasingly realizing that the changing economics and technologies of their business, especially as the era of 5G looms, favor the deployment of shared network radio infrastructure on purely commercial grounds^{68,69}. Co-financing arrangements can reduce the dependence of the pace at which coverage of more powerful broadband networks is expanded on the investment decisions and motivations of only a very small number of large operators. Co-financing arrangements have the benefit of reducing the costs for any one investor in infrastructure, however they also have to be constructed carefully to avoid any anti-competitive effects. The risk of these effects is most apparent if two large operators cooperate in this manner and then argue that they should not be obliged to offer wholesale access to third parties, or they limit access only to other parties, which also agree to contribute to the investment. Where public funds play some role in the investment open access rules are usually applied. More broadly arrangements for co-financing new network infrastructure are reviewed by the regulator for potential anti-competitive effects before being approved. The principle to follow is that co-financed infrastructure should be subject to the same wholesale obligations as are applied to comparable network elements deployed by one investor. Mandated wholesale access is a way to ensure that competition will thrive wherever and by whomever infrastructure sharing arrangements are established as well as wherever there are essential facilities controlled by one operator.

Investments in infrastructure, whether co-financed or funded by one operator can also be facilitated by arrangements to make the maximum possible - and timely - use of existing passive assets such as ducts, poles, and towers, and minimize the administrative burdens associated with negotiating and establishing agreements between stakeholders including local governments which have a say in construction

⁶⁸ "5G Mobile is nearly here – but we should share networks to make it affordable," <https://www.weforum.org/agenda/2018/08/5g-mobile-is-nearly-here-share-networks-to-make-affordable/>

⁶⁹ Insights into the motivations behind the trend towards more infrastructure sharing are presented in the ITU News Magazine, "Sharing Networks, Driving Growth," https://www.itu.int/en/itunews/Documents/2017/2017-06/2017_ITUNews06-en.pdf

and installation permits. The European Union has been pursuing stronger rules to implement these arrangements than in North America.

The principle of allowing multiple paths for entry and expansion in the retail broadband services market, without prescribing or unduly favoring one over another, serves the objective of allowing innovation in services and applications to flourish. It is impossible to predict from where the most popular and valuable innovations in services and applications will emerge. No one or small number of gatekeepers, such as major network operators should be in a position to determine at their sole discretion which services can be delivered to end-users, or to delay or inhibit the commercial launch of some services compared to others.

Appendix 1 – Rebuttal of the NERA Report, “An Accurate Price Comparison of Communications Services in Canada and Select Foreign Jurisdictions”⁷⁰

A report by NERA commissioned by the incumbent TELUS and published recently presents the conclusion that prices for communications, including broadband services in Canada are lower than the prices foreign providers would charge for the same plans. On this basis the broadband market in Canada is therefore claimed to be performing better on average than the benchmark countries (G7 – US, Canada, France, UK, Germany, Italy, Japan - plus Australia). The NERA report seeks to rebut the opposite conclusion reached in the 2017 Nordicity report and similar reports from other years by Wall Communications⁷¹ which were commissioned by Innovation, Science and Economic Development (ISED) and the Canadian Radio-television and Telecommunications Commission (CRTC). NERA also disagrees with the findings presented in the body of this report, which draws on additional independent sources of international comparisons.

NERA claims that the methodology it applies in its analysis is superior to that used by Nordicity and Wall, which it characterizes as “fatally flawed”, in contrast to its own approach. NERA tries to account for the intrinsic differences between the countries that are compared which are outside the control of communications service providers and must therefore be considered in order to construct comparisons as close to “apples to apples” as possible. NERA makes frequent positive references to the methodology or more accurately several methodologies applied by the FCC⁷² in the latter’s work on international broadband comparisons. NERA emphasizes the similarities of its approach with the FCC’s and recommends the FCC’s methodology for use in future international comparisons that the CRTC and ISED undertake or commission.

Most remarkably however NERA then ignores the results of the FCC’s work, summarized in this report, which thoroughly and consistently contradict NERA’s own results. The FCC finds that Canada’s broadband prices are high and, in some instances, substantially higher than those in several (and even most) of the countries in the international comparisons, applying a variety of approaches that seek to account for intrinsic country differences as honestly and objectively as possible on the basis of the best available information on broadband markets.

NERA’s conclusion that Canada’s broadband prices are lower than international benchmarks is based on its finding that the majority of plans available in Canada would be priced higher if offered by the average foreign services provider than they actually are by their Canadian counterparts. But without an understanding or some

⁷⁰ NERA Economic Consulting, “An Accurate Price Comparison of Communications Services in Canada and Select Foreign Jurisdictions,” *ibid.*

⁷¹ Nordicity, *ibid.* and Wall Communications, “Price Comparisons of Wireline, Wireless and Internet Services in Canada and with Foreign Jurisdictions,”
[https://www.ic.gc.ca/eic/site/693.nsf/vwapj/telecom2018e.pdf/\\$file/telecom2018e.pdf](https://www.ic.gc.ca/eic/site/693.nsf/vwapj/telecom2018e.pdf/$file/telecom2018e.pdf)

⁷² FCC, “International Broadband Data Report,” *ibid.*

plausible estimate of the relative popularity of the various plans this definition of superiority – or inferiority of Canadian broadband performance if it were found that the majority of Canadian plans would be priced lower by the foreign than by Canadian services providers – is meaningless for the purpose of assessing the market conditions experienced by customers or end users in Canada and the choices they actually make in the market. Data on the market shares of individual plans is not available – a problem acknowledged by the FCC in its analyses. The FCC at least makes some attempt to account for the different popularities of plans by weighting various performance categories of plans according to the information that is available on their shares among all broadband subscriptions. But as far as can be told in the NERA approach one plan carries as much weight as any other in comparing prices between countries. One might as well try to calculate the average fuel consumption of passenger vehicles in a country as a basis for comparison with other countries by taking the fuel consumption figures for every type and model of vehicle being driven in that country, and then assuming that the total population of vehicles contains equal numbers of each individually distinguishable vehicle, and they are all driven the same number of kilometers every year under the same conditions (e.g. short distance commuting, long distance highway trips etc.).

In addition to the FCC's international comparisons of broadband pricing NERA also refers to the UK regulator Ofcom's International Communications Market Report 2017⁷³. Ofcom compares the UK's communications market along several dimensions, and not just price, e.g. network coverage, data usage etc., with varying numbers of comparator countries, representing both developed and in some cases also emerging economies. For broadband pricing Ofcom only looked at 5 countries in addition to the UK, namely France, Germany, Italy, Spain and the US. NERA points out that Ofcom, like the FCC, draws attention to the limitations of the methodology it uses and the difficulties in making "apples to apples" comparisons. Ofcom finds (Figure 1, p. 37) that for broadband pricing the UK ranks in third best position in this sample, while the US ranks last, in sixth position. Many of the FCC's findings rank Canada below the US in terms of broadband pricing, which strongly suggests that NERA's conclusion regarding the allegedly lower broadband pricing enjoyed by Canadian customers is also contradicted by Ofcom's analysis.

Furthermore the NERA analysis notably dismisses the value of including an assessment of bundled plans in international broadband pricing comparisons, because they pose additional difficulties in finding ways to develop reasonable comparisons, even though they are included in the FCC's analyses. NERA asserts (Section 3.2 – Communications Services Covered), *"An evaluation of standalone services suffices to evaluate retail prices in Canada because it is unlikely that the prices for bundled services follow a different trend."* This assertion is another example of NERA's contradictions with the FCC's international comparisons, and of its neglect of actual market or customer behaviour. The FCC makes a serious attempt to include

⁷³ "International Communications Market Report 2017," <https://www.ofcom.org.uk/research-and-data/multi-sector-research/cmr/cmr-2017/international>

bundled services packages in its comparisons, and points out that they are already highly popular with US consumers and are offered with substantial discounts compared to the combined price of separate stand-alone services. Tellingly the FCC finds that the rankings of countries by price do vary between stand-alone and bundled service packages. The Ofcom report also includes evaluations of the pricing of bundled broadband services packages.

Both Ofcom and the FCC evidently consider that the role of bundled services in the broadband market is significant and needs to be considered along with that of stand-alone services. NERA's dismissal of bundled services as both impractical to compare and unworthy or unnecessary of consideration ignores the evidence for the complementarity of fixed wireline and mobile wireless broadband services, and the corresponding moves by services providers to try to offer both as a "one stop shop" if they do not already do so.

The NERA report provides no explanation or justification for the stark contradictions between its findings and those of the FCC, whose methodology it strongly recommends and claims it emulates. It counts broadband plans indiscriminately regardless of their weight in the marketplace. Furthermore NERA's dismissal of the significance or probative value of looking at bundled plans, which both the FCC and Ofcom include in their analyses of broadband pricing, betrays a fundamental lack of understanding of the dynamics and directions of today's broadband markets. The NERA analysis does not reflect a forward looking or even a realistic contemporary perspective on the behavior and expectations of services providers and the choices of their customers. NERA's finding in its report that the performance of the Canadian broadband market in terms of pricing is superior compared to international benchmarks is unjustified and has no probative value.

Appendix 2 – Misleading Claim Based on the EIU Internet Affordability Index⁷⁴

The expert report produced by Dr. Robert W. Crandall commissioned by TELUS for the Canadian Competition Bureau Broadband Market Study includes the statement, “Confirmation of the relative affordability of Canadian high-speed broadband services is also provided by the Economist Intelligence Unit’s (EIU’s) recent 2017 *Inclusive Internet Index* report. Canada is ranked highest among the 75 countries it sampled in terms of affordability of broadband according to the EIU.” Reference is made to this finding in the 2017 EIU report. The EIU’s more recent 2018 report⁷⁵ not referred to in the Crandall report confirms Canada’s #1 ranking according to its Internet Affordability index. The Crandall report then asserts that, “Based on the available recent evidence, one must conclude that Canadians are able to subscribe to high-speed wireline Internet services at very reasonable prices.”

However the term “high speed” in this assertion is imprecise and not quantified, in contrast to the details of the services for which pricing data is analyzed in this report on international comparisons of broadband prices for both fixed wireline and mobile wireless connectivity. An analysis of the structure and inputs into the calculation of the EIU’s Internet Affordability Index reveals that the conclusion just cited is unjustified for the wireline Internet services, which perform at levels that are relevant to an assessment of Canada’s broadband market in relation to other developed economies. The assertion in the Crandall report cited above is a rush to an incorrect judgment reached without an adequate understanding of, or attention to how the EIU’s Affordability Index is calculated.

Affordability in the EIU work is characterized as follows: ***Affordability:*** *The category looks at the cost of access to the Internet and considers initiatives, whether private or public, to decrease costs or promote access in other ways. Cost of access relative to income is a critical factor in Internet adoption. The category includes factors that look at price, such as the cost of a handset or fixed-line broadband, and the competitive environment for wireless and broadband operators.*

Affordability is calculated by the EIU on the basis of a number of inputs, which do not represent the current, let alone the emerging demands and expectations of Canadians, or residents of other rich and developed economies for the broadband connections needed to handle the services and applications they actually use⁷⁶. The list of indicators used in evaluating this affordability, and the sources used are shown in Table A.2-1, taken from the EIU Methodology Report (GNI – Gross National Income):

⁷⁴ Expert Report of Dr. Robert W. Crandall, Submission by TELUS Communications, Inc. to Competition Bureau Canada -Market Study Notice: Competition in Broadband Services, *ibid*.

⁷⁵ <https://theinclusiveinternet.eiu.com/explore/countries/performance> (accessed Jan. 4 2019)

⁷⁶ EIU, “The Inclusive Internet Index 2018 -Methodology Report,” <https://theinclusiveinternet.eiu.com/assets/external/downloads/3i-methodology.pdf>

Table A2.1 – List of Indicators for the EIU's Affordability Index

No.	Indicator	Unit	Description	Source
2	AFFORDABILITY	0-100	The category looks at the cost of access to the Internet. Cost of access relative to income is a critical factor in Internet adoption. The score for the affordability category is the weighted sum of the following indicator scores: 2.1 to 2.2.	
2.1	PRICE	0-100	The cost of access relative to income is an important factor for Internet adoption. Generally, the lower the cost of access, the higher the adoption rates. The price score is the weighted sum of the following indicators: 2.1.1 to 2.1.4.	
2.1.1	Smartphone cost (handset)	Score of 0-100, 100 = most affordable	This measures the indexed scores of the price of an entry-level handset to the consumer, as a percentage of GNI per capita. Generally, the lower the cost of a smartphone handset, the higher the adoption rates.	GSMA
2.1.2	Mobile phone cost (prepaid tariff)	% of monthly GNI per capita	This measures the price of a prepaid 500 MB mobile data plan, as a percentage of monthly income. Generally, the lower the mobile phone data cost, the higher the adoption rates.	ITU, World Bank
2.1.3	Mobile phone cost (postpaid tariff)	% of monthly GNI per capita	This measures the price of a postpaid 500 MB mobile data plan, as a percentage of monthly income. Generally, the lower the mobile phone data cost, the higher the adoption rates.	ITU, World Bank
2.1.4	Fixed-line monthly broadband cost	% of monthly GNI per capita	This measures the price of fixed-line monthly broadband to the consumer as a percentage of monthly income. Generally, the lower the broadband cost, the higher the adoption rates.	ITU, World Bank
2.2	COMPETITIVE ENVIRONMENT	0-100	A healthy, competitive environment usually leads to lower prices for consumers. The competitive environment score is the weighted sum of the following indicators: 2.2.1 to 2.2.3.	
2.2.1	Average revenue per user (ARPU, annualized)	USD	This measures the average revenue per user (ARPU) for wireless operators. Generally, the higher the ARPU, the higher the adoption rates.	Telegeography
2.2.2	Wireless operators' market share	HHI score (0-10,000)	This measures the market concentration among all wireless operators. The Hirschman-Herfindahl Index measures the concentration of markets as follows: HHI < 3,000 "unconcentrated"; 3,000 ≤ HHI < 4,000 "moderately concentrated"; and HHI ≥ 4,000 "highly concentrated". A lower HHI score indicates a more competitive environment.	EIU, Telegeography
2.2.3	Broadband operators' market share	HHI score (0-10,000)	This measures the market concentration among all broadband operators. The Hirschman-Herfindahl Index measures the concentration of markets as follows: HHI < 3,000 "unconcentrated"; 3,000 ≤ HHI < 4,000 "moderately concentrated"; and HHI ≥ 4,000 "highly concentrated". A lower HHI score indicates a more competitive environment.	EIU, Telegeography

Price accounts for 2/3 of these calculations of Affordability by country, weighted equally between the four prices shown in the preceding table, while the Competitive Environment accounts for the remaining 1/3, within which the two operators' market shares each have weights of 40% and ARPU represents the remaining 20%.

The key prices used in these calculations do not correspond to broadband connections that can handle the services and applications, which dominate the traffic generated by Canadians, or Americans, or Europeans in the wealthiest countries of Western Europe, or by Japanese or South Koreans. These broadband customers already consume on average much more than 500 MB of mobile data, while the ITU's figures for fixed line monthly broadband cost do not cover today's popular high speed services⁷⁷.

The findings of the EIU Affordability Index are not entirely inconsistent given the differences in the methodologies employed with the findings in this report (see Tables 3 and 4 in Section 2.3 above). In these findings Canada, while not ranked #1, is ranked significantly higher at the lower end of broadband performance than for

⁷⁷ "ICT Prices," https://www.itu.int/en/ITU-D/Regional-Presence/ArabStates/Documents/events/2018/ICT-Statistics/Presentations/Session_11EXTRA_ITU_Prices.pdf

the higher performance services which are relevant to a forward looking contemporary evaluation of the status of the Canadian broadband market.

The EIU findings are valuable in identifying and quantifying gaps - the global “digital divide” – which mean that internet access, and/or internet access beyond minimal DSL speeds is unaffordable for many of the world’s inhabitants. But they are not a reasonable representation of where wealthy developed countries stand in relation to each other regarding the prices of the modern and emerging fixed wireline and mobile wireless broadband services at the performance levels which customers in these countries expect and to which they subscribe.

Appendix 3: Iliad (France)

Iliad France is the fourth operator in France, which has been a disruptive force in this market for both fixed wireline and mobile wireless broadband services. Iliad's market success, despite its much later market entry as a challenger to three well entrenched operators (Orange, the incumbent (formerly France Telecom), SFR (now Altice France) and Bouygues Telecom), can be attributed to its innovations over time in both the services it has offered and the structure of its pricing. Iliad's most striking initial innovation was the introduction in 2002 of the first "triple play" device (under development since 2000) to deliver access to the Internet, telephone and TV services through one end-user terminal, the "Freebox." Competitors took four years to launch comparable devices. The capabilities of the Freebox have been substantially expanded since then, most notably in the launch of the high end Freebox Delta⁷⁸. Most recently Iliad has reported a total of almost 6.5 million fixed wireline broadband customers in France of which about one eighth were FTTH (fiber-to-the-home) subscribers. Its estimated share of the French market for fixed wireline broadband at end-2017 was 24%, putting it in second place behind the incumbent Orange, a position it has occupied for several years, ahead of two other operators SFR (Altice France) and Bouygues Telecom.

In the mobile wireless arena the business model of Free (Iliad's mobile wireless operation) has not simply relied on offering lower prices than the other three operators it confronted on entering the market at the beginning of 2012. Free has also launched pioneering initiatives in distribution, selling SIM cards and contracts through vending machines, and in the features or capabilities it includes in some of its offerings, e.g. including roaming from Australia at no extra charge, at one time initiating offers with very large data allowances (20GB) and bundling its mobile wireless service with Iliad's innovative Freebox-based offerings. As of end 2017 Free had a mobile wireless market share of 19%, with over 13.5 million subscribers.

The significance of Iliad extends well beyond its individual achievements. This entrant's disruptive effect on the dynamics of the French market, through its approach to pricing and its innovations, has obliged the other three operators to rethink their approaches to the market in ways that are more responsive to customers' desires, and the more demanding expectations which Iliad's initiatives have aroused. These responses have begun to have an effect on Iliad's growth⁷⁹. While it remains to be seen how the structure and dynamics of the French market

⁷⁸ "Iliad à la relance avec une Freebox Delta haut de gamme," https://www.lesechos.fr/tech-medias/hightech/0600272090827-xavier-niel-lance-la-nouvelle-freebox-delta-a-4999-euros-par-mois-2227031.php#xtor=EPR-3034-%5Bnl_thematique%5D-20181205-%5BProv_paywall%5D-2031980 (in French)

⁷⁹ "Télécoms. Iliad, maison mère de Free, change de direction pour rebondir," May 2018, <https://www.ouest-france.fr/high-tech/telephonie/telecoms-iliad-maison-mere-de-free-change-de-direction-pour-rebondir-5762452> (in French)

may evolve in future, nevertheless Iliad's impact on competition, pricing, and the behavior of operators in the French market has been profound.

The story of Iliad to date is a striking example of success in changing the dynamics, increasing the competitive intensity, and reducing the pricing of broadband services for the benefit of end-users in a developed economy. However it is not the only path that should be considered to achieve these objectives, particularly in the case of Canada where the time required and the costs of building a national network capable of competing with the facilities of established major operators across its vast territory are much more daunting than in France.

Appendix 4 - Curriculum Vitae of Martyn F. Roetter

Address: 144 Beacon Street, Boston, Massachusetts 02116, USA

email: mroetter@gmail.com

Cell: (+1) 617-216-1988

Dr. Martyn Roetter is a management consultant and advisor to high technology business executives, regulators, and investors on matters involving products, markets, competitors, sales channels, and technology. His work frequently involves the application of global perspectives in dealing with the complexities of challenges whose outcomes depend upon the interactions between business and market dynamics, technologies, finance, and public policy. He has extensive business experience in Europe, the Americas, Asia and elsewhere. Over the course of his career he has initiated or contributed to the foundation and growth of several new services businesses. He has over 30 years of consulting experience as a Vice President with Arthur D. Little Inc., PA Consulting and others as well as his own sole proprietorship MFRConsulting. He is also associated as a Senior Adviser with South Africa-based BMI-TechKnowledge (<http://bmit.africa>) and with TechPolis (<https://techpolis.com>), which provides international consulting services to leading players in the mobile technologies sector. He has provided international comparisons of the impact and efficacy of regulatory policies in the ICT (Information and Communication Technology) arena on both the supply and demand sides for a major project conducted by BMIT on behalf of the South African Department of Communications, and assessed the sometimes competing policy arguments by satellite and terrestrial operators for global, regional and national spectrum allocations in a project led by TechPolis. He has also analyzed spectrum policies and spectrum costs as influences on the development of mobile communications markets in a number of countries on behalf of the GSM Association.

He frequently deals with the interactions between business, technology, and finance, as well as regulation, politics, and public policy. He has carried out strategy assessment and implementation work as well as project due diligence for network operators, service providers, components and equipment vendors, and their investors. His clients and their target geographies have ranged extensively across the Americas, Europe, Asia, and the Middle East and Africa. Most recently he has been concentrating on the economics, markets, and business plans of wireless communications operators, including techno-economic comparisons of new broadband wireless technologies as well as, in the broader arena of ICT, next generation Web services and the implications of all-IP networks for fixed/mobile competition and convergence and related regulatory issues. He has tackled a number of projects involving competitive and other business dynamics that very much reflect the changing shape of globalization, i.e. the “globalization of globalization”, in which the traditional economic powerhouses of North America, Western Europe, and Japan have been joined by major actors such as China, India,

and Brazil as well as financial investors from the Middle East. He has authored or co-authored submissions to several recent proceedings at the Federal Communications Commission, on a *pro bono* basis as well as through commissioned analyses, including reviews of proposed mergers and acquisitions involving cable companies and mobile operators.

He served as a non-executive member on the Board of Directors of Allen Telecom (leading global supplier of wireless subsystems) from 1998 until its acquisition by Andrew Corp. in 2003. He was educated in England, Germany, and the U.S., and holds a doctorate in physics from the University of Oxford. A U.S. citizen, he also speaks French and has a working knowledge of German.