

Analysis of BDU Contributions, ISP Taxes and Regulations in the Canadian Broadcasting & Telecommunications Industries:

ECONOMIC EFFICIENCY, INVESTMENT
AND INNOVATION

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Notice

- This Report was prepared for Shaw Communications Inc. in connection with its participation in the Broadcasting and Telecommunications Legislative Review initiated by the Ministers of Innovation, Science and Economic Development Canada and Canadian Heritage.
- We acknowledge the valuable contributions of many individuals to this Report and to the underlying analysis, including members of The Brattle Group for peer review.
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I. Executive Summary

1. We have been retained by Shaw Communications Inc. (“Shaw”) to draft this report in connection with Shaw’s participation in the Broadcasting and Telecommunications Legislative Review (the “Legislative Review”), which was launched by the Ministers of Innovation, Science and Economic Development Canada and Canadian Heritage on June 5, 2018.¹ While the Legislative Review covers a broad array of issues under the Broadcasting Act, Telecommunications Act and Radiocommunication Act, Shaw has asked us specifically to address the economic efficiency implications of:
 - a. Existing and proposed taxation programs in the broadcasting sector designed to collect revenues from broadcasting distribution undertakings (“BDUs”), and potentially internet service providers (“ISPs”) and wireless service providers (“WSPs”), in support of Canadian media content; and
 - b. Existing and proposed regulations in the telecommunications sector, such as regulations designed to promote non-facilities-based competition from resellers.
2. While the government and regulatory interventions in the broadcasting and telecommunications sectors described in (a) and (b) above are distinct—with the intervention in the broadcasting sector being the imposition of a tax and the intervention in the telecommunications sector being both a tax and a form of economic regulation—we apply standard economic analyses and find that the economic efficiency implications of both are quite similar. Our analysis shows that both policies will significantly dampen incentives to invest in facilities and networks, thus negatively impacting broadband network investment, deployment and innovation in both wireline and wireless broadband markets and, importantly, delay and hinder the growth in nascent fifth-generation mobile network technologies (“5G”).
3. Existing and proposed taxation programs of BDUs, ISPs and WSPs in support of Canadian content, as well as the resale regulations to promote retail competition in telecommunications, have, albeit for different reasons, negative impacts on network investment and innovation, including on 5G deployment. For the taxation programs in support of Canadian content in the broadcasting sector, in addition to the above-noted harm to “dynamic” efficiency, we also consider the “static” cost to society caused by the tax

¹ “Broadcasting and Telecommunications Legislative Review,” Innovation, Science and Economic Development Canada, available at <http://www.ic.gc.ca/eic/site/110.nsf/eng/home>.

resulting in higher prices and thus an inefficient allocation of resources in the economy – i.e., “deadweight loss.”²

4. In the broadcasting sector, our analysis of the existing mandatory BDU contribution regime and proposed ISP and WSP taxation plans finds that these schemes are associated with significant deadweight losses to the Canadian economy from the lower total consumer and producer welfare (also referred to as “social welfare loss” or “total welfare loss”) that is generated as a result of their market-distorting effects.³ These social welfare losses stem from the lost value to consumers (measured by the lost consumer surplus) and producers (measured by the lost producer surplus) from decreased output following the introduction of the tax. The tax effectively raises the price to consumers for the service being taxed, which under normal market demand conditions results in reduced demand and therefore lower output. This lower output results in social welfare losses to the economy from exchanges of goods or services between consumers and producers that do not occur at the higher after-tax price, but would otherwise have occurred absent the tax.⁴ In addition, these levies lower the utilization of the existing, currently deployed networks and disincentivize network

² Effects on innovation and the development of products and services over time are referred to as “dynamic” efficiencies, in contrast to “static” efficiencies which consider whether resource allocation is maximized at a point in time.

³ The terms “social welfare loss,” “deadweight loss,” “total welfare loss,” and “allocative inefficiency” are interchangeable concepts in this report, all referring to the static efficiency losses resulting from the tax, as explained below. Total welfare is comprised of two components: consumer surplus and producer surplus. Consumer surplus is an economic measure of consumer welfare in the market for a good or service based on the difference between what consumers are willing to pay for the good or service and the price consumers actually pay. Producer surplus is an economic measure of producer welfare based on the difference between the price of the good or service and what it costs to supply the good or service. Social welfare maximization dictates that transactions occur up to the point where the amount consumers are willing to pay for a marginal unit of the good is equal to the amount it costs to supply that marginal unit.

⁴ This deadweight loss analysis is what economists refer to as a “partial equilibrium” framework. In other words, it considers only the direct impact of the tax on consumers and producers in terms of lower output of the goods affected by the tax. It does not consider broader economic impacts on the sector(s) being taxed, which would reflect a “general equilibrium” framework (and would also consider the knock-on effects of that lost output on employment levels in other sectors or more generally on gross domestic product).

Additionally, in estimating these social welfare effects, we do not weigh any sector of the economy with greater or less importance relative to any other. In other words, while there is inherently a trade-off occurring when one sector is taxed to benefit another sector, our analysis is agnostic as to whether the digital sector subject to the tax is more or less important from an efficiency perspective than the cultural sector that receives the benefits of the taxes, and we do not use any multipliers to show greater impact for one sector over another. Similarly, we do not consider the potential negative economic impacts that occur when a sector receives a subsidy that is not commensurate with a market failure or externality, such as greater output in the sector than is otherwise optimal.

providers to invest in improvements to their networks, investments that are critical to dynamic competition in Canada and accrue to the benefit of the Canadian economy.

5. The existing mandatory BDU contribution regime requires BDUs to contribute 5% of their gross broadcasting revenues to Canadian programming. Our baseline analysis indicates that this program results in an annual deadweight loss to the Canadian economy of 38¢ for every \$1 of revenue contributions elicited by the regime, which is equivalent to approximately \$167 million per year.⁵
6. We understand that a new set of contributions to Canadian programming from ISPs and WSPs (collectively, the “ISP Tax”) has been proposed by certain stakeholders,⁶ in part to account for the expected ongoing decrease in traditional revenues from broadcast distribution (e.g., as a result of cord cutting) in favour of the consumption of programming online. To address that prospect, we implement the same empirical analysis to (i) an assumed ISP Tax of 1% in addition to the existing 5% tax on BDUs; and (ii) an assumed future decrease in the mandated 5% BDU contributions, such that the overall contribution regime remains revenue neutral (i.e., the regime generates the same total contribution revenue following the introduction of the 1% ISP Tax). We demonstrate the revenue neutral scenario for illustrative purposes, since over time there may be a continued decline in BDU revenues subject to the existing 5% mandatory contribution, or the government may simply seek to maintain certain contribution levels in light of these decreasing BDU revenues.⁷ In addition, revenue neutrality makes policies comparable on an apples-to-apples basis.

⁵ All dollar values in this report are in Canadian dollars.

⁶ *See, e.g.*, “Comments of the Canadian Media Producers Association,” Broadcasting Notice of Consultation CRTC 2017-359, December 1, 2017.

⁷ *See, e.g.*, “Terms of Reference,” Broadcasting and Telecommunications Legislative Review, available at <http://www.ic.gc.ca/eic/site/110.nsf/eng/00001.html>, Section 10: “Traditional regulatory mechanisms by which creation and access to Canadian content have been achieved may not be as effective in the digital environment where usual practices linked to scheduled audio or television programming or story-telling may no longer apply. Therefore, there is an opportunity to consider whether there are new ways that Canadian content creation, distribution, and discovery in both official languages can be supported in this new digital communications environment. However, the Government is not interested in an approach that increases the cost of services to Canadians.”

See, e.g., “Harnessing Change: The Future of Programming Distribution in Canada,” CRTC, Section “Conclusions and Potential Options,” available at <https://crtc.gc.ca/eng/publications/s15/pol1.htm>: “For instance, contributions from these connectivity services could be based on a fixed percentage of the revenues of BDU and radio services, as well as appropriate telecommunications services earning more than a minimum exempted level of revenues. For example, at an estimated level of 1% of revenues, contributions from telecommunications services would be somewhat higher than those expected from existing contribution commitments, contributions from radio services would be somewhat higher than those currently made to Canadian content development and contributions from BDUs would be considerably less than their current requirement to contribute up to 5% of their revenues. With this

7. Under the scenario where we assume no change in the existing mandatory BDU contribution regime, our baseline analysis finds that the ISP Tax would result in an *incremental* deadweight loss of 54¢ for every \$1 of generated tax revenue, which is equivalent to approximately \$180 million per year (above and beyond the \$167 million per year in deadweight loss from the current 5% BDU contribution regime) for a total deadweight loss of approximately \$347 million per year. Assuming a future decrease in the BDU contribution rate to produce revenue neutrality under the scenario of the 1% ISP Tax, the resulting deadweight loss would be \$221.2 million per year, which represents a significant incremental deadweight loss of \$54.4 million per year as compared to the deadweight loss from the existing 5% BDU contribution regime. Accordingly, even the introduction of a notionally “revenue-neutral” ISP Tax would carry a significant cost to the Canadian economy, notwithstanding that it might be presented as, *per se*, not raising the cost of services to Canadians.
8. The ISP Tax would also have the effect of reducing the utilization of existing network infrastructure and diminishing the incentives for investment by facilities-based providers in expanding, maintaining and improving their network infrastructure. Hence, to the extent it is deemed that taxes are helpful to promote Canadian content, imposing regulations on the telecommunications sector would inevitably distort otherwise beneficial market outcomes, thereby reducing overall economic efficiency.
9. In a prior report,⁸ we demonstrated that over-regulation harms dynamic efficiency in telecommunications markets, especially in today’s landscape with the anticipated rollout of 5G on the horizon. Our analysis highlighted the technological evolution and convergence of wireline and wireless broadband markets in Canada, as well as the “technology competition” between fiber and coaxial broadband on the one hand and wireless LTE and nascent 5G on the other – a trend only likely to strengthen. We concluded that, in the context of this technology convergence, any additional resale obligations on wireline facilities-based broadband providers would further distort and bias this dynamic competition, delay

approach, the burden of supporting content by and for Canadians would be partly reallocated within the system to include appropriate telecommunications services, while continuing support for broadband deployment. This approach recognizes the fact that the vast majority of the demand for telecommunications services and the associated growth in their revenues is driven by video and audio content. It further recognizes that most telecommunications services in Canada are part of highly vertically integrated companies that also include BDUs and often programming services of various types. Preliminary analysis suggests that such an integrated fund could potentially be revenue-neutral across the entire system.”

- ⁸ Coleman Bazelon, Renée Duplantis, and Agustin J. Ros (2018), “An Analysis of Broadband Services in Canada: Competition, Regulation, and Investment,” available at [http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf/\\$file/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf](http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf/$file/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf).

facilities-based broadband investment, and lower overall economic efficiency in Canadian broadband markets. An ISP Tax will have similar effects on investment and efficiency in broadband markets.

10. We conclude, as supported by relevant tax literature, that consumption taxes on a broader revenue base are generally more efficient than an asymmetric tax on certain producers and not others.⁹ We understand, of course, that any tax on industry revenues is going to have some distortionary effect, resulting in a deadweight loss. However, there are more efficient revenue-neutral tax alternatives to consider, such as a sales tax (GST/HST).
11. In addition to calls in the Legislative Review for an ISP Tax to promote Canadian content, some stakeholders have called for the introduction of legislative and regulatory changes to mandate increased non-facilities-based resale business, arguably to facilitate telecommunications competition at the retail level. Similar to the conclusions at which we arrived regarding calls for an ISP Tax to promote Canadian content, a regulatory or legislative approach that weakens support for facilities-based competition would diminish investment and cause dynamic efficiency losses.
12. In the telecommunications sector, the Canadian Radio-television and Telecommunications Commission (“CRTC”) has explained that its “general approach towards wholesale service regulation has been to promote facilities-based competition wherever possible,” and has concluded that facilities-based competition “is typically regarded as the ideal and most sustainable form of competition.”¹⁰ Our prior economic analysis supports this view and demonstrates the important role that facilities-based investment and competition plays in achieving economic efficiency in broadband markets in Canada.¹¹ We find here that stringent regulation of facilities-based suppliers – intended to aid resellers – can have significant distortions on investment incentives, which would be exacerbated if those regulations were to ignore the full cost that resellers impose on facilities-based suppliers.
13. In particular, over-broad price regulation diminishes incentives for long-term investment (a conclusion that is consistent with the broad consensus in the economics literature). Any legislative or regulatory changes aimed at promoting the resale segment at the expense of

⁹ The exception to this general conclusion, not applicable in the current analysis, is taxation meant to correct market failure. The classic example is a “Pigouvian tax” on pollution. *See, e.g.*, Hal Varian (2010), “Intermediate Microeconomics: A Modern Approach, Eighth Edition,” WW Norton & Company, at 655-658.

¹⁰ “Review of Wholesale Wireline Services and Associated Policies,” Telecom Regulatory Policy 2015-326 CRTC, July 22, 2015, at paragraph 5.

¹¹ Coleman Bazelon, Renée Duplantis, and Agustin J. Ros (2018), “An Analysis of Broadband Services in Canada: Competition, Regulation, and Investment,” available at [http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf/\\$file/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf](http://www.competitionbureau.gc.ca/eic/site/cb-bc.nsf/vwapj/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf/$file/Shaw_Submission_to_Competition_Bureau--Broadband_Market_Study--The_Brattle_Group_Report--PUBLIC_REDACTED.pdf).

facilities-based service providers, would likely deter further investment in infrastructure by those providers in their networks especially if they are not compensated at rates that reflect the full opportunity cost of that investment. Further, lowering the rental price of leasing infrastructure below the full opportunity cost of the investment could lead resellers toward less efficient leasing practices and away from building their own infrastructure. Together, the diminished investment incentives for both facilities-based service and resellers could easily cause significant social welfare losses because new technology would not be introduced to consumers as the marketplace would otherwise optimally dictate.

II. Introduction and Assignment

14. We have been retained by Shaw to draft this Report in connection with the Legislative Review launched by the Ministers of Innovation, Science and Economic Development Canada and Canadian Heritage on June 5, 2018.¹² The Canadian government set out the objectives and scope of the Legislative Review in its Terms of Reference.¹³ An expert panel has been tasked with studying the *Broadcasting Act*, the *Telecommunications Act*, and the *Radiocommunication Act* to make recommendations to the Ministers; the panel has invited written submissions in response to its call for comments.¹⁴
15. Shaw has asked us to address two issues relevant to the topics under consideration by the panel in the Legislative Review. The first relates directly to the existing taxes levied on BDUs for contribution to various funds that promote the production of Canadian content, as well as to potential changes or alternative taxes aimed at achieving the same policy goal. Specifically, Shaw has asked us to address the economic efficiency and network investment implications of these existing and potential future/alternative taxation programs. We address Shaw's questions by first conducting empirical analyses to quantify the social welfare loss to the Canadian economy from: (a) the existing 5% tax levied on BDU gross revenues, and (b) a potential additional 1% ISP Tax. We do so first with the assumption that the 5% BDU contribution regime remains unchanged; and, second, assuming revenue neutrality following introduction of the ISP Tax – i.e., we assume a decrease in the BDU contribution rate that leads to the same total contribution revenue following the introduction of the ISP Tax.

¹² "Broadcasting and Telecommunications Legislative Review," Innovation, Science and Economic Development Canada, available at <http://www.ic.gc.ca/eic/site/110.nsf/eng/home>.

¹³ "Terms of Reference," Broadcasting and Telecommunications Legislative Review, available at <http://www.ic.gc.ca/eic/site/110.nsf/eng/00001.html>.

¹⁴ "Responding to the New Environment: A Call for Comments, Broadcasting and Telecommunications Legislative Review," Innovation, Science and Economic Development Canada, available at <http://www.ic.gc.ca/eic/site/110.nsf/eng/00003.html>.

16. In relation to the existing and potential taxation regimes, we also address the question of whether there is a more efficient way in which the Canadian government could achieve its policy goal of promoting Canadian content, but in a manner that would negate some of the efficiency losses that arise from the existing program and proposed ISP Tax. We then discuss the implications of these taxes (and the Canadian government's policy objective more broadly) – namely, the impact of the taxes on Shaw's (and its facilities-based competitors') utilization of current network infrastructure and incentive and ability to invest in network development. From both perspectives, we assess whether the current Canadian regulatory approach to supporting Canadian content through a levy on the revenues of BDUs, as well as any introduction of an ISP Tax, will diminish network investments and, in turn, lower dynamic economic efficiency.
17. The second topic Shaw has asked us to address also relates to the dynamic efficiency effects of regulation. In particular, we were asked to consider the impacts of resale regulation in the Canadian telecommunications sector, which is currently facilitated by a cost-based, resale regime imposed on both traditional telephone and cable operators. This question is related to the above-noted prior report we submitted in connection with Shaw's participation in the *Competition in Broadband Services Market Study* commenced by the Competition Bureau that sought comments from industry participants concerning the competitive dynamics of Canada's broadband internet services industry.
18. As discussed in our August 2018 report, our analysis there supports the view that facilities-based competition "is typically regarded as the ideal and most sustainable form of competition,"¹⁵ including the important role that facilities-based investment and competition play in achieving economic efficiency in broadband markets in Canada. In the report, we reviewed the economic literature and empirically quantified the effect of wholesale access regulation in the telecommunications sector on investment, including the implications in a dynamic market with the anticipated rollout of 5G.
19. Specifically, we discussed how stringent regulation of facilities-based suppliers intended to aid resellers can have significant distortions on investment incentives that, in turn, can be exacerbated if those regulations ignore the full cost that resellers impose on facilities-based suppliers. Moreover, by making it comparatively cheaper to continue leasing infrastructure instead of building their own, such regulation can also distort the incentive for facilities-based entry by resellers. The diminished investment incentives for both facilities-based service providers and resellers under such regimes may lead to social welfare losses if new technology is not optimally introduced to consumers.
20. While we do not explicitly address the questions set out in the panel's Terms of Reference in this Report, our analysis of the issue of BDU and potential ISP contributions to Canadian

¹⁵ "Review of Wholesale Wireline Services and Associated Policies," Telecom Regulatory Policy 2015-326 CRTC, July 22, 2015, at paragraph 5.

content, as well as our analysis in support of facilities-based competition, directly relate to the following questions set out in those Terms of Reference:

- a) **1.2.** Given the importance of passive infrastructure for network deployment and the expected growth of 5G wireless, are the right provisions in place for governance of these assets?
- b) **2.1.** Are legislative changes warranted to better promote competition, innovation, and affordability?
- c) **10.1.** How can we ensure that Canadian and non-Canadian online players play a role in supporting the creation, production, and distribution of Canadian content?
- d) **14.4.** Are there tools that the CRTC does not have in the Broadcasting Act that it should?

21. The remainder of this Report is structured as follows:

- a) Section III contains an overview of recent trends in the Canadian broadcasting and telecommunications sectors, which are relevant to our analyses of social welfare and dynamic efficiency effects from regulation and potential additional regulation in these sectors;
- b) Section IV sets out our analysis of the social welfare effects of the existing mandatory BDU contribution regime and the proposed ISP Tax, as well as the dynamic efficiency effects (e.g., impacts on network investment and innovation) from these contribution regimes;
- c) Section V analyzes the impact of resale regulation on network investment, innovation and facilities-based competition in the telecommunications sector; and
- d) Section VI concludes.

III. The Canadian Broadcasting and Telecommunications Sectors

22. To help contextualize our analysis, we describe certain features and recent trends in the broadcasting and telecommunications industries.

A. Broadcasting Sector

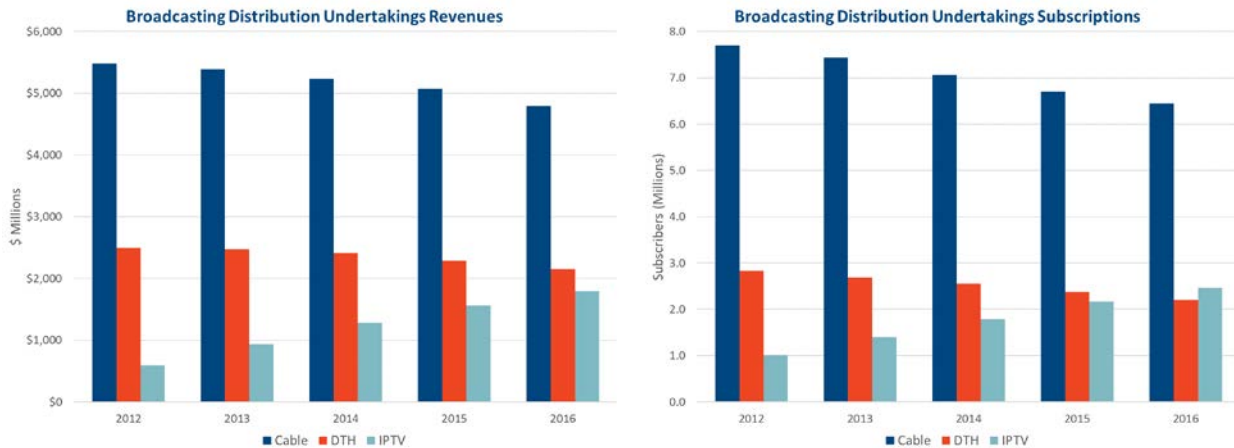
1. Overview and Recent Trends

23. In its annual Communications Monitoring Reports, the CRTC classifies the Canadian broadcasting sector into four segments:¹⁶
- a) “Radio,” including privately owned commercial radio stations, public radio stations operated by the Canadian Broadcasting Corporation/Société Radio-Canada (“CBC”), and community, campus and Aboriginal radio stations;
 - b) “Conventional Television,” including privately owned conventional television stations, and CBC television stations that are originated over-the-air;
 - c) “Discretionary and On-Demand Television Services,” including pay television, pay per view (“PPV”), video-on-demand (“VOD”), and specialty services; and
 - d) “Broadcasting Distribution Undertakings,” including cable companies, national direct-to-home and multipoint distribution service satellite providers (“DTH”), and Internet protocol television (“IPTV”), that provide subscription television services and distribute Conventional Television, Discretionary and On-Demand Television Services. BDUs are also referred to as “paid television service providers.”
24. Figure 1 shows the distribution of revenue and subscriptions by BDU type (i.e., cable, DTH, and IPTV). As shown, while cable BDUs (\$4.8 billion in revenue and 6.4 million subscribers) and DTH satellite providers (\$2.2 billion in revenue and 2.2 million subscribers) were the largest types of BDUs in terms of revenues, their share of the market declined during the 5-year period from 2012 to 2016 to the benefit of IPTV services, which saw revenues increase by over 200% to \$1.8 billion and subscribers increase by almost 150% to 2.5 million subscriptions during this period.¹⁷ In fact, IPTV subscriptions outnumbered DTH satellite subscriptions for the first time in 2016, although its geographical reach is more limited than that of DTH (the footprints of which reach nearly all of Canada) due to its reliance on wireline infrastructure.

¹⁶ See, e.g., “Communications Monitoring Report 2017,” Canadian Radio-television and Telecommunications Commission, (hereafter “CRTC Communications Monitoring Report 2017”), Section 4.0 at p. 91-92, Section 4.1 at p. 100, and Section 4.3 at p. 192.

¹⁷ CRTC Communications Monitoring Report 2017, Table 4.3.1 and Table 4.3.3.

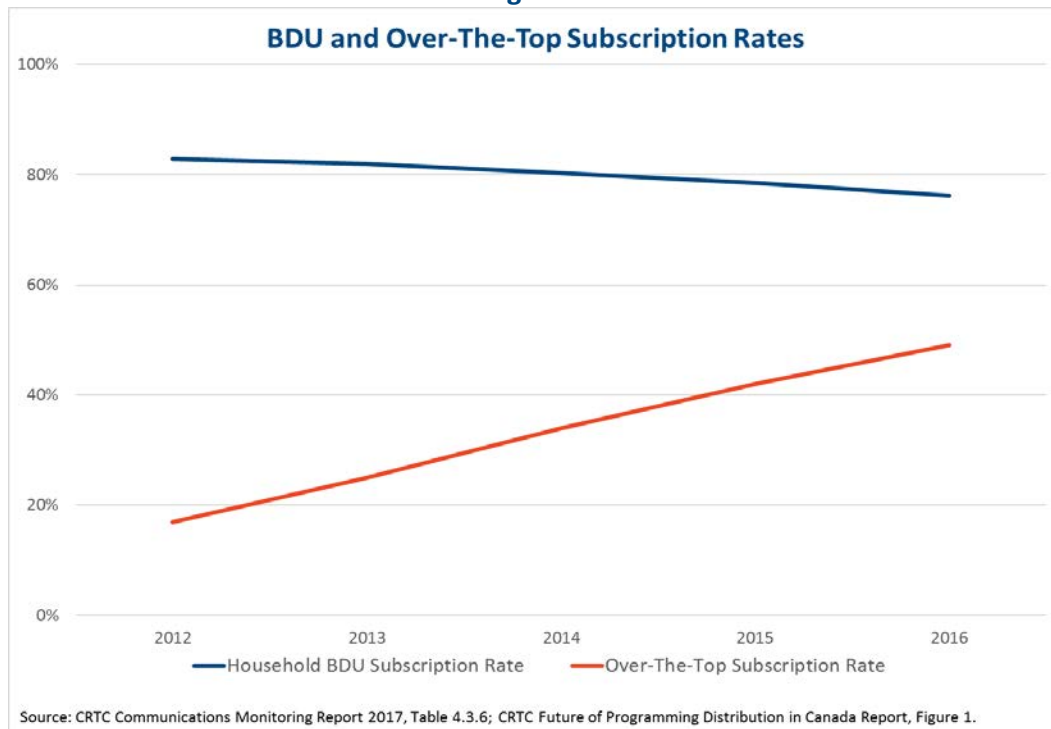
Figure 1



Source: CRTC Communications Monitoring Report 2017, Table 4.3.1 and Table 4.3.3.

25. The compound annual growth rate of BDU subscriptions between 2012 and 2016 was -4.3% for cable, -6.0% for DTH, and 25.2% for IPTV.¹⁸ During this period, total subscriptions across all BDUs decreased at a compound annual growth rate of -0.9%. The percentage of households subscribing to BDUs decreased from approximately 83% in 2012 to 76% in 2016, as shown in Figure 2.¹⁹

Figure 2



Source: CRTC Communications Monitoring Report 2017, Table 4.3.6; CRTC Future of Programming Distribution in Canada Report, Figure 1.

¹⁸ CRTC Communications Monitoring Report 2017, Table 4.3.1 and Table 4.3.3.

¹⁹ CRTC Communications Monitoring Report 2017, Table 4.3.6.

26. Much of the decline in BDU subscriptions has been attributed to “cord cutting,” with Canadians cancelling their subscriptions to traditional broadcast distributors or reducing their pay television packages and then switching to “over the top” (“OTT”) programming services, such as Netflix.²⁰ As shown in Figure 2, OTT subscriptions increased from 17% of the Canadian population in 2012 to almost 50% of the population in 2016.²¹

2. Mandatory BDU Contributions and Proposed Taxation Schemes for Canadian Content

27. Pursuant to the *Broadcasting Distribution Regulations*,²² licensed BDUs are required to contribute 5% of their annual gross broadcasting revenues to support the production of Canadian programming content. This includes contributions to the Canada Media Fund (“CMF”), various Certified Independent Production Funds (“CIPF”), or to community channels. Figure 3 below summarizes the breakdown of the BDU contributions by destination fund.²³

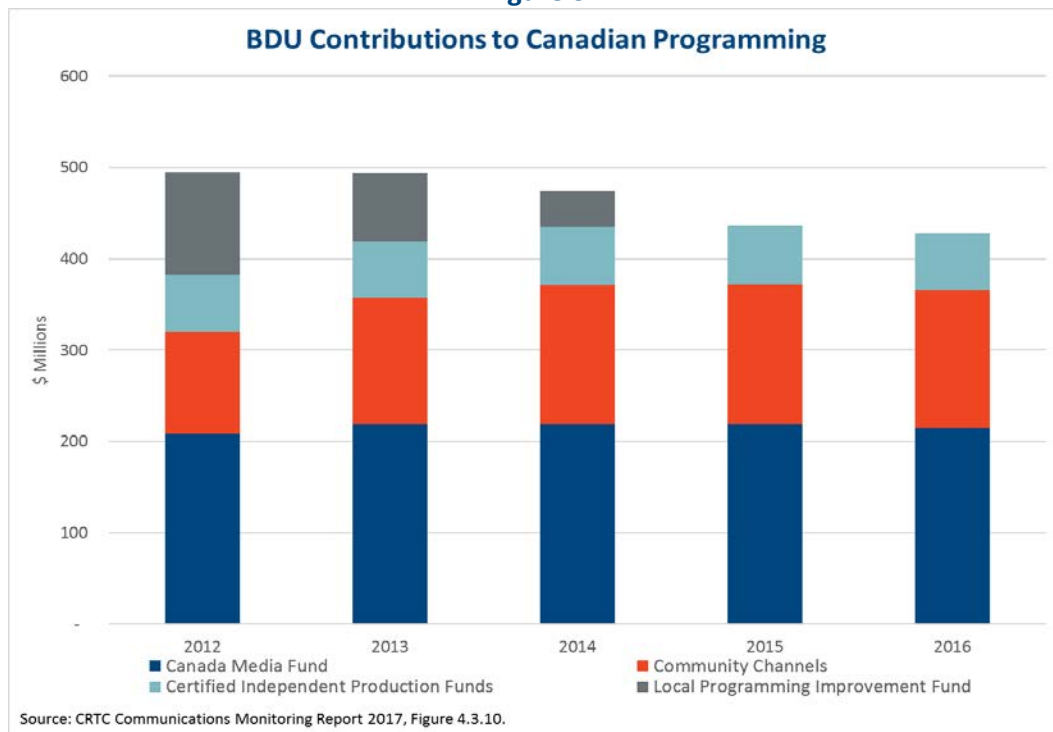
²⁰ See, e.g., “Canadians Tuning in Less to Traditional TV and Radio, CRTC Report Finds,” CBC News, November 8, 2017, available at <https://www.cbc.ca/news/business/crtc-media-report-1.4392937>; “The Writing’s on the Wall’: Streaming Services like Netflix Set to Overtake Cable TV,” CBC News, April 29, 2018, available at <https://www.cbc.ca/news/business/netflix-cable-tv-convergence-cord-cutting-1.4637065>.

²¹ “Harnessing Change: The Future of Programming Distribution in Canada,” CRTC, Section “Part 1: Internet Trends,” Figure 1, available at <https://crtc.gc.ca/eng/publications/s15/mar1.htm>.

²² “Broadcasting Distribution Regulations,” Minister of Justice, ss. 35 and 52(1), available at <https://laws-lois.justice.gc.ca/PDF/SOR-97-555.pdf>.

²³ CRTC Communications Monitoring Report 2017, Figure 4.3.10.

Figure 3



28. As shown, between 2012 and 2016, BDU contributions fell in absolute dollar terms by approximately 13%, from \$494.7 million in 2012 to \$428.2 million in 2016.²⁴ Notably, BDU contributions actually increased to the CMF (by 3%), CIPF (by 1%), and community channel expenditures (by 34%) between 2012 and 2016, as contributions to the LPIF ended. Subsequent to the contributions represented by the data above, the CRTC enabled BDUs to contribute a portion of their community channel contributions to conventional broadcasters for the production of local news.²⁵
29. In light of recent industry trends, certain industry stakeholders have advocated for new forms of contribution by industry participants to increase funding for Canadian content contributions. One proposal is for the introduction of a legislative change that would facilitate a new ISP Tax to supplement the existing tax on BDUs.²⁶ For the purpose of this

²⁴ As expected, these contributions of \$428.2 million for 2016 represent approximately 5% of total BDU gross revenues of \$8,734 million. [CRTC Communications Monitoring Report 2017, Table 4.0.1.]

²⁵ “Policy Framework for Local and Community Television,” Broadcasting Regulatory Policy CRTC 2016-224, June 15, 2016, at paragraph 90, available at: <https://crtc.gc.ca/eng/archive/2016/2016-224.htm>.

²⁶ See, e.g., “Comments of the Canadian Media Producers Association,” Broadcasting Notice of Consultation CRTC 2017-359, December 1, 2017.

Report, when estimating the impact of an ISP Tax we assume a tax rate of 1% on gross ISP and WSP revenues.²⁷

30. To illustrate the magnitude of a potential ISP Tax, had a 1% ISP Tax been implemented between 2012 and 2016, the revenues that would have been raised by the tax are shown in Figure 4 under the assumption that the retail Internet and wireless markets would have remained at the same size in each of those years.²⁸ In our analysis, we consider the tax base for the ISP Tax to be total retail Internet service revenues and total retail wireless revenues.²⁹

Figure 4
Hypothetical Tax Revenues from a 1% ISP Tax (\$ Millions)

Year	ISP Tax Rate	Wireline and Wireless Revenues			Tax Revenue
		Retail Wireline Total	Retail Wireless Total	Total Tax Base	
[A]	[B]	[C]	[D]	[E] = [C] + [D]	[F] = [B] × [E]
2012	1%	7,196	19,527	26,723	267
2013	1%	7,725	20,198	27,923	279
2014	1%	8,414	20,945	29,359	294
2015	1%	9,249	22,524	31,773	318
2016	1%	10,178	23,244	33,422	334

Source: CRTC Communications Monitoring Report 2017, Table 5.3.1 and Table 5.5.2.

31. As shown in Figure 4, a 1% ISP Tax would have generated (all else equal) approximately \$334 million in tax revenue in 2016. Assuming no change in BDU revenues, this would be incremental to the existing contributions from the 5% levy on BDUs.
32. To illustrate the magnitude of the 1% ISP Tax relative to the existing 5% BDU contribution regime, \$334 million represents approximately 78% of the \$428 million in BDU contributions collected. Similarly, the 1% ISP Tax revenue (\$334 million) would be equivalent to 3.8% of the total 2016 BDU revenues of \$8.7 billion. Said differently, in order for such an ISP Tax to remain revenue neutral (i.e., for the total revenues generated for contribution to be the same both with and without the proposed ISP Tax), the required BDU

²⁷ The basis for the 1% estimate is that it is the level contemplated by the CRTC in its digital report, “Harnessing Change: The Future of Programming Distribution in Canada,” available at <https://crtc.gc.ca/eng/publications/s15/>. As described in detail below, we consider an ISP Tax on total retail broadband and wireless service revenues.

²⁸ As discussed below, a tax generally increases price and decreases output, thus resulting in smaller market size and lower overall economic efficiency. In our calculations later in this report, we take into account this increase in price and decrease in output when assessing the impact of the tax. The figures here are close approximations for illustrative purposes of the magnitude of the tax.

²⁹ To the extent the ISP Tax is implemented on a different tax base, the deadweight loss estimates in this report would change accordingly. A higher ISP Tax rate would generate higher deadweight losses, and a lower ISP Tax rate would generate lower deadweight losses.

contribution rate would have to decrease from 5% to 1.2% of BDU revenues.³⁰ To the extent ISP and WSP revenues increase in the future, an even greater decline in the BDU contribution rate would be required to maintain revenue neutrality.³¹

33. In Section IV below, we analyze the social welfare effects resulting from the existing mandatory BDU contribution regime and the proposed ISP Tax. We find that both the existing BDU contribution regime and the proposed 1% ISP Tax lead to substantial deadweight losses. Even a revenue-neutral ISP Tax would be associated with a substantial deadweight loss – and, notably, a greater deadweight loss than the BDU contribution regime alone. These levies will also have negative implications for investment and dynamic efficiency.

B. Telecommunications Sector Background

1. Overview and Recent Trends

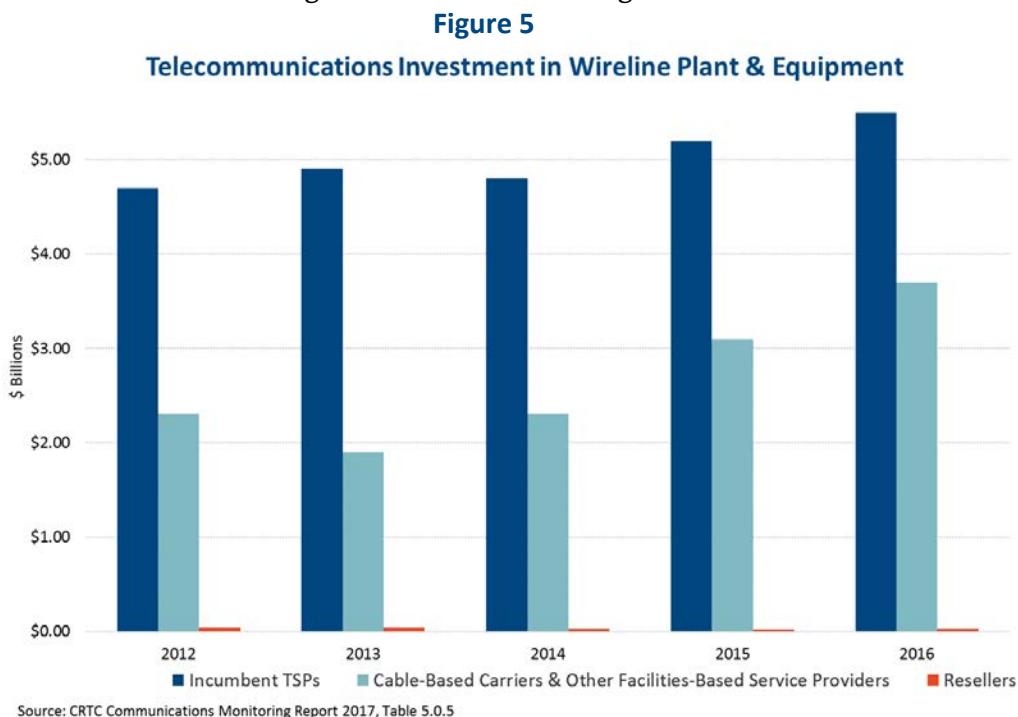
34. In its reporting, the CRTC classifies telecommunications service providers according to four primary categories:³²
- a) Incumbent Telecommunications Service Providers (“Incumbent TSPs”), comprised of companies that provided local telecommunications services on a monopoly basis prior to the introduction of competition. The large Incumbent TSPs are Bell Canada and its regional subsidiaries (including Bell Aliant, Bell MTS, Northwestel, and Télébec), TELUS, and SaskTel (owned by the provincial government of Saskatchewan).
 - b) “Cable-Based Carriers,” comprised of companies that originally provided only cable service and now also provide telecommunications services. The most prominent Cable-Based Carriers are Rogers, Shaw, Vidéotron (a subsidiary of Québecor), Eastlink (Bragg) and Cogeco.
 - c) “Other Facilities-Based Service Providers,” including companies such as Xplornet and Zayo Canada that are non-incumbent providers of telecommunications services and own and operate telecommunications networks.
 - d) “Non-Facilities-Based Service Providers” or “resellers,” including companies such as Distributel, TekSavvy and Verizon Canada that provide services by leasing others’ facilities and reselling those services.

³⁰ A lower required BDU contribution rate could decrease price and increase output, thereby resulting in larger revenues from the broadcasting sector, and higher overall economic efficiency.

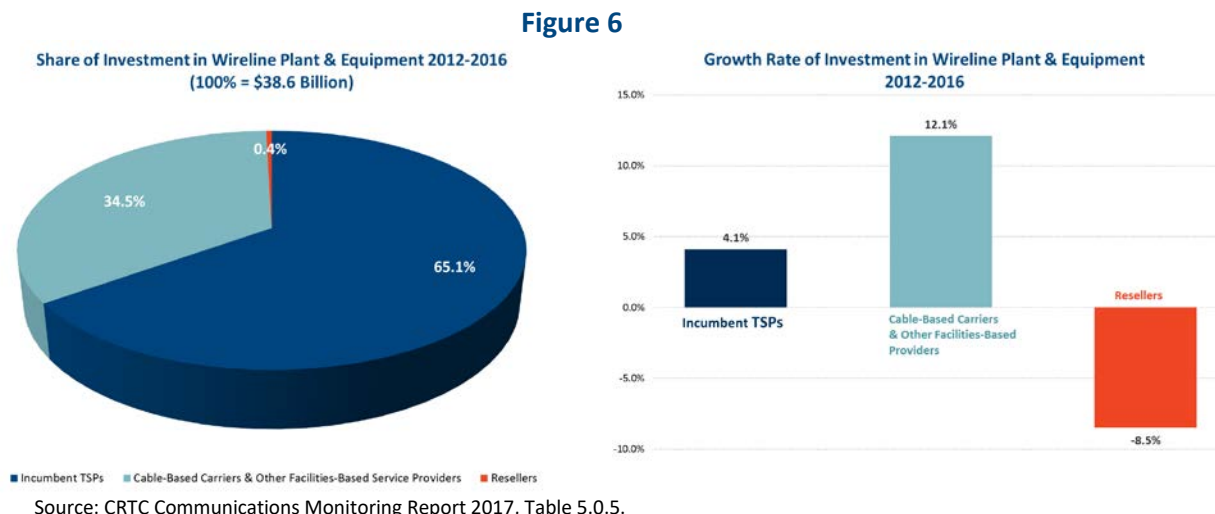
³¹ Note that we consider both an incremental ISP Tax (i.e., an ISP Tax that generates revenues in addition to existing BDU contributions) and a revenue neutral ISP Tax. The illustration in this paragraph is to demonstrate the relative impacts of the taxes for a given level of revenue raised.

³² CRTC Communications Monitoring Report 2017, p. 214.

35. Facilities-based providers are responsible for virtually all network investment in Canada and their level of investment is significant, as shown in Figure 5.³³



36. Facilities-based providers together accounted for 99.6% of telecommunications investments made in wireline plant and equipment during the period 2012 through 2016, while resellers accounted for only 0.4% (see left panel of Figure 6). In fact, the compound annual growth rate in telecommunication investment during this period was 4.1% for Incumbent TSPs, 12.1% for Cable-Based Carriers and Other Facilities-Based Service Providers, but -8.5% for resellers – that is, annual investment by resellers was, on average, declining between 2012 and 2016 (see right panel of Figure 6).



³³ CRTC Communications Monitoring Report 2017, Table 5.0.5.

2. Convergence and Platform Competition Between Wireline and Wireless Broadband Internet

37. The telecommunications industry is characterized by frequent and significant technological change. The tendency of the industry towards the convergence of telecommunications services, first by facilitating the provision of various services on various networks (e.g., voice telephony with traditional telephone, cable and wireless; and Internet service on traditional telephone and cable wireline networks and, subsequently, wireless networks) and, more recently, through the convergence of different networks (e.g., wherein one network is used to provision broadband Internet and closed BDU service) creates competition in the marketplace, thereby reducing the need for broad regulatory intervention to correct market failures. Based on the trajectory of innovation in this product space, it is fair to anticipate that 5G may bring about more robust platform competition than current wireless offerings due to increases in capacity and improving latency constraints compared to 4G technology.

a. Telecommunications Convergence and Platform Competition

38. Since at least the mid-to-late 1990s, the telecommunications sector has been undergoing significant technological changes in all aspects of the network, including customer access, transmission/transport, switching/routing and retail network service functionalities. The terms “telecommunications convergence,” “platform competition,” and “network convergence” are variously used to refer to the ongoing technological and market-based evolution of multiple communications services that once required discrete networks migrating to and being offered over a single “converged” network. The telecommunications services being migrated onto a single network include voice telephony, data and private line, broadband and Internet, and video.
39. Voice telephony is a paradigmatic example of convergence. Previously only available over fixed-line circuit-based telecommunications networks, today voice telephone services are also available from cable and Voice over Internet Protocol (“VoIP”) providers and, most importantly, wireless network operators. In 2015, 27.5% of Canadian households used only wireless telephone services, compared to 4.8% in 2005.³⁴ Similarly, video services that were previously only offered by cable television networks are today also offered by fixed-line telecommunications network and wireless network providers.
40. Convergence and platform competition has been occurring and continues to occur for broadband Internet service as well, as reflected in the significant platform competition between the traditional telephone service providers and Cable-Based Carriers described above in this Report. Platform competition for broadband Internet services from wireless network providers is more recent. The first wireless broadband technologies deployed in the 1990s and 2000s, such as 2.5G and 3G, could not compete with wireline broadband in terms of capacity, quality and price.

³⁴ CRTC Communications Monitoring Report 2017, Table 2.0.5.

41. The deployment of fourth generation technology (“4G”), e.g., LTE and LTE Advanced, by wireless network providers has altered these dynamics and is contributing to increasing platform competition among wireline and wireless broadband providers. Wireless 4G technology can provide comparable download and upload speeds as wireline broadband services.³⁵
42. Speed is an important, but not the sole, criterion for substitutability and healthy competition between wireline and wireless broadband; the LTE Advanced networks currently deployed in Canadian cities are more than capable of matching the speeds of most wireline connections.³⁶ There are other criteria that must be satisfied to ensure substitutability and healthy competition, including the availability of and equitable access to spectrum by wireless companies. Today, wireline broadband’s advantage is in terms of capacity (the amount of data a network can handle overall) and latency (the time between an instruction for a data transfer and its execution).
43. 5G is predicted to erase the gaps in latency and capacity between wireline and wireless broadband, in addition to offering even faster download and upload speeds. As a result, 5G is expected to make broadband platform competition between wireline and wireless significantly stronger.

b. Rollout of 5G and Ability to Compete With Wireline Broadband

44. 5G is the combined result of technical developments, infrastructure deployment, and improvements in network management.³⁷ In its IMT-2020 framework for international mobile telecommunications for 2020 and beyond, the International Telecommunications

³⁵ In its most recent Mobile Wireless Competition Report, the U.S. Federal Communications Commission noted that “[s]ervice providers continue to expand and adjust data plans and pricing, including adding new plans and reintroducing unlimited data plans to the mobile wireless marketplace. [...] In recent years, both average revenue per connection and average revenue per MB have been falling.” [“Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services,” Federal Communications Commission, Twentieth Report, WT Docket No. 17-69, September 27, 2017, at para 6. See also the discussion in ss. III.A. Available at <https://docs.fcc.gov/public/attachments/FCC-17-126A1.pdf>.]

³⁶ The popular publication PCMag tested wireless broadband speeds in cities across Canada, using phones with the necessary hardware and software to fully utilize the newest LTE network technology. The three largest carriers (Bell, TELUS, and Rogers) all had average download speeds over 50 Mbps. [“Fastest Mobile Networks Canada 2017,” PCMag.com, September 11, 2017, available at <https://www.pcmag.com/article/348825/fastest-mobile-networks-canada-2017>.]

³⁷ For a brief summary of the technical aspects of 5G, see Oughton, E. J., & Frias, Z. (2018), “The Cost, Coverage and Rollout Implications of 5G Infrastructure in Britain,” *Telecommunications Policy*, 42(8), 636-652. For a more comprehensive treatment, see Andrews, J. G., Buzzi, S., Choi, W., Hanly, S. V., Lozano, A., Soong, A. C., & Zhang, J. C. (2014), “What will 5G Be?” *IEEE Journal on Selected Areas in Communications*, 32(6), 1065-1082.

Union (“ITU”) calls for mobile networks that can support new use cases, such as a large number of connected devices and applications that require high data-rate communications, ultra-low latency and high reliability applications, and envisions networks that can reach peak data-rates of up to 20 Gbps, over-the air latency as low as 1 ms, and support connection densities of up to 1 million devices per square kilometer.³⁸ Building on this framework, the 3rd Generation Partnership Project’s (“3GPP”), the association of telecommunications standard development organizations behind the standards for 2G (GSM, EDGE), 3G (UMTS, HSPA) and 4G (LTE, LTE Advanced), is developing a 5G New Radio standard (“5G NR”) for the air interface of mobile networks, i.e., use of spectrum for the radio transmission between mobile devices and base stations.³⁹ The improvement in wireless technology offered by 5G is expected to lead to a convergence between wireline and wireless broadband networks, thereby bringing about even more fulsome platform competition.

45. Simulated field tests conducted in February 2018 by Qualcomm have shown that a 5G NR network operating in 800 MHz of 28 GHz mmWave spectrum with an underlying Gigabit LTE network can achieve browsing speeds of 1.4 Gbps (a 2000% improvement over 4G for the median user), latency of 4.9 ms (a 2300% improvement), and file download speeds of 442 Mbps for the median user.⁴⁰
46. 5G technology is expected to offer improvements over 4G in all key performance measures: faster speeds, much lower latency, and the capacity to handle many more connections and volume of throughput.⁴¹ Industry experts have identified a few key use cases, including:⁴²

³⁸ “Recommendation ITU-R M.2083-0: IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond,” International Telecommunications Union, September 2015 at 1, 14.

³⁹ “Mobile Industry Works Together to Deliver Complete 5G System Standard on Time”, 3GPP press release, June 14, 2018, available at http://www.3gpp.org/news-events/3gpp-news/1965-rel-15_news; “Release 15,” 3GPP press release, July 16, 2018, <http://www.3gpp.org/release-15>.

⁴⁰ “Qualcomm Network Simulation Shows Significant 5G User Experience Gains,” Qualcomm press release, February 25, 2018, available at <https://www.qualcomm.com/news/releases/2018/02/25/qualcomm-network-simulation-shows-significant-5g-user-experience-gains>.

⁴¹ *See, e.g.*, Collins, M., Das, A., Ménard, A. and Patel, D. “Are you Ready for 5G?” McKinsey & Company, February 2018, available at <https://www.mckinsey.com/industries/telecommunications/our-insights/are-you-ready-for-5g>; “A Network of Networks: How will Carriers Handle the Evolution to 5G?” Deloitte Insights, June 22, 2017, available at <https://www2.deloitte.com/insights/us/en/topics/emerging-technologies/5g-next-gen-network-of-networks.html>.

⁴² “Recommendation ITU-R M.2083-0: IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond,” International Telecommunications Union, September 2015, at 11-12.

- Enhanced mobile broadband (“eMBB”), addressing consumer use of the Internet for multi-media content, with networks capable of handling high user density and providing high data rates with seamless coverage;
 - Ultra-Reliable and Low Latency Communications (“URLLC”), addressing commercial use of mobile networks in fields such as industrial manufacturing, medicine, and transportation that have exacting requirements for throughput, latency and availability; and
 - Massive Machine Type Communications (“mMTC”), addressing the automated use of the Internet and exchange of information by “smart” machines.
47. In addition to improved mobile broadband, 5G is expected to handle the enormous number of connections needed to enable the so-called Internet of Things, i.e., the high density of network connections required for the interconnection of everyday objects via Internet; the extremely low latency is expected to open up applications that require time-critical control; and its speed and capacity is expected to make fixed wireless access a viable alternative to wireline broadband.⁴³ Richard Bennett, a prominent network expert whose accomplishments include co-inventing Wi-Fi, emphasizes that 5G could be significantly cheaper than deploying fibre over the ‘last mile’ to homes.⁴⁴
48. In early June 2018, the Federal Government of Canada announced that it would be holding two more auctions for 5G-capable spectrum by 2021, in addition to the one it had already announced for 2019. The March 2019 auction will be for 600 MHz band spectrum, and an auction to be held in 2020 will be for 3.5 GHz spectrum, the latter of which is expected to be key for 5G networks. The Government plans to auction millimeter-wave spectrum in 2021.⁴⁵
49. Moreover, wireless network operators in Canada are all actively investing to develop 5G mobile networks. In February 2018, TELUS began trials for wireless-to-the-home, promising

⁴³ Mark Collins, Arnab Das, Alexandre Ménard, and Dev Patel, “Are you Ready for 5G?” McKinsey & Company, February 2018, available at <https://www.mckinsey.com/industries/telecommunications/our-insights/are-you-ready-for-5g>.

⁴⁴ “A great deal of the cost of building a network is the last 1,000 feet. FiOS [i.e, fibre-optic service] costs Verizon about \$700 to \$1,000 per home, but small cells lowers [sic] that costs to \$100 to \$200 per home.” [“The Dawn of 5G: Will Wireless Kill the Broadband Star?” Forbes, September 22, 2017, available at <https://www.forbes.com/sites/washingtonbytes/2017/09/22/the-dawn-of-5g-will-wireless-kill-the-broadband-star/>.]

⁴⁵ “Ottawa to Hold 5G Spectrum Auctions by 2021, Introduces New Low-Income Internet Program,” The Globe and Mail, June 6, 2018.

a ‘fibre-like experience’ for home users.⁴⁶ In April 2018, Rogers and Ericsson announced 5G trials in Toronto, Ottawa, and other selected cities over the next year.⁴⁷ Shaw (owner of Freedom Mobile) completed its first technical trials of 5G in May 2018.⁴⁸ Bell, which had conducted its first 5G trial in partnership with Nokia in 2016 and followed with further trials in partnership with Huawei in 2017,⁴⁹ has publicized plans to use 5G-oriented technology to deliver high-speed Internet to rural customers.⁵⁰ GSMA, an international industry association representing mobile operators, expects 5G to launch in 2020 in Canada, and will make up roughly 50 percent of all mobile connections by 2025.⁵¹

50. In Section V below, we discuss the implications of regulations designed to address potential market imperfections—particularly, resale regulations—on facilities-based competition and network-investment decisions by facilities-based service providers. As noted in a 2005 OECD report, while the CRTC has made significant efforts to expand the number of players in the telecommunications industry, “[t]hese restrictions could have negative effects, limiting investment, increasing the cost of capital and delaying the spread of new technologies.”⁵²

⁴⁶ “Huawei, Telus Announce 2Gbps WTTx Trial,” Telegeography CommsUpdate, February 16, 2018, available at <https://www.telegeography.com/products/commsupdate/articles/2018/02/16/huawei-telus-announce-2gbps-wttx-trial/>.

⁴⁷ “Rogers, Ericsson Report on 5G Tests, Network Development Plans,” Telegeography CommsUpdate, April 17, 2018, available at <https://www.telegeography.com/products/commsupdate/articles/2018/04/17/rogers-ericsson-report-on-5g-tests-network-development-plans/>.

⁴⁸ “Shaw Completes its First 5G Trials,” Telegeography CommsUpdate, May 23, 2018, available at <https://www.telegeography.com/products/commsupdate/articles/2018/05/23/shaw-completes-its-first-5g-trials/>.

⁴⁹ “Bell and Nokia Complete First Canadian Trial of 5G Mobile Technology,” Bell Canada press release, July 29, 2016, available at <https://www.newswire.ca/news-releases/bell-and-nokia-complete-first-canadian-trial-of-5g-mobile-technology-588663571.html>; “Bell, Huawei and BeWhere Bring New Internet of Things Solution to Ontario Winery,” Bell Canada Press Release, November 9, 2017, available at <https://www.newswire.ca/news-releases/bell-huawei-and-bewhere-bring-new-internet-of-things-solution-to-ontario-winery-656383253.html>.

⁵⁰ “Huawei Enables Bell Canada's Wireless to the Home (WTH) Trials that put Canadian Rural Customers on the Path to 5G,” Huawei Canada press release, February 27, 2018, available at <https://www.newswire.ca/news-releases/huawei-enables-bell-canadas-wireless-to-the-home-wth-trials-that-put-canadian-rural-customers-on-the-path-to-5g-675262803.html>.

⁵¹ “The Mobile Economy: North America 2018,” GSMA, 2017, available at <https://www.gsma.com/mobileeconomy/northamerica/>, at p. 3.

⁵² Maher, M. and Shaffer, J.C. (2005), “Product Market Competition and Economic Performance in Canada,” OECD Economics Department Working papers No. 421, at 26.

IV. Efficiency and Investment Effects of Mandatory BDU Contributions and ISP Taxation

A. The Static Efficiency Implications of Existing and Potential Broadcasting Tax Regimes

51. Economics focuses on three broadly defined efficiency concepts:⁵³
- Productive efficiency: The production of a given volume of output at the lowest possible resource cost;
 - Allocative efficiency: The socially optimal allocation of goods to their most valuable uses; and
 - Dynamic efficiency: The socially optimal introduction of new production processes or goods and services.
52. Productive and allocative efficiency are static concepts, in that they look at economic efficiency at a given point in time. Allocative efficiency captures the concept of productive efficiency, but also asks whether resources are allocated in the most efficient fashion, i.e., whether the optimal amount of each good is produced. Dynamic efficiency looks at improvements in the quality of the set of available goods and services over time as well as the introduction of new goods and services.
53. A tax on a good or service can have effects on allocative efficiency because it increases the price paid by consumers, decreases demand and thereby reduces the volume of output that is produced (leading to consumer and producer deadweight losses).⁵⁴ Consumer surplus is an economic measure of consumer welfare based on the difference between what consumers are willing to pay for a good and the price consumers actually pay. Producer surplus is an economic measure of producer welfare based on the difference between the price of the good and what it costs to supply the good. Static social welfare maximization dictates that transactions occur up to the point where the amount consumers are willing to pay for a marginal unit of the good is equal to the amount it costs to supply that marginal unit.
54. A tax effectively raises the price to consumers for the service being taxed, resulting in lower demand, and in turn, lower output – i.e., leading to efficiency losses to the economy. These

⁵³ See, e.g., “Merger Enforcement Guidelines,” Competition Bureau, October 6, 2011, ss. 12.14 – 12.18 and 12.25.

⁵⁴ See, e.g., Hal Varian (2010), “Intermediate Microeconomics: A Modern Approach, Eighth Edition,” WW Norton & Company, at 304-306.

losses result from exchanges of goods or services between consumers and producers that do not occur at the higher after-tax price, but otherwise would have occurred absent the tax.

55. To the extent that the tax also lowers the economic return from producing the good or service, the tax can also have effects on dynamic efficiency if it reduces firms' incentives to invest in new goods and services.⁵⁵

1. Consumption Taxes are Generally More Efficient than Asymmetric Commodity Taxes

56. It is generally understood in economics that taxes can create market distortions because they cause changes in market prices. As noted by Auerbach and Hines (2002):

Tax-induced reductions in economic efficiency are known as deadweight losses or the excess burdens of taxation, the latter signifying the added cost to taxpayers and society of raising revenue through taxes that distort economic decisions.⁵⁶

57. Further, precisely because of changes in market prices from taxation, the burden of a tax is not necessarily borne by the party on which it is levied; if imposed on producers, it can also be borne by consumers of the good and vice versa. "Economic incidence differs from the statutory incidence because of changes in behavior and consequent changes in equilibrium prices."⁵⁷
58. Optimal tax theory is a field of economics that studies the design and implementation of taxation systems to maximize social welfare or at least minimize the distortion caused by taxes.⁵⁸ Early research in the field led to the assertion by Ramsey (1927) that, in order to minimize efficiency losses, goods and services should be taxed in inverse proportion to their income elasticity.⁵⁹ This means that goods and services that experience high demand volatility in response to price changes should be taxed less as compared to those that are relatively less responsive to changes in price.

⁵⁵ See, e.g., Kotlikoff, L. J., & Summers, L. H. (1987), "Tax Incidence," in *Handbook of Public Economics Vol. 2*, 1043-1092. Elsevier.; Auerbach, A. J., & Hines Jr, J. R. (2002), "Taxation and Economic Efficiency," in *Handbook of Public Economics Vol. 3*, 1347-1421. Elsevier.

⁵⁶ Auerbach, A. J., & Hines Jr, J. R. (2002), "Taxation and Economic Efficiency," in *Handbook of Public Economics Vol. 3*, 1347-1421. Elsevier.

⁵⁷ Fullerton, D., & Metcalf, G. E. (2002), "Tax Incidence," in *Handbook of Public Economics Vol. 4*, 1787-1872 at 1787. Elsevier.

⁵⁸ For a review of the literature on optimal tax theory see, for example, Auerbach, A. J., & Hines Jr, J. R. (2002), "Taxation and Economic Efficiency," in *Handbook of Public Economics Vol. 3*, 1347-1421. Elsevier.

⁵⁹ Ramsey, F. P. (1927), "A Contribution to the Theory of Taxation," *The Economic Journal*, 37(145), 47-61.

59. A more general view of taxation considers an economy where other forms of taxation are available. In this environment, economists such as Atkinson and Stiglitz (1976), Mirrlees (1976), Deaton (1979) and Kaplow (2006) suggest uniform taxes.⁶⁰ The distortionary impact of taxation occurs because consumers change their consumption behaviour and producers change their supply behaviour due to the distortion in price caused by a tax. In a uniform tax environment, the price of all goods increases by the same percentage amount, so relative prices remain unchanged and the efficiency losses to the economy from consumers and producers changing their behavior is minimized.
60. The efficiency implications of taxes in the telecommunications industry, specifically, are also well documented. Jerry Hausman's (2000) seminal research on the mobile telephone industry addressed the economic efficiency effects of the taxation of wireless services.⁶¹ Hausman calibrated a model of the compensating variation (based on the elasticity of demand for wireless services), or the amount needed to pay an individual to keep the individual as well off with an increase in taxes as they would be without the increase in taxes, and finds that for every \$1 increase in wireless taxes there is a corresponding \$0.72-\$0.93 loss in social welfare. He attributes the large efficiency costs of taxation in this sector in part to the high price elasticity for wireless phone services at that time. This means that for any increase in the cost of wireless services, demand will decrease significantly. Therefore, when tax rates increase, consumers respond by purchasing fewer wireless phone services and consumers suffer because they are consuming a sub-optimal quantity of the service. Producers also suffer because their revenues decrease. Hausman (2000) concludes that taxing wireless phone services cannot be justified on a luxury good basis (because these technologies are becoming increasingly crucial for all consumers) or for efficiency reasons.
61. Ingraham and Sidak (2004) build on Hausman's (2000) work by re-investigating the price elasticity of demand for wireless services.⁶² They find that the elasticity increased since Hausman's original research, suggesting that an increase in taxes on wireless services would lead to an even larger negative quantity response and thus decrease welfare even further. The authors estimate that increasing the tax rate by 1% decreases demand for the service by 1.12%-1.29%. The authors call for a reduction of the tax rate on wireless services, stating that each \$1 reduction would increase total welfare by between \$1.23 and \$1.95.

⁶⁰ Atkinson, A. B., & Stiglitz, J. E. (1976), "The Design of Tax Structure: Direct versus Indirect Taxation," *Journal of Public Economics*, 6(1-2), 55-75; Mirrlees, James A. (1976), "Optimal Tax Theory: A Synthesis," *Journal of Public Economics*, 6(4), 327-358; Deaton, A. (1979), "Optimally Uniform Commodity Taxes," *Economics Letters*, 2(4), 357-361; Kaplow, L. (2006), "On the Undesirability of Commodity Taxation even when Income Taxation is not Optimal," *Journal of Public Economics*, 90(6-7), 1235-1250.

⁶¹ Hausman, J. (2000), "Efficiency Effects on the US Economy from Wireless Taxation," *National Tax Journal*, 53(3), 733-742.

⁶² Ingraham, A. T., & Sidak, J. G. (2004), "Do States Tax Wireless Services Inefficiently? Evidence on the Price Elasticity of Demand," *Virginia Tax Review*, 24(2), 249-261.

62. In the context of wireline Internet, Goolsbee (2006) studies the impact that taxes would have had on broadband access if it were to have been taxed at the early stage of its diffusion.⁶³ Goolsbee estimates that the deadweight loss from taxing broadband in 1998 would have been high, “at almost 200% of the revenue such a tax would have generated.”⁶⁴
63. Eisenach (1999) investigates the economic impacts of taxing the telecom industry more generally.⁶⁵ He finds that due to the interconnected nature of telecom and Internet, an increase in the tax rate on telecom services also serves to decrease the availability of Internet services. Eisenach, like Hausman, argues that the impact of an increase in the tax rate is especially severe because the price elasticity for telecom services is relatively high. As Eisenach explains:
- The circumstances that made it possible to subject telecommunications services to a complex system of extremely high tax rates have changed. In fact, the same traditional tax policy analysis that suggests that telecommunications taxes were relatively efficient ways to raise revenue in the pre-competition, pre-Internet environment strongly suggests that they are quite costly and highly inefficient today.⁶⁶
64. A study by Cordes, Kalenkoski and Watson (2000) outlines why taxing telecommunications results in efficiency losses beyond those of other excise taxes.⁶⁷ Among those reasons is that telecommunications companies set prices above marginal cost to cover the substantial fixed costs associated with entering the industry. Therefore, when taxes are added to the price of the good, the final price moves even further from marginal cost, which amplifies the resulting welfare loss. A second reason for greater efficiency losses in telecommunications is that consumers must make two decisions in relation to telecommunications services: whether to purchase the service at all, and how much of the service to purchase. Therefore, an increase in price could result in either a decrease in the quantity purchased or consumers exiting the market altogether.

⁶³ Goolsbee, A. (2006), “The Value of Broadband and the Deadweight Loss of Taxing New Technology,” *The BE Journal of Economic Analysis & Policy*, 5(1).

⁶⁴ Goolsbee, A. (2006), “The Value of Broadband and the Deadweight Loss of Taxing New Technology,” *The BE Journal of Economic Analysis & Policy*, 5(1), p. 2.

⁶⁵ Eisenach, J. A. (1999), “The High Cost of Taxing Telecom,” Progress & Freedom Foundation Progress on Point Paper, Vol. 6.6.

⁶⁶ Eisenach, J. A. (1999), “The High Cost of Taxing Telecom,” Progress & Freedom Foundation Progress on Point Paper, Vol. 6.6., at 14.

⁶⁷ Cordes, J. J., Kalenkoski, C., and Watson, H. S. (2000), “The Tangled Web of Taxing Talk: Telecommunication Taxes in the New Millennium,” *National Tax Journal*, 53(3), 563-587.

65. Ellig (2006) focuses on the negative impacts that regulation and taxation can have on investment in the telecommunications industry.⁶⁸ Ellig states that, “[r]egulation diminishes entrepreneurial incentives to lower costs, improve quality, and develop new products and services.”⁶⁹ Firms face weaker incentives to innovate in their product market if a portion of their revenues or profits are captured by taxation.

2. Empirical Analysis of Deadweight Loss from Taxation in the Canadian Broadcasting and Telecommunications Sector

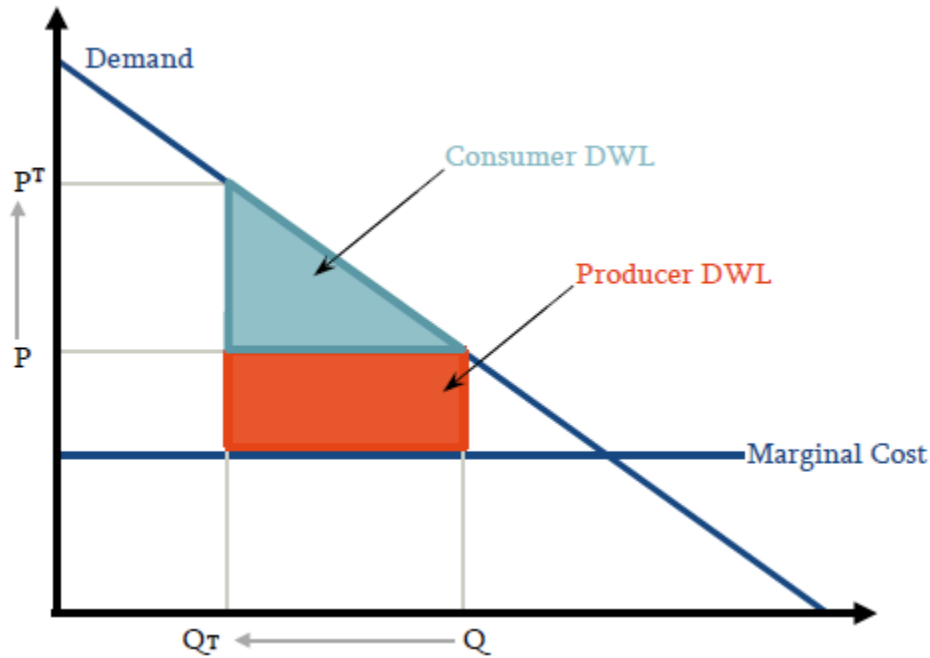
66. In this section, we empirically assess the static deadweight loss – i.e., the loss in consumer and producer surplus – resulting from the regime in which we have the existing 5% mandatory BDU contribution and the proposed ISP Tax. To do so, we first quantify the welfare effects of the current 5% mandatory BDU contribution, and then quantify the incremental welfare effects from the proposed 1% ISP Tax.
67. By increasing prices, and thus lowering demand, taxes distort economic activity and create a loss in social welfare. The social welfare loss of a tax consists of the deadweight loss to consumer and producer surplus that would result from an increase in price.⁷⁰ The deadweight loss and its distribution between consumers and producers will vary depending on the price elasticity of demand of the service, the magnitude of the price increase (which depends upon the amount of the tax that is passed through from producers to consumers), the total revenue of the service being taxed, and the marginal cost of production. The consumer deadweight loss (“Consumer DWL”) is the lost consumer surplus on the consumption that no longer would occur because of the higher price that results from the tax. The producer deadweight loss (“Producer DWL”) is the lost profits on the sales that would no longer be made as a result of the reduced demand after the tax.
68. As illustrated in Figure 7 below, the Consumer DWL is the teal triangle under the market demand curve and above the pre-tax price, given the reduction in consumption that occurs with the increased price after the tax. Similarly, the Producer DWL is the red rectangle below the market demand curve and above firms’ marginal cost, and it can be estimated by multiplying the pre-tax variable margin by the reduction in sales associated with the higher price after the tax. The pre-tax price is shown above the marginal cost of production because for telecommunications and broadcasting services fixed costs are significant and prices must be set above marginal costs in order to recover fixed costs. Both the Consumer DWL and Producer DWL are impacted by the price elasticity of the market demand curve (e.g., for a given price increase, a more elastic demand will result in a greater change in quantity).

⁶⁸ Ellig, J. (2006), “Costs and Consequences of Federal Telecommunications Regulations,” *Federal Communications Law Journal*, 58, 37-102.

⁶⁹ Ellig, J. (2006), “Costs and Consequences of Federal Telecommunications Regulations,” *Federal Communications Law Journal*, 58, 37-102, at 43.

⁷⁰ Hausman, J. (2000), “Efficiency Effects on the US Economy from Wireless Taxation,” *National Tax Journal*, 53(3), 733-742, at 736.

Figure 7
Deadweight Loss from a Tax



69. The Consumer DWL can be estimated as:

$$\text{Consumer DWL} \approx \frac{1}{2} \times \% \Delta P^2 \times \varepsilon \times R \quad (1)$$

where $\% \Delta P$ is percentage change in price due to the tax, ε is the market demand elasticity, and R is the pre-tax size of the market in terms of total revenues. The Producer DWL can be calculated as:

$$\text{Producer DWL} \approx \%M \times \% \Delta P \times \varepsilon \times R \quad (2)$$

where $\%M$ is the percentage margin on marginal costs of firms in the industry.⁷¹

70. Accordingly, for a given price increase, estimating the deadweight loss associated with that price increase requires information on the total size of the market in terms of annual revenues, the profit margin on the lost unit sales that are assumed to occur as a result of that price increase, and the market elasticity of demand.

⁷¹ See, e.g., Equation (1) in Hausman, J. (2000), "Efficiency Effects on the US Economy from Wireless Taxation," *National Tax Journal*, 53(3), 733-742, at 736.

These formulas are exact for a linear demand curve. More generally, for arbitrary demand and supply curves, these formulas are a (first-order) approximation of the Consumer DWL and Producer DWL.

a. Measuring Deadweight Loss under the Current Mandatory BDU Contribution Regime

71. We use the statistical and financial summaries for the broadcast distribution sector for 2016, the most recent year for which data are available from the CRTC,⁷² to quantify the deadweight loss associated with the existing mandatory BDU contribution regime that requires BDUs to contribute 5% of their annual gross broadcasting revenues to support the production of Canadian programming content.⁷³
72. Figure 8 below shows the inputs we use for the total size of the market in terms of annual revenues and the profit margin on the lost unit sales.

Figure 8
Financial Summary for Broadcast Distribution Sector, 2016

Revenues		
Subscription		\$7,797,080,051
Connection		\$55,870,655
Set-top Box Rentals		\$790,080,348
Set-top Box Net Sales		\$38,980,917
Community Channel Sponsorship & Facilities Rental		\$2,591,118
Other Revenue		\$49,581,725
Total Revenues	[A]	\$8,734,184,814
Costs		
Affiliation Payments		\$3,479,059,932
Technical		\$1,522,686,649
Sales & Promotion		\$615,116,196
Administration & General (A&G)		\$1,570,440,707
Total Costs	[B]	\$7,187,303,484
Costs excluding A&G Expenses	[C]	\$5,616,862,777
Margin		
Margin based on Total Costs	[D]	17.7%
Margin based on Costs excluding A&G Expenses	[E]	35.7%

Source: CRTC Broadcasting Distribution Statistical and Financial Summaries for 2012 - 2016, available at <https://crtc.gc.ca/eng/industr/fin.htm>.

Notes: Amounts are aggregate annual returns for Broadcast Distribution Sector (Cable, DTH and IPTV), pursuant to Broadcasting Regulatory Policy CRTC 2009-560.

[D] = $([A] - [B])/[A]$

[E] = $([A] - [C])/[A]$

⁷² “Financial Summaries for Broadcasting Sector,” CRTC, 2012-2016, available at <https://crtc.gc.ca/eng/industr/fin.htm>.

⁷³ Technically, as the inputs we use for the total size of the market and firms’ profit margin are based on annual amounts for 2016, and thus reflect market outcomes under the existing mandatory BDU contribution regime, our calculation reflects the gain to society from eliminating the mandatory BDU contribution regime.

73. With respect to the inputs for our calculations, for market revenue we use total BDU revenues for 2016 from subscriptions, connections, set-top box rentals and sales as well as other sources of revenue. For the margin, we first calculate total BDU costs as the sum of affiliation payments, technical costs, and sales and promotion expenses in 2016.⁷⁴ We then calculate the margin as the difference between total BDU revenues and these costs.⁷⁵
74. For the market demand elasticity, we consider a baseline scenario of 1.0, which is consistent with empirical estimates of the elasticity of demand for television services in Canada found in the economics literature.⁷⁶ Nevertheless, while past studies suggest an elasticity of 1.0 is reasonable, the results are somewhat dated. The introduction of substitutes and increasing prominence of OTT services in recent years may have resulted in demand becoming more elastic, as consumers now have more options to choose from. To account for this trend, we also consider elasticities of 1.5 and 2.0 as more elastic cases.
75. Regarding the price increase associated with the levying of a mandatory BDU contribution, it is generally understood by economists that a tax will have the same effect on the equilibrium price facing consumers and producers, regardless of the side of the market on which the tax is levied (the so called tax equivalence principle).⁷⁷ In general, a tax will both raise the price paid by consumers and lower the corresponding revenues received by

⁷⁴ We have not included administrative and general costs in our calculation of margins, as these costs would not be incremental costs. Furthermore, while the CRTC also includes community programming expenses in its reporting of BDU costs, we have excluded these expenses as they are part of the mandatory BDU contribution regime.

⁷⁵ Technically, the margin for the deadweight loss calculation should be based on marginal costs. To the extent that some of the included costs are not marginal costs, we are using an underestimated margin, which in turn results in an underestimate of the deadweight loss. Said differently, using this lower margin for our analysis provides a conservative (lower) estimate of the deadweight loss.

⁷⁶ For example, an early study by Rubinovitz (1993) estimates an elasticity of approximately 1.45 for U.S. demand for cable television services in 1984 and 1991. Law (2007) re-estimates the Rubinovitz model using data from the CRTC for the period 1989-1991 and finds similar results for Canadian demand for television services, though more recently Law (2002) finds price elasticities of below 1 when looking at data for the period 1990-1996. More recently, in a widely cited study, Goolsbee and Petrin (2004) use a detailed data set on television subscriptions for 30,000 households to identify the own- and cross-price elasticities of demand for cable and satellite services. These authors find that, among various categories of packages considered, expanded basic cable packages had the lowest price elasticity at 1.53, followed by direct broadcast satellite at 2.45 and premium cable at 3.18. [Rubinovitz, R. N. (1993), "Market Power and Price Increases for Basic Cable Service Since Deregulation," *RAND Journal of Economics*, 24(1), 1-18; Law, S. M. (1999), "Holding the Line: The CRTC and the Pricing of Canadian Basic Cable Television Services," *Canadian Journal of Economics*, 32(3), 630-653; Law, S. M. (2002), "Estimating Demand for Canadian Cable Television Services," Mimeo; Goolsbee, A., & Petrin, A. (2004), "The Consumer Gains from Direct Broadcast Satellites and the Competition with Cable TV," *Econometrica*, 72(2), 351-381.]

⁷⁷ Kotlikoff, L. J., & Summers, L. H. (1987), "Tax Incidence," *Handbook of Public Economics Vol. 2*, 1043-1092 at 1045-1047. Elsevier.

producers, and the ultimate incidence of the tax (i.e., how much of the tax is borne by consumers as compared to the amount borne by producers) depends on the relative elasticity of demand and supply. We consider the case where 100% of the tax is passed through to prices.⁷⁸

76. In Figure 9, we show our calculations of the deadweight loss associated with the existing mandatory BDU contribution regime under our baseline assumptions about the elasticity of demand and the pass-through rate.

⁷⁸ Weyl, E. G., & Fabinger, M. (2013), “Pass-Through as an Economic Tool: Principles of Incidence Under Imperfect Competition,” *Journal of Political Economy*, 121(3), 528-583.

Note that the pass-through rate could be higher or lower than 100%, but we have been instructed to consider the scenario where 100% of the tax is passed through to consumers. The case of 100% pass through is consistent with, for example, a perfectly inelastic supply curve. Various models of imperfect competition also allow for price pass-through rates above 100%. Likewise, in a differentiated product market, the mixed logit specification allows for price pass-through rates above and below 100%. Indeed, pass-through rates of greater than 100% have often been found in the empirical literature. [Stern, N.H. (1987), “The Effects of Taxation, Price Control and Government Contracts in Oligopoly and Monopolistic Competition,” *Journal of Public Economics*, 32(2), 133-58; Delipalla, S., and Keen, M. (1992), “The Comparison between Ad Valorem and Specific Taxation under Imperfect Competition,” *Journal of Public Economics*, 49(3), 351-67; Besley, Timothy J., and Rosen. H. S. (1999), “Sales Taxes and Prices: An Empirical Analysis,” *National Tax Journal*, 52(2), 157-178; Bielinska-Kwapisz, A., & Young, D. J. (2002), “Alcohol Taxes and Beverage Prices,” *National Tax Journal*, 55(1), 57-74; Kenkel, D.S., (2005), “Are Alcohol Tax Hikes Fully Passed Through to Prices? Evidence from Alaska,” *American Economic Review*, 95(2), 273-277; Doyle Jr, J. J., & Samphantharak, K. (2008), “\$2.00 Gas! Studying the Effects of a Gas Tax Moratorium,” *Journal of Public Economics*, 92(3-4), 869-884.; Hamilton, S. F. (2008), “Excise Taxes with Multiproduct Transactions,” *American Economic Review*, 99(1), 458-471.]

Figure 9
Deadweight Loss from Current Mandatory
Contribution Regime of 5.0% of BDU Revenues

Tax Revenue			
Total Revenue	[A]	\$8,734,184,814	
Tax Rate	[B]	5.0%	
Tax Revenue	[C]	\$436,709,241	
Deadweight Loss			
Price Change Resulting from Tax	[D]	5.0%	
Elasticity	[E]	1.0	
Total Revenue	[F]	\$8,734,184,814	
Margin	[G]	35.7%	
Consumer DWL	[H]	\$10,917,731	
Producer DWL	[I]	\$155,866,102	
Deadweight Loss	[J]	\$166,783,833	

Notes:

[A] & [F]: Based on total BDU revenues in 2016, as reported by the CRTC.

[B]: Based on current mandatory BDU contribution of 5.0% of total revenues.

[C]: [A] x [B]

[D]: We have assumed that 100% of the 5% required BDU contribution is passed through to prices.

[E]: We have assumed a demand elasticity for broadcast distribution services of 1, which is consistent with empirical estimates of the elasticity of demand for television services found by the literature.

[G]: Based on BDU Costs excluding A&G Expenses in 2016, as reported by the CRTC.

[H]: $0.5 \times [D]^2 \times [E] \times [F]$

[I]: $[D] \times [E] \times [F] \times [G]$

[J]: [H] + [I]

77. As shown in Figure 9, we find that the annual deadweight loss to the Canadian economy resulting from existing mandatory BDU contribution regime is on the order of \$167 million per year under the baseline case. This implies a deadweight loss of approximately 38¢ for every \$1 of revenue contributions elicited by the regime. More generally, as shown in Figure 10 below, the deadweight loss estimates under our alternative assumptions about the elasticity of demand range up to \$334 million of annual losses in total welfare.⁷⁹

⁷⁹ Notably, the overall deadweight loss is driven significantly by the Producer DWL, which represents the vast majority of the total welfare losses. This is especially indicative that the tax is likely to have dynamic efficiency implications by lowering the incentive for innovation and investment on the part of producers. This is discussed below.

Figure 10
Deadweight Loss from Current Mandatory
Contribution Regime of 5.0% of BDU Revenues

Elasticity of Demand	2.0	\$333,567,666
	1.5	\$250,175,749
	1.0	\$166,783,833

b. Measuring Deadweight Loss of an ISP Tax of 1%

78. We implement a similar empirical analysis to that above to quantify the potential deadweight loss associated with an ISP Tax of 1% of ISP and WSP revenues. As before, we consider the tax base to be total retail Internet service revenues and total retail wireless revenues.
79. For market revenue, we use the retail Internet service revenues and retail wireless service revenues reported by the CRTC for 2016.⁸⁰ For margins, we use an estimate of incremental costs, based on the total costs implied by the EBITDA margins for the wireline and wireless sectors in 2016, as reported by the CRTC, less an estimate of administrative and general costs.⁸¹ Figure 11 below summarizes these inputs.

⁸⁰ CRTC Communications Monitoring Report 2017, Table 5.3.1 and Table 5.5.2.

⁸¹ CRTC Communications Monitoring Report 2017, Figure 5.0.3.

We have adjusted the EBITDA margins reported by the CRTC to eliminate administrative and general expenses in order to account for the fact that some of the costs included in the CRTC's calculations of EBITDA margins are not incremental costs. We have used the information reported by the CRTC to develop our best estimates of margins over true marginal costs, but our estimated margins are likely lower than actual margins over marginal costs. To the extent that our estimated margins still include non-incremental costs, which is likely, our estimated margins are likely understated. Because higher margins would lead to greater deadweight losses (all else equal), this implies that our deadweight loss estimates are also likely understated.

Figure 11
Financial Summary for
Retail Internet and Retail Wireless Sectors, 2016

Retail Internet	
Revenues	\$10,178,000,000
EBITDA Margin	33.3%
Margin based on Costs excluding A&G	47.9%
Retail Wireless	
Revenues	\$23,243,900,000
EBITDA Margin	43.4%
Margin based on Costs excluding A&G	55.8%

Source: CRTC Communications Monitoring Report 2017, Table 5.3.1, Table 5.5.2 and Figure 5.0.3.

Notes: Revenue amounts are aggregate revenues for the retail internet and retail wireless sector in 2016, as reported by the CRTC. EBITDA Margins are earnings before interest, taxes, depreciation and amortization ("EBITDA") for the retail internet and retail wireless sector in 2016, as reported by the CRTC. Margin based on Costs excluding A&G are calculated as the total costs implied by the EBITDA Margin less an estimate of A&G Expenses based on the cost share of A&G Expenses in the broadcast distribution sector in 2016.

80. For the market demand elasticities, various studies of wireline Internet demand have produced estimates of the own-price elasticities between of 1.0 and 2.0.⁸² We consider an elasticity of 1.0 as a baseline scenario for the elasticity of demand for wireline Internet, and elasticities of 1.5 and 2.0 as more elastic alternatives. For wireless, studies have found estimates of the elasticity of demand for mobile Internet in the range of between 1.0 and 1.5.⁸³ We consider an elasticity of 1.0 as baseline scenario for the elasticity of demand for

⁸² See, e.g., Goolsbee, A. (2002), "Subsidies, the Value of Broadband and Fixed Costs," in Crandall, R. and Alleman, J. (eds.), *Broadband: Should We Regulate High-Speed Internet Access*, pp. 278-294, Brookings Institution Press: Washington, D.C; Crandall, R. W., Sidak, J. G., & Singer, H. J. (2002), "The Empirical Case against Asymmetric Regulation of Broadband Internet Access," *Berkeley Technology Law Journal*, 17(3), 953-987; Rappoport, P., Kridel, D., Taylor, L., Duffy-Deno, K. and Alleman, J. (2003), "Residential Demand for Access to the Internet," in ed. Madden, G. *The International Handbook of Telecommunications Economics: Volume I*, pp. 55-72, Edward Elgar Publishers: Cheltenham; Goolsbee, A. (2006), "The Value of Broadband and the Deadweight Loss of Taxing New Technology," *The BE Journal of Economic Analysis & Policy*, 5(1); Dutz, M., Orszag, J., & Willig, R. (2009), "The Substantial Consumer Benefits of Broadband Connectivity for US Households," Internet Innovation Alliance; Liu, H., Chintagunta, P. K., & Zhu, T. (2010), "Complementarities and the Demand for Home Broadband Internet Service," *Marketing Science*, 29(4), 701-720.

⁸³ See, e.g., Rappoport, P., Taylor, L. D., & Alleman, J. (2004), "WTP Analysis of Mobile Internet Demand," in *Frontiers of Broadband, Electronic and Mobile Commerce*, pp. 165-179, Physica: Heidelberg; Waverman, L., Meschi, M., & Fuss, M. (2005), "The Impact of Telecoms on Economic Growth in Developing Countries," The Policy Paper Series Vodafone Public Policy Series No. 2; Kathuria, R., Uppal, R. & Mamta, M. (2009), "An Econometric Analysis of the Impact of Mobile," Policy Paper Series

mobile Internet, and as alternatives we consider elasticities of 1.25 and 1.5 as more elastic cases.

81. Regarding the price increases associated with the ISP Tax, similar to the analysis of the 5% BDU contribution above, we have been instructed to consider the case where 100% of the tax is passed through to prices.
82. In Figure 12, we show our calculations of the deadweight loss associated with the proposed ISP Tax under our baseline assumptions.

Figure 12

**Deadweight Loss from ISP Tax of
1.0% of Retail Internet and Retail Wireless Revenues**

Deadweight Loss		
Retail Internet Sector		
Price Change Resulting from Tax	[A]	1.0%
Elasticity	[B]	1.0
Total Revenues	[C]	\$10,178,000,000
Margin	[D]	47.9%
Consumer DWL	[E]	\$508,900
Producer DWL	[F]	<u>\$48,726,247</u>
Deadweight Loss	[G]	\$49,235,147
Retail Wireless Sector		
Price Change Resulting from Tax	[H]	1.0%
Elasticity	[I]	1.0
Total Revenues	[J]	\$23,243,900,000
Margin	[K]	55.8%
Consumer DWL	[L]	\$1,162,195
Producer DWL	[M]	<u>\$129,624,762</u>
Deadweight Loss	[N]	\$130,786,957
Total Deadweight Loss	[O]	\$180,022,104
Tax Revenues		
Retail Internet Sector		
Tax Rate	[P]	1.0%
Post-Tax Total Revenues	[Q]	<u>\$10,176,982,200</u>
Tax Revenue from Retail Internet	[R]	\$101,769,822
Retail Wireless Sector		
Tax Rate	[S]	1.0%
Post-Tax Total Revenues	[T]	<u>\$23,241,575,610</u>
Tax Revenue from Retail Wireless	[U]	\$232,415,756
Total Tax Revenue	[V]	\$334,185,578

Notes:

[A], [H], [P] & [S]: We have assumed an ISP Tax of 1% and that 100% of the ISP Tax would be passed through to prices.

[B] & [I]: We have assumed a demand elasticity for broadband internet services of 1 and for retail wireless of 1, which are consistent with empirical estimates of these elasticities found by the literature.

[C] & [J]: Source is CRTC Communications Monitoring Report 2017, Table 5.3.1 and Table 5.5.2.

[D] & [K]: Margins based on Costs excluding A&G, as calculated based on the total costs implied by the EBITDA Margin less an estimate of A&G Expenses.

[E]: $0.5 \times [A]^2 \times [B] \times [C]$

[F]: $[A] \times [B] \times [C] \times [D]$

[G]: $[E] + [F]$

[L]: $0.5 \times [H]^2 \times [I] \times [J]$

[M]: $[H] \times [I] \times [J] \times [K]$

[N]: $[L] + [M]$

[O]: $[G] + [N]$

[Q]: $[C] \times (1 + [A]) \times (1 - [B] \times [A])$

[R]: $[P] \times [Q]$

[T]: $[J] \times (1 + [H]) \times (1 - [I] \times [H])$

[U]: $[S] \times [T]$

[V]: $[R] + [U]$

Vodafone Public Policy Series No. 9; Cardona, M., Schwarz, A., Yurtoglu, B. B., & Zulehner, C. (2009), "Substitution Between DSL, Cable, and Mobile Broadband Internet Services," in *Telecommunication Markets*, 95-111, Physica: Heidelberg; Srinuan, P., Srinuan, C., & Bohlin, E. (2012), "Fixed and Mobile Broadband Substitution in Sweden," *Telecommunications Policy*, 36(3), 237-251; Grzybowski, L., Nitsche, R., Verboven, F., & Wiethaus, L. (2014), "Market Definition for Broadband Internet in Slovakia—Are Fixed and Mobile Technologies in the Same Market?" *Information Economics and Policy*, 28, 39-56.

83. As shown in Figure 12, we find that the annual deadweight loss to the Canadian economy resulting from the 1% ISP Tax, based on 2016 revenues, is approximately \$180 million per year under our baseline scenario. This implies a deadweight loss of approximately 54¢ for every \$1 of taxes. More generally, as shown in Figure 13 below, the deadweight loss estimates associated with the proposed 1% ISP Tax under our alternative assumptions range up to approximately \$295 million of annual losses in total welfare.

Figure 13
Deadweight Loss from ISP Tax of
1.0% on Retail Internet and Retail Wireless Revenues

		Elasticity of Demand for Wireless Sector		
		1.5	1.25	1.0
Elasticity of Demand for Wireline Sector	2.0	\$294,650,730	\$261,953,991	\$229,257,251
	1.5	\$270,033,156	\$237,336,417	\$204,639,678
	1.0	\$245,415,583	\$212,718,844	\$180,022,104

84. Under the scenario that an ISP Tax would be in addition to the existing mandatory BDU contribution regime, the combined deadweight loss in the broadcasting sector from the existing mandatory BDU contribution regime (Figure 10) together with the deadweight loss in the telecommunications sector from the proposed ISP Tax (Figure 13), would result in a total loss in social welfare of between \$347 million and \$628 million per year (under various assumptions of elasticity of demand).
85. The above calculations assume that the proposed ISP Tax would be levied without any change to the existing mandatory BDU contribution regime. Conversely, if the proposed ISP Tax were to be implemented alongside a commensurate reduction in the required BDU contribution rate (i.e., to achieve revenue neutrality), this would lead to a reduced deadweight loss in the broadcasting sector, and as a result, the net deadweight loss of the ISP Tax would be lower than in circumstances where the current BDU contribution was maintained. Accounting for price changes, in order for a 1% ISP Tax to remain revenue neutral, we calculate that the required BDU contribution rate would fall from 5% to 1.18% (3.82 percentage points).
86. In Figure 14, we show our calculations of the reduction in deadweight loss associated with a decrease in the required BDU contribution rate for the case of a revenue neutral ISP Tax under our baseline assumptions.

Figure 14
Reduction in Deadweight Loss from a Decrease in the
Required BDU Contribution Rate by 3.82%

Deadweight Loss		
Price Change Resulting from Tax Decrease	[A]	-3.82%
Elasticity	[B]	1.00
Total Revenue	[C]	\$8,734,184,814
Margin	[D]	35.7%
Change in Consumer DWL	[E]	-\$6,387,525
Change in Producer DWL	[F]	-\$119,220,734
Change in Deadweight Loss	[G]	-\$125,608,259
Tax Revenues		
Tax Rate	[H]	1.18%
Post Tax Total Revenue	[I]	\$8,721,409,764
Tax Revenue from Retail Internet Sector	[J]	\$102,523,663

Notes:

[A] & [H]: Accounting for price changes, in order for a 1% ISP Tax on residential internet service and wireless data to remain revenue neutral, we calculate that the required BDU contribution rate would have to fall by 3.82% points, from 5.0% down to 1.18%. We have assumed that 100% of the resulting 1.18% required BDU contribution would be passed through prices at a rate of 100%.

[B]: We have assumed a demand elasticity for broadcast distribution services of 1, which is consistent with empirical estimates of the elasticity of demand for television services found by the literature.

[C]: Based on total BDU revenues in 2016, as reported by the CRTC.

[D]: Based on BDU Costs excluding A&G Expenses in 2016, as reported by the CRTC.

[E]: $0.5 \times [A]^2 \times [B] \times [C]$

[F]: $[A] \times [B] \times [C] \times [D]$

[G]: $[E] + [F]$

[I]: $[C] \times (1 + [A]) \times (1 - [B] \times [A])$

[J]: $[H] \times [I]$

87. In Figure 15 below, we summarize the results of the net deadweight loss from a revenue neutral ISP Tax under our baseline assumptions. As shown, combining the deadweight losses of \$180 million in the wireline Internet and mobile wireless sectors (\$49.2 million and \$130.8 million, respectively) from the 1% ISP Tax with the reduction in the deadweight loss of - \$125.6 million in the broadcasting sector afforded by a revenue neutral tax, together these estimates imply a net deadweight loss from a revenue neutral ISP Tax of approximately \$54.4 million per year. That is, the total deadweight loss under a revenue neutral ISP Tax (\$221.2 million per year) is greater than the deadweight loss arising from the 5% BDU contribution regime alone (\$166.8 million, as shown in Figure 9) by \$54.4 million.

Figure 15
Incremental Tax Revenue and Deadweight Loss From
Revenue Neutral 1.0% ISP Tax

Existing Contribution Regime of 5.0% of BDU Revenues		
Tax Revenue	[A]	\$436,709,241
Deadweight Loss	[B]	\$166,783,833
ISP Tax of 1.0% Tax on Retail Internet and Wireless Revenues		
Incremental Revenue		
Retail Internet Sector		\$101,769,822
Retail Wireless Sector		\$232,415,756
BDU Sector		<u>-\$334,185,578</u>
Total	[C]	\$0
Incremental Deadweight Loss		
Retail Internet Sector		\$49,235,147
Retail Wireless Sector		\$130,786,957
BDU Sector		<u>-\$125,608,259</u>
Total	[D]	\$54,413,846
Total Effect of Revenue Neutral 1.0% ISP Tax		
Tax Revenue	[E]	\$436,709,241
Deadweight Loss	[F]	\$221,197,678
Notes:		
[E]: [A] + [C]		
[F]: [B] + [D]		

88. It is important to note that upon introducing a 1% ISP Tax, even under the assumption of revenue neutrality an increase in deadweight loss of \$54.4 million occurs, which is an incremental loss in total welfare over and above that of the status quo existing mandatory BDU contribution regime. That is, under our baselines assumption, **a revenue neutral ISP Tax would result in an annual deadweight loss that is approximately \$54.4 million higher than that from the existing mandatory BDU contribution regime of \$166.8 million, yet yield the same level of tax revenue.** This shows that a revenue neutral ISP Tax leads to greater social welfare losses for a given level of revenue raised than the existing mandatory BDU contribution regime, which itself is associated with a substantial loss in social welfare. Therefore, if the objective is to maximize economic efficiency while raising a given level of revenue, the ISP Tax is a less efficient means of raising revenue than the existing levy on BDUs (under our assumptions set out above), but the existing levy also leads to significant efficiency losses.

3. Alternative Taxation Schemes

89. Value-added taxes (“VATs”), often called goods and services taxes, are an example of a uniform consumption tax. VATs are pervasive – all OECD countries levy VATs at the national level, except the U.S., where sales taxes are levied at the state level.⁸⁴ Canada has a mix of federal and provincial VATs, though many provinces have harmonized their sales

⁸⁴ “Consumption Tax Trends 2016: VAT/GST and Excise Rates, Trends and Policy Issues,” OECD Publishing, Paris, at pp. 181-184.

taxes (“HST”) with the Federal Goods and Services Tax (“GST”) and thus levy a combined GST/HST.⁸⁵

90. As mentioned above, many economists have argued that uniform *ad valorem* taxation is generally welfare improving compared to differentiated commodity taxes.⁸⁶ The intuition is that, in a uniform tax environment, the relative price of all goods and services increases by the same amount so relative prices remain unchanged and the efficiency losses to the economy from consumers and producers changing their behavior is in turn minimized. Non-uniform taxes also exacerbate the impact of taxes, as deadweight losses increase more than proportionally to any given tax increases. As a result, using a uniform commodity tax to support the production of Canadian programming content would be less distortionary than the proposed ISP Tax (and indeed welfare improving compared to the existing mandatory BDU contribution regime). In principle, Canada’s GST/HST could be used to implement such a policy.
91. The key feature of a VAT is that it applies uniformly to goods and services, so the relative prices facing consumers and producers remain unchanged as a result of the tax. However, as explained in detail in a recent article by Wyonch (2017) of the C.D. Howe Institute:⁸⁷

[P]roviders of digital products and services, ranging from e-books and online games to streaming services such as Netflix and Spotify, are not obligated to collect and remit sales tax if they are not “carrying on business” in Canada. Instead, the consumers of the service are responsible for determining and paying the associated GST/HST. This creates two major problems. (1) Among general consumers, compliance is virtually nonexistent. This leaves significant amounts of tax revenue uncollected, but enforcement at the individual level would be prohibitively expensive and, likely, incredibly unpopular. (2) Since the sales tax is not being paid, foreign suppliers have a competitive advantage over domestic companies that are required to collect

⁸⁵ “Consumption Tax Trends 2016 – Canada”, OECD, available at <http://www.oecd.org/tax/consumption/consumption-tax-trends-canada.pdf>.

The Federal GST is levied on all goods and services purchased in Canada, except certain items that are “exempt” or “zero rated” [“Excise Tax Act (R.S.C., 1985, c. E-15),” Part IX: Goods and Services Tax, available at <https://laws-lois.justice.gc.ca/PDF/E-15.pdf>.]

⁸⁶ Atkinson, A. B., & Stiglitz, J. E. (1976), “The Design of Tax Structure: Direct versus Indirect Taxation,” *Journal of Public Economics*, 6(1-2), pp. 55-75; Mirrlees, James A. (1976) “Optimal Tax Theory: A Synthesis,” *Journal of Public Economics*, 6(4), 327-358; Deaton, A. (1979), “Optimally Uniform Commodity Taxes,” *Economics Letters*, 2(4), 357-361; Kaplow, L. (2006), “On the Undesirability of Commodity Taxation even when Income Taxation is not Optimal,” *Journal of Public Economics*, 90(6-7), 1235-1250.

⁸⁷ Wyonch, R. (2017), “Bits, Bytes, and Taxes: VAT and the Digital Economy in Canada,” C.D. Howe Institute Commentary No. 487, at 2.

and remit the GST/HST on behalf of consumers. Sales taxes collected by domestic suppliers add 5 percent to 15 percent to the price of their products. Therefore, foreign vendors can extract more revenue, while charging the same final price as a domestic company, by not charging GST/HST.

92. In fact, OTT providers are at a further competitive advantage because, in addition to effectively not facing a sales tax on their services, they also do not face a mandatory 5% BDU-like contribution to Canadian programming. To the extent that the majority of the programming content available from OTT is foreign produced, this bias towards OTT augments the supply of foreign programming relative to Canadian programming, which directly undermines the policy objectives of the 5% BDU tax. Indeed, the authors of a report on Canadian programming content in the digital world by the C.D. Howe Institute note:⁸⁸

This state of affairs creates two related problems. First, if Internet-delivered TV continues to increase in popularity, this could lead to a significant decline in the amount of available Canadian television content, at least in the regulated system. Second, if Canadian broadcasters and cable companies are regulated, and Internet-delivered competitors like Netflix are not, it will be difficult for Canadian providers to compete or even to survive, especially if foreign competitors face no Canadian tax.

93. Wyonch (2017) offers Netflix as an example of a foreign OTT provider that avoids any tax burden in Canada, and calculates that the lost GST/HST revenue from Netflix alone is approximately equal to \$52 million per year.⁸⁹ Wyonch (2017) argues that “Ottawa should amend the Excise Tax Act to reflect the Organisation for Economic Development and Co-operation’s (OECD) International VAT/GST Guidelines for determining the place of taxation for cross-border services and intangibles. The main goal should be to level the playing field for domestic and foreign providers of digital products and services in Canada.”⁹⁰

B. Taxation, Investment and the Dynamic Efficiency Effects of an ISP Tax Regime

94. In addition to static welfare effects, in network industries, taxes can have the effect of lowering the utilization of existing network infrastructure and diminishing important investment that network providers would otherwise make in expanding, maintaining and improving their infrastructure.

⁸⁸ Hunter, L., Engelhart, K.G., & P. Miller (2017), “Strengthening Canadian Television Content: Creation, Discovery and Export in a Digital World,” C.D. Howe Institute Commentary No. 498, at 1.

⁸⁹ Wyonch, R. (2017), “Bits, Bytes, and Taxes: VAT and the Digital Economy in Canada,” C.D. Howe Institute Commentary No. 487, at 9.

⁹⁰ Wyonch, R. (2017), “Bits, Bytes, and Taxes: VAT and the Digital Economy in Canada,” C.D. Howe Institute Commentary No. 487, at 2-3. [Internal Citations Omitted.]

95. Network providers must expend significant resources to adopt new technology or expand their network, and thereby incur large sunk costs before they can sell any services. As a result, long-run dynamic efficiency is heavily dependent on the incentives faced when making those investment decisions.⁹¹ The effects on incentives are readily apparent. When considering investing to build and upgrade their network infrastructure, if market participants expect to face a distortionary tax that tends to decrease the returns they would have earned otherwise, they will have less incentive to take on such risks. This, in turn, can lead to suboptimal levels of investment and dynamic inefficiency in the long run.
96. As noted above, most of the deadweight losses estimated from the 5% BDU contribution and the 1% ISP Tax are Producer DWL, rather than Consumer DWL. This means that the decrease in producer surplus resulting from the tax (which represents lost margin from sales that would have occurred absent the tax with marginal revenue above marginal cost) is particularly significant, leaving producers with less margin to recover fixed costs and lowering the incentive for investment. Specifically, the lower output resulting from the tax leads to lower utilization of existing network capacity and thus delays and postpones investment longer than would otherwise have been the case.
97. Dynamic efficiency, i.e., the optimal introduction of goods and services over time, in the telecommunications sector is achieved by network providers expanding and upgrading their network, and so is inextricably tied to the investment incentives faced by firms. As mentioned above, the telecommunications industry is characterized by frequent and significant technological change. For example, total telecommunications investment in plant and equipment amounted to over \$11.6 billion in 2016, \$9.2 billion of which was in wireline and \$2.3 billion in wireless network infrastructure.⁹² Moreover, wireless network operators in Canada are all actively investing to develop 5G mobile networks.⁹³

⁹¹ See, e.g., Hausman, J. (1999), "The Effect of Sunk Costs in Telecommunications Regulation," in *The New Investment Theory of Real Options and its Implication for Telecommunications Economics*, eds. James J. Alleman and Eli M. Noam, 191-204. Springer.

⁹² CRTC Communications Monitoring Report 2017, Table 5.0.5.

⁹³ See, e.g., "Bell and Nokia Complete First Canadian Trial of 5G Mobile Technology," Bell Canada press release, July 29, 2016, available at <https://www.newswire.ca/news-releases/bell-and-nokia-complete-first-canadian-trial-of-5g-mobile-technology-588663571.html>; "Huawei, Telus Announce 2Gbps WTTx Trial," Telegeography CommsUpdate, February 16, 2018, available at <https://www.telegeography.com/products/commsupdate/articles/2018/02/16/huawei-telus-announce-2gbps-wttx-trial/>; "Rogers, Ericsson Report on 5G Tests, Network Development Plans," Telegeography CommsUpdate, April 17, 2018, available at <https://www.telegeography.com/products/commsupdate/articles/2018/04/17/rogers-ericsson-report-on-5g-tests-network-development-plans/>; "Shaw Completes its First 5G Trials," Telegeography CommsUpdate, May 23, 2018, available at <https://www.telegeography.com/products/commsupdate/articles/2018/05/23/shaw-completes-its-first-5g-trials/>.

98. However, it is generally understood in economics that a distortionary excise tax on a specific industry tends to decrease the returns from investment in that industry.⁹⁴ Accordingly, an ISP Tax would tend to decrease the incentive for network operators to undertake infrastructure investment as they will face the full cost and risk of that investment, but not receive the full benefit. Further, in the telecommunications industry where networks are “sunk investments” – in the sense that network operators cannot shift them to other uses when their returns fall below competitive levels because of their irreversible nature – infrastructure investment is important not only for competition in the market, but also for competition *for* the market.⁹⁵ Said differently, a distortionary excise tax not only can cause network operators to lower the *level* of investment they would have made otherwise, but can also cause network operators to forgo making the investment all together.⁹⁶ To the extent that the diminished investment incentives from an ISP Tax result in new technology not being introduced to consumers optimally, the resulting dynamic inefficiency can lead to losses in social welfare that go well beyond the static deadweight losses generated by the ISP Tax that we have calculated above.

V. Incentivizing Facilities-Based Competition and Investment in the Telecommunications Industry

99. As discussed above, the existing and proposed contribution/tax regimes for funding Canadian content could have the effect of disincentivizing network investment. In a prior report from August 2018, we demonstrated a similar effect in the telecommunications sector from regulation intended to promote resale services. Shaw has asked us to revisit this analysis in the context of the Legislative Review, and consider the impacts of resale regulation in the Canadian telecommunications sector, which is currently facilitated by a cost-based, resale regime imposed on both traditional telephone and cable operators.
100. In our prior report, we demonstrated the important role that facilities-based investment and competition plays in achieving economic efficiency. Our analysis highlighted the technological evolution and convergence of wireline and wireless broadband markets in

⁹⁴ See e.g., Kotlikoff, L. J., & Summers, L. H. (1987), “Tax Incidence,” in *Handbook of Public Economics Vol. 2*, 1043-1092 at 1050-1054 and 1060-1062. Elsevier.

⁹⁵ Hausman, J. (1999), “The Effect of Sunk Costs in Telecommunications Regulation,” in *The New Investment Theory of Real Options and its Implication for Telecommunications Economics*, eds. James J. Alleman and Eli M. Noam, 191-204. Springer; Demsetz, H. (1968), “Why Regulate Utilities,” *Journal of Law and Economics*, 11, 55–65.

⁹⁶ Hausman, J. (1999), “The Effect of Sunk Costs in Telecommunications Regulation,” in *The New Investment Theory of Real Options and its Implication for Telecommunications Economics*, eds. James J. Alleman and Eli M. Noam, 191-204. Springer; Pindyck, R.S. (2007), “Mandatory Unbundling and Irreversible Investment in Telecoms Networks,” *Review of Network Economics*, 6(3), 274-298.

Canada and the benefits of “technology competition” between fiber and coaxial broadband on the one hand and wireless LTE and nascent 5G on the other hand.

101. Our prior analysis indicated that competition from wireless broadband will be an increasingly important factor of Internet markets in Canada and throughout the world. Given the trajectory of innovation in this product space, we concluded that it was fair to anticipate that next-generation mobile technology may bring about even more robust platform competition with wireline broadband. This tendency of the telecommunications industry towards convergence intrinsically creates competition in the marketplace, thereby reducing the need for broad regulatory intervention to correct retail-market failures.
102. Similarly here, the end result of imposing unnecessary regulations will be to put the regulated technologies at a competitive disadvantage, distort outcomes and further reduce overall economic efficiency. Legislation and regulatory policy should be consistent with incentivizing facilities-based competition, and any policy that would diminish these investments should be carefully considered.

A. Likely Impact of Over-Regulation on 5G Deployment and Competition

103. Wireline and wireless broadband platform competition will be an important factor for Internet markets in Canada and throughout the world. This healthy technological competition will provide significant benefits to consumers in terms of lower prices, improved service quality and new and innovative services. No technology is guaranteed success, as *ex-ante* investments in this sector are sunk, uncertain, and risky – all in the face of rapid changes in demand. Ultimately, market forces – and network providers’ abilities to both respond to changing consumer preferences and efficiently incorporate continued wireline and wireless broadband technological advances – will determine the “optimal” mix of Canadian wireline and wireless broadband consumers.
104. Strong platform competition between wireline and wireless broadband networks necessarily means that wireless broadband markets will be impacted and affected by regulations, including wireline regulations. For example, if wireline broadband resale regulations cause market distortions, then they could also distort the network convergence of wireline and wireless broadband. By contrast, to the extent it is deemed that some market imperfection still exists, given the observed competitive improvement in the sector (as discussed above) and the anticipated rollout of 5G, changes to wireline broadband resale obligations to scale those obligations to be more proportionate to whatever market imperfection may remain would ensure that society’s scarce economic resources are efficiently put to use in the deployment of 5G broadband networks.
105. Imposing regulations on any given technology (either existing wireline broadband or emerging wireless broadband technologies) would inevitably distort market outcomes that

would otherwise have been observed in the wireline and wireless broadband markets, thereby reducing overall economic efficiency.

B. Diminished Incentives for Investment

106. An efficient telecommunications market requires that any measures put in place to achieve a policy objective in the near-term should also consider any potential long-term efficiency losses resulting from reduced investment incentives. In the telecommunications sector, this applies particularly to the incentives of facilities-based providers to invest in expanding, maintaining, and improving their network infrastructure. There is a broad consensus in the economics literature that over-broad price regulation can diminish incentives for long-term investment.
107. In this section, we review the economics literature on the impact of resale regulation on the wireline broadband industry to highlight the effect of regulatory resale obligations on competition, investment and market efficiency in the telecommunication sector. We begin with a brief overview of the economics of networks, and the consumer welfare considerations of a mandatory resale regime, in terms of dynamic efficiency. We then focus on the economic theory underpinning the decision to invest in network infrastructure, and the conditions under which resale obligations disincentivize investment. We also consider the empirical literature where several studies have found support of the hypothesis that mandatory resale policies create disincentives for facilities-based providers to invest in their infrastructure.

1. Dynamic Efficiency: Competition and Investment

108. The literature demonstrates that the key consideration in determining optimal resale policies is the trade-off between static and dynamic efficiency.⁹⁷ Perfect competition, where price is equal to the marginal cost of production, maximizes static efficiency. However, perfectly competitive prices do not allow firms to recover the fixed costs of investing in infrastructure, developing new products and discovering new processes of production.⁹⁸

⁹⁷ See, e.g., Guthrie, G. (2006), “Regulating Infrastructure: The Impact on Risk and Investment,” *Journal of Economic Literature*, 44(4), 925-972 at 926: “A common theme is the tension between allocative and dynamic efficiency when segments of vertically integrated industries are opened up to competition.”

Here, ‘static efficiency’ refers to productive and allocative efficiency. We refer readers unfamiliar with the definitions of productive, allocative and dynamic efficiency to ss. 12.14 – 12.18 and 12.25 of the Competition Bureau’s Merger Enforcement Guidelines. [“Merger Enforcement Guidelines,” Competition Bureau, October 6, 2011.]

⁹⁸ Economic policy must often balance these objectives. For example, the patent system trades off the short-run inefficiency of granting monopoly rights to patent holders for the long-run welfare-increasing effects of incentivizing research and development by entrepreneurs.

109. In telecommunications, dynamic efficiency is served by facilities-based service providers expanding and upgrading their network. It is also benefitted by facilities-based competition, as competitive pressure encourages participants to engage in those activities. Thus, dynamic efficiency is inextricably tied to the investment incentives faced by firms. Telecommunications infrastructure, as one author puts it, “is most economically provided in large, lumpy increments [...]”⁹⁹ Traditional telephone and cable providers must expend significant resources to adopt new technology or expand their network, and facilities-based entrants must incur large costs before they can sell any services. Long-run efficiency is therefore heavily dependent on the incentives faced when making those investment decisions.¹⁰⁰
110. In sum, when considering investing to upgrade their infrastructure, if market participants expect to face subsequent pricing that will not allow them to recover their sunk costs, they will not have the incentive to make the investments. This may lead to suboptimal levels of investment, and thus dynamic inefficiency in the long run.¹⁰¹ The same is true for incremental-cost based pricing, if such pricing rules are based on current costs that are incurred with respect to that element of infrastructure or service, rather than the costs actually incurred by the providing carrier¹⁰² inclusive of the risks inherent in making the sunk investments.¹⁰³

2. Competition versus Regulation in Achieving Market Efficiency

111. The economics literature has generally shown that competition is preferable to regulation in achieving efficient outcomes, in the absence of market failures.¹⁰⁴ Studies demonstrate that regulation (a) increases costs by reducing firms’ incentives to pursue more efficient

⁹⁹ Pindyck, R. S. (2007), “Mandatory Unbundling and Irreversible Investment in Telecoms Networks,” *Review of Network Economics*, 6(3), 274-298 at 295.

¹⁰⁰ See, e.g., Hausman, J. (1999), “The Effect of Sunk Costs in Telecommunications Regulation,” in *The New Investment Theory of Real Options and its Implication for Telecommunications Economics*, eds. James J. Alleman and Eli M. Noam, 191-204. Springer.

¹⁰¹ See, e.g., Hausman, J. (1999), “The Effect of Sunk Costs in Telecommunications Regulation,” in *The New Investment Theory of Real Options and its Implication for Telecommunications Economics*, eds. James J. Alleman and Eli M. Noam, 191-204. Springer.

¹⁰² Pindyck, R. S. (2007), “Mandatory Unbundling and Irreversible Investment in Telecoms Networks,” *Review of Network Economics*, 6(3), 274-298.

¹⁰³ Hausman, J. (1999), “The Effect of Sunk Costs in Telecommunications Regulation,” in *The New Investment Theory of Real Options and its Implication for Telecommunications Economics*, eds. James J. Alleman and Eli M. Noam, (Springer, 1999), 191-204.

¹⁰⁴ See, e.g., Armstrong, M. and Sappington D. (2007), “Recent Developments in the Theory of Regulation,” in *Handbook of Industrial Organization Vol. 3*, eds. Mark Armstrong and Robert H. Porter, 1557-1700, North-Holland, and the references cited therein.

operations, (b) impedes the efficient allocation of goods and services, and often (c) slows innovation.¹⁰⁵

112. The modern regulatory approach to telecommunications in Canada and the U.S. has developed with the understanding that large, traditional wireline providers might, at times, possess market power. However, economic theory suggests that as new facilities-based competitors enter the market and substitutable technologies develop, the need for regulation could be largely eliminated.¹⁰⁶ Likewise, experience suggests that regulation can have a significant impact on the investment behavior of regulated firms.¹⁰⁷
113. In fact, the CRTC itself has acknowledged that the promotion of such facilities-based competition remains a central goal of wholesale access regulation.¹⁰⁸ Mandated access price regulation is one way to introduce competition by forcing traditional wireline service providers to share their infrastructure with resellers, but there is a significant risk that such regulation undermines the dynamics of new entry in these growing markets.

3. Investment Incentives and the Economics of Regulation

114. In order to obtain the efficient outcomes ultimately provided by facilities-based competition and the adoption of new technologies, a regulatory regime must carefully consider the incentives for investment faced by participants.
115. Facilities-based providers often make large, irreversible investments in infrastructure. The complexity of the investment decision gives rise to a considerable diversity of

¹⁰⁵ Rose, N. L. (2014), “Learning from the Past: Insights for the Regulation of Economic Activity,” in *Economic Regulation and Its Reform: What Have We Learned?* ed. Nancy L. Rose, 1-23. University of Chicago Press.

¹⁰⁶ See, e.g., Braeutigam, R. R. (1989), “Optimal Policies for Natural Monopoly,” in *Handbook of Industrial Organization Vol. 2*, eds. Richard Schmalensee and Robert D. Willig, 1289-1346, North-Holland, and the references cited therein.

Competition has supplanted regulation in some jurisdictions; for example, a survey of cable regulation in the U.S. found that “[s]atellite and telco competition has largely replaced price regulation as the constraining force on cable pricing and driving force for innovative services, a welcome outcome given the empirical record on regulation’s effects in cable markets.” [Crawford, G. S. (2014), “Cable Regulation in the Internet Era,” in *Economic Regulation and Its Reform: What Have We Learned?* ed. Nancy L. Rose, 137-193 at 187. University of Chicago Press.]

¹⁰⁷ See, e.g., Joskow, P. L. and Rose, N.L. (1989), “The Effects of Economic Regulation,” in *Handbook of Industrial Organization Vol. 2*, ed. Richard Schmalensee and Robert D. Willig, 1450-1506. North-Holland
Guthrie, G. (2006), “Regulating Infrastructure: The Impact on Risk and Investment,” *Journal of Economic Literature*, 44(4), 925–972, and the references cited therein.

¹⁰⁸ “Review of Wholesale Wireline Services and Associated Policies,” Telecom Regulatory Policy 2015-326 CRTC, July 22, 2015, at paragraph 5.

approaches in modeling this behaviour.¹⁰⁹ But there is a general consensus that overly broad price regulation can diminish incentives for long-term investment in infrastructure.¹¹⁰ The literature also demonstrates the numerous challenges of regulating prices in a manner that avoids this disincentive effect on investment.

116. For example, modelling by Pindyck (2007) has shown that, by making the network investments of traditional telephone and cable providers available to competitors at rates that do not fully compensate for the opportunity cost of investment, further investment by telephone and cable providers in those networks is deterred.¹¹¹ Conversely, in addition to covering current operating costs, “an efficient level of investment requires that the returns to that investment are anticipated to include a payback of sunk costs.”¹¹²
117. The literature also emphasizes the critical role of the allocation of risk between facilities-based providers and resellers. An asymmetric allocation of risks discourages traditional telephone and cable providers from sunk investment in infrastructure, tilting the balance in

¹⁰⁹ See, e.g., Cambini C. and Jiang Y. (2009), “Broadband Investment and Regulation: A Literature Review,” *Telecommunications Policy*, 33, 559-574.

Some economists have found that by increasing demand some degree of access-based pricing may encourage investment. However, such results require that the access rates be high enough (perhaps unregulated) to allow the facilities-based competitors to capture a sufficient portion of the ensuing profits to compensate them for their investment. [Grajek M. and Röller L.H. (2012), “Regulation and Investment in Network Industries: Evidence from European Telecoms,” *Journal of Law and Economics*, 55(1), 189-216; Sibley D. S. and Weismann D. L., (1998), “Raising Rivals’ Costs: The Entry of an Upstream Monopolist into Downstream Markets,” *Information Economics and Policy*, 10(4), 451-470; Foros, O. (2004), “Strategic Investments with Spillovers, Vertical Integration and Foreclosure in the Broadband Access Market,” *International Journal of Industrial Organization*, 22(1), 1-24; Kotakorpi, K. (2006), “Access Price Regulation, Investment and Entry in Telecommunications,” *International Journal of Industrial Organization*, 24(5), 1013- 1020.]

¹¹⁰ See, e.g., Guthrie, G. (2006), “Regulating Infrastructure: The Impact on Risk and Investment,” *Journal of Economic Literature*, 44(4), 925-972; Pindyck, R. S. (2007), “Mandatory Unbundling and Irreversible Investment in Telecoms Networks,” *Review of Network Economics*, 6(3), 274-298.

¹¹¹ Pindyck (2007) concludes that “[i]f a policy deprives owners of returns from capital already sunk, this alters the perspective of forward-looking investors, who observe a policy change that influences the levels of risk and reward they anticipate in future periods. Investors’ estimates of both profits and risk shift in response. In short, a rule depriving investors of the ability to recoup sunk costs becomes part of the forward-looking analysis for capital *not yet sunk*.” [Pindyck, R. S. (2007), “Mandatory Unbundling and Irreversible Investment in Telecoms Networks,” *Review of Network Economics*, 6(3), 274-298 at 282.]

¹¹² Pindyck, R. S. (2007), “Mandatory Unbundling and Irreversible Investment in Telecoms Networks,” *Review of Network Economics*, 6(3), 274-298 at 2812.

favour of resellers.¹¹³ A broad expansion of resale regulation risks discouraging investment by traditional telephone and cable providers if, for example, it places resellers in a comparable position to facilities-based service providers, but provides no mechanism for redistributing risk from the incumbent to the reseller. Such regulation encourages free-riding and ultimately leads to less competition and lower economic efficiency.

118. The usual economic argument for mandated access regulation is the “stepping stone” or “ladder theory of investment.”¹¹⁴ The hypothesis is that, as resellers gain market share, they would naturally migrate toward facilities-based entry.¹¹⁵
119. Contrary to the “ladder theory,” imposing cost-based access rates can negatively impact dynamic efficiency in two ways. First, if the basis for determining costs is inaccurate, it can discourage the adoption of new technologies by preventing incumbents from fully recovering the sunk costs of upgrading their infrastructure.¹¹⁶ Second, it can lower facilities-based entry by resellers by making it comparatively cheaper to continue leasing infrastructure instead of building their own.¹¹⁷ Again, this creates a tendency towards suboptimal levels of investment, this time by resellers, and thus dynamic inefficiency.

4. Empirical Evidence of Diminished Investment Incentives

120. Numerous empirical studies have assessed the effects of mandated resale regulation on investment incentives. Generally, these studies find that mandated resale regulation discourages infrastructure investment by facilities-based service providers and has not led

¹¹³ See, e.g., Jorde T.M., Sidak, J.G., and Teece D.J. (2000), “Innovation, Investment, and Unbundling,” *Yale Journal on Regulation*, 17(1), 1–37; Guthrie, G. (2006), “Regulating Infrastructure: The Impact on Risk and Investment,” *Journal of Economic Literature*, 44(4), 925–972.

¹¹⁴ The “ladder theory of investment” should not be confused with the “ladder of investment”, which refers to the different stages of investment over the life cycle of a firm or an industry, with each additional stage building on top of the progress from the previous stages.

¹¹⁵ Cave M. and Vogelsang I. (2003), “How Access Pricing and Entry Interact,” *Telecommunications Policy*, 27, 717–728; Cave M. (2006), “Encouraging Infrastructure Competition via the Ladder of Investment,” *Telecommunications Policy*, 30(3–4), 223–237.

¹¹⁶ Hausman, J. and Sidak, J.G. (2014), “Telecommunications Regulation: Current Approaches with the End in Sight,” in *Economic Regulation and Its Reform: What Have We Learned?* ed. Nancy L. Rose, 345–406. The University of Chicago Press.

¹¹⁷ Crandall, R.W., Ingraham, A.T. and Singer, Hal J. (2004), “Do Unbundling Policies Discourage CLEC Facilities-Based Investment,” *The BE Journal of Economic Analysis & Policy*, 4(1), 1–25; Pindyck, R. S. (2007), “Mandatory Unbundling and Irreversible Investment in Telecoms Networks,” *Review of Network Economics*, 6(3), 274–298; Hausman, J. and Sidak, J.G. (2014), “Telecommunications Regulation: Current Approaches with the End in Sight,” in *Economic Regulation and Its Reform: What Have We Learned?* ed. Nancy L. Rose, 345–406. The University of Chicago Press.

resellers to invest in their own facilities.¹¹⁸ For example, a 2012 empirical study by Grajek and Röller finds that resale regulations “negatively affect both total industry and individual carrier investment. Thus promoting market entry by means of regulated access undermines incentives to invest in facilities-based competition.”¹¹⁹

121. Further, both professors Cave and Vogelsang, initial proponents of the ladder theory of investment, have since acknowledged the practical limitations of the theory. In a survey of the performance of mandated access policy in Europe, Cave (2014) stated “[i]t is clear that entrants faced with an alternative to investing in access infrastructures will normally adopt it.”¹²⁰ And, in a survey of telecommunication policy, Vogelsang (2012) concluded that “[b]oth the more theoretical and the empirical literature suggest that the ladder-of-investment hypothesis has only limited applicability. [...] [T]he approach shows little suitability for achieving full infrastructure competition in classical essential facilities settings and in cases where infrastructure competition is inter-modal.”¹²¹

C. Policy Implications

122. Legislation and regulatory policy should be consistent with incentivizing facilities-based competition, and any policy (such as those promoting resellers) that would diminish these incentives should be carefully considered given its likely impact on investment.
123. In our August 2018 Report, we discussed in detail how, in the absence of significant market imperfections, consumer choices of wireline broadband suppliers would appropriately reflect the economic value consumers place on the broadband suppliers’ service offerings. Under

¹¹⁸ See, e.g., Cambini C. and Jiang Y. (2009), “Broadband Investment and Regulation: A Literature Review,” *Telecommunications Policy*, 33, 559-574; Briglauer, W., Gugler, K. and Haxhimusa, A. (2016), “Facility- and Service-Based Competition and Investment in Fixed Broadband Networks: Lessons from a Decade of Access Regulations in the European Union Member States,” *Telecommunications Policy*, 40(8): 729-742 and the literature cited therein.

¹¹⁹ Grajek M. and Röller L.H. (2012), “Regulation and Investment in Network Industries: Evidence from European Telecoms,” *Journal of Law and Economics*, 55(1): 189-216 at 189.

See also Bacache, M., Bourreau, M. and Gaudin, G. (2014), “Dynamic Entry and Investment in New Infrastructures: Empirical Evidence from the Fixed Broadband Industry,” *Review of Industrial Organization*, 44(2), 179-209.

¹²⁰ Cave, M. (2014), “The Ladder of Investment in Europe, in Retrospect and Prospect,” *Telecommunications Policy*, 38, 674-683 at 681-682.

He continues: “Where the alternative bitstream or virtual access product is denied or restricted, the evidence suggests that competitors will invest. [...] There is good evidence that benefits accrue to broadband customers from full end-to-end competition between a telecommunications operator and a cable company. Access-based competition seems to confer fewer benefits.”

¹²¹ Vogelsang, I. (2013), “The Endgame of Telecommunications Policy? A Survey,” *Review of Economics*, 64, 193-270 at 212.

those conditions, broadband suppliers have significant incentives to operate efficiently and invest in new technologies to develop new products and services that are attractive to consumers. Our August 2018 report also found that there were no significant market imperfections hindering the ability of efficient resale suppliers to compete and win customers. Consequently, the current market share of resellers is consistent with a well-functioning market, rendering any additional resale regulations unnecessary. To the extent it is deemed that some market imperfection still exists, given the observed competitive improvement in the sector and the anticipated rollout of 5G (discussed above), changes to wireline broadband resale obligations so that they are more proportionate to that remaining imperfection would ensure that society's scarce economic resources are efficiently put to use in the deployment of 5G broadband networks.

124. In a May 2014 report, experts from The Brattle Group examined the potential competitive benefits of a fourth wireless carrier and found them to outweigh costs to carriers from having less spectrum.¹²² Specifically, they performed a competitive analysis of the pricing benefits brought on by a fourth competitor. These benefits were weighed against the greater costs the wireless mobile network operators would incur by each having less spectrum so as to accommodate a fourth competitor. Their analysis found that the competitive benefits outweighed any adverse cost effects, suggesting further facilities-based competition would enhance consumer welfare.

VI. Conclusion

125. In the context of the Legislative Review, certain stakeholders have advocated for an ISP Tax, in addition to the currently mandated 5% BDU contribution to support Canadian programming. We estimate the total deadweight loss resulting from the 5% BDU contribution regime together with a proposed 1% ISP Tax, and find that both are associated with significant social welfare losses, collectively of at least \$347 million per year, which represents our baseline case.
126. If the 1% ISP Tax is implemented on an ostensibly revenue neutral basis, it will nevertheless result in additional deadweight loss relative to the status quo in the magnitude of \$54.4 million per year, for a total of \$221.2 million per year (under our baseline case). This implies that the proposed 1% ISP Tax is less efficient than the existing regime, which itself is associated with a substantial deadweight loss.
127. Using a uniform commodity tax to fund support for the production of Canadian programming content would be less distortionary and welfare enhancing as compared to the proposed ISP Tax. OTT providers are at a competitive advantage against BDUs because, in

¹²² Hearle, K.C., McHenry, G.C., Reitzes, J.D., Verlinda, J., and Bazelon, C. (2014), "Canadian Wireless Market Performance and the Potential Effect of an Additional Nationwide Carrier," available at <https://services.crtc.gc.ca/pub/DocWebBroker/OpenDocument.aspx?DMID=2131727>.

addition to effectively not facing a sales tax on their services, they do not face a mandatory 5% contribution to Canadian programming (nor is the 1% ISP Tax borne by OTT providers). Further, to the extent that the majority of the programming content available from OTT providers is foreign produced, this bias towards OTT augments the supply of foreign programming relative to Canadian programming, creating incentives directly counter to the policy objectives that the 5% BDU tax is funding.

128. In addition to static welfare effects, taxes can have the effect of lowering the utilization of existing network infrastructure and diminishing important investment that network providers would otherwise make in expanding, maintaining and improving their infrastructure. This is particularly relevant in the case of the proposed 1% ISP Tax and 5% BDU contributions because most of the social welfare losses come in the form of losses in producer surplus, which lead to decreased margin to contribute towards fixed costs, thereby lowering network utilization and lower investment.
129. In addition to calls for an ISP Tax, stakeholders have also called for the introduction of legislative and regulatory changes to mandate increased non-facilities-based resale competition, arguably to facilitate telecommunications competition at the retail level. We find that stringent regulation of facilities-based suppliers – intended to aid resellers – can have significant distortions on investment incentives. Similar to our conclusions regarding calls for an ISP Tax to promote Canadian content, a regulatory or legislative approach that weakens support for facilities-based competition will diminish investment and lead to dynamic efficiency losses.
130. Our analysis shows that both an ISP Tax and regulation of facilities-based suppliers will, for different reasons, significantly dampen incentives to invest in facilities and networks, thus negatively impacting broadband network investment, deployment and innovation in both wireline and wireless broadband markets and, importantly, delay and hinder the growth in nascent 5G networks.

Appendix A. Curriculum Vitae

Coleman Bazelon
Principal

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Dr. Coleman Bazelon is a Principal in the Washington, D.C. office of *The Brattle Group*. He is an expert in regulation, strategy and valuation in the wireless, wireline, and video sectors. He has consulted and testified on behalf of clients in numerous telecommunications matters, ranging from wireless license auctions, spectrum management, and competition policy, to patent infringement, business valuation, and broadband deployment.

Dr. Bazelon frequently advises regulatory and legislative bodies, including the U.S. Federal Communications Commission and the U.S. Congress. He also has expertise in the federal government's use of discount rates for policy and regulatory analysis, intellectual property valuation, economic impact analysis, and antitrust and damages analysis.

Throughout his career, Dr. Bazelon has had extensive experience with spectrum license auctions. He advises on and evaluates numerous auction designs and regularly serves as an auction advisor for bidders in spectrum license auctions.

Prior to joining *Brattle*, Dr. Bazelon was a Vice President with Analysis Group, an economic and strategy consulting firm. During that time, he expanded the firm's telecommunications practice area. He also served as a Principal Analyst in the Microeconomic and Financial Studies Division of the Congressional Budget Office where he researched reforms of radio spectrum management; estimated the budgetary and private sector impacts of spectrum-related legislative proposals; and advised on auction design and privatization issues for all research at the CBO.

SELECTED CONSULTING PROJECTS

Litigation

- Estimated damages related to spectrum value in Canada, in International Arbitration.
- Provided Domestic Industry testimony in ITC 337 case involving Solid State Storage devices.
- Provided written testimony of the value of a satellite joint venture.
- Estimated damages related to spectrum value in India, in International Arbitration.
- Provided declaration on spectrum valuation for potential SEC fraud matter.
- Provided written testimony in private fraud case involving 700 MHz Guard and Expansion Band licenses.
- Provided testimony in ITC 337 enforcement case involving reusable coffee brewing cup patents.
- Provided written testimony in Virginia State Corporation Commission fraud case involving 700 MHz Guard and Expansion Band licenses.

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- Provided testimony in SEC fraud case involving 700 MHz Guard and Expansion Band licenses.
- Estimated value of a spectrum portfolio.
- Developed auction format for sale of private equity management firm.
- Estimated racial impact of voter ID law in Texas.
- Assessed Domestic Industry requirement in ITC 337 case involving mobile location patents.
- Evaluated damages in the applications market.
- Assessed allocation theories in an international bankruptcy.
- Evaluated damages from a programming contract termination.
- Evaluated damages from allegations of reputational harm in gaming equipment market.
- Evaluated damages from non-working wireless network equipment.
- Assessed Domestic Industry requirement in ITC 337 case involving wireless equipment patents.
- Assessed commercial viability of full text searching of books business model.
- Assessed Domestic Industry requirement in ITC 337 case involving portable storage device patents.
- Estimated value of satellite assets in bankruptcy.
- Estimated damages from denial of pole attachments.
- Provided written testimony evaluating the performance of a numbering resource administrator.
- Provided written testimony on the ability to estimate damages for a class of satellite phone users.
- Provided written testimony on the economic value of Rights-of-Ways in Massachusetts.
- Estimated damages for a broadcast tower permit revocation.
- Provided oral testimony on the proprietary nature of specific information contained in a statewide public safety network bid.
- Provided written testimony on economic value associated with items provided in a labor neutrality agreement.
- Estimated damages associated with USF and other telephone taxes paid by a calling card reseller.
- Assessed the damages associated with the infringement of patents related to VoIP technology and the likely impact of a permanent injunction.
- Estimated recoverable data costs for two pesticides.
- Estimated cost of delay in granting local cable franchise.
- Analyzed the economic underpinnings of an exclusivity clause of a mobile phone affiliation agreement.
- Assessed commonality issues of physicians for class certification of RICO action against a set of health insurance companies.
- Estimated “Loss of Use” damages for a severed fibre optic cable.
- Provided written testimony estimating the value of a surety bond in a contract dispute involving toll free phone numbers used in an enhanced service application.

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- Assessed damages associated with infringement of patents used to provide Voice over Internet Protocol (VoIP).
- Assessed basis for guidance of a large telecommunications firm in a 10-b securities litigation.
- Valued digital television radio spectrum in St. Louis in the pre-litigation phase of a breach of contract dispute.
- Estimated damages in a breach of contract case involving the sale of a fibre optic network.
- Researched the basis for generally optimistic forecasts of broadband deployment in the later 1990s and early 2000s in an anti-trust litigation.
- Researched the basis for generally optimistic beliefs about the telecommunications sector in the late 1990s in a 10-b securities litigation.
- Assessed the market for Competitive Local Exchange Carriers in an SEC fraud case.
- Assessed a bankruptcy sale proposal for a national tier 1 broadband backbone provider.
- Examined the business case asserted for a small wireless reseller in a breach of contract litigation.
- Assessed damages associated with infringement of patents used in DNA fingerprinting applications.
- Assessed changes in contributions to the Cable Royalty Fund on behalf of Sports Claimants in a Copyright Arbitration Royalty Panel (CARP) proceeding.
- Assessed the capital adequacy of the U.S. branch of a foreign bank.

Regulatory Proceedings

- Provided written testimony on rates for TRS service.
- Assessed basis for mechanical royalties in copyright proceeding.
- Provided declaration on minority incentives in spectrum secondary market transactions.
- Evaluated proposed pole attachment rate.
- Analyzed cost[s] of USPS.
- Assessed impact on incentive auction of unlicensed operations in guard bands.
- Assessed market power in Canadian wireless market.
- Provided testimony in prison phone rate proceeding.
- Estimated economic impact of LNP on RLECs.
- Assessed relevance of U.S. UNE-L experience for New Zealand benchmarking proceeding.
- Authored analysis of harm from revoking LightSquared's ATC authorization.
- Estimated value of pairing Upper 700 MHz A Block with public safety.
- Estimated impact of increased regulatory uncertainty on spectrum value.
- Estimated value of government provision of GPS service to private industry.
- Coauthored analysis of feasibility of reallocating broadcast television through the use of incentive auctions.
- Analyzed impact on spectrum value of pairing AWS III spectrum.
- Coauthored analysis of the merits of licensed versus unlicensed allocation of the TV White Spaces.

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- Estimated the value of TV White Spaces.
- Provided written testimony on the economic harm of using proprietary information in retention marketing.
- Provided written testimony on the economics of pole attachment rates.
- Estimated the value of the PCS H-Block spectrum band.
- Estimated the economic impact of ITC Exclusion Order on cell phone handsets.
- Authored several reports on the 700 MHz auction rules.
- Analyzed the relationship between the size of cable systems and the economics of the programming market.
- Presented analysis on pricing differentials in overlapping cable markets.
- Assessed proposed regulation of mobile phone roaming rates.
- Analyzed impact of local franchise requirements on competition in the video marketplace.
- Developed and assessed Indian spectrum management proposals.
- Analyzed economic ramifications of à la carte cable channel pricing on consumers and the cable and television programming industries.
- Examined the relative merits of licensed versus unlicensed radio spectrum and the effects of “underlay” licenses on existing commercial licensees.
- Examined federalism issues related to mobile telephony regulation.
- Examined and refuted arguments suggesting that the California Telecommunications Consumer Bill of Rights was an appropriate response to market failures.
- Assessed the impact on consumers of California’s Telecommunications Consumer Bill of Rights proposal.
- Provided written testimony refuting analysis purporting to show a positive relationship between UNE-P and telecom network investment.
- Provided written testimony examining the effects of unbundling regulations on capital spending in the telecommunications sector.
- Estimated the adjustment to the TELRIC pricing formula to account for irreversible investment in the local telephone network.
- Examined the impact of irreversible investments in the local telephone network on the TELRIC pricing methodology.
- Assessed the degree of market overlap of two food service firms for purposes of merger review.
- Provided written testimony that assessed the validity of an analysis of the costs of a DTV tuner mandate.
- Provided written testimony of a forecast of toll free number demand for the toll free number administrator, SMS/800, in a rate case proceeding.

Other

- Auction planning and support for CAF II auction.
- Estimated value of spectrum pipeline.
- Provided support for Australian Rules Football collective bargaining negotiations.

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- Provided support for MLB/MLBPA Collective Bargaining Agreement negotiations.
- Estimated value of new spectrum technology.
- Analyzed market for VRS services.
- Coauthored analysis of wireless technology on agricultural water use.
- Evaluated impacts of Boston 2024's Olympic bid.
- Estimated value of licensed mobile broadband spectrum.
- Estimated future needs for licensed mobile broadband spectrum.
- Advised bidder in Canadian 700 MHz auction.
- Evaluated performance of TV stations when repacked in an Incentive Auction.
- Analyzed differences in U.S. and European wireless markets.
- Assessed business case and value of HF license holder.
- Analyzed likely auction outcomes for TV broadcaster participating in incentive auction.
- Assessed value of commercial mobile spectrum bands.
- Analyzed economic impacts of the commercial casino industry.
- Evaluated impact of digitization on copyright industries.
- Analyzed economic and employment effects of Dutch gas hub.
- Advised bidder in Indian 3G spectrum license auction.
- Estimated economic and employment effects of network neutrality regulation.
- Analyzed relative costs of wireless and wireline deployments in rural areas.
- Analyzed potential harms from Internet gambling.
- Estimated economic value of reallocating TV spectrum for wireless broadband.
- Estimated economic and employment effects of electric power transmission construction in support of new wind generation facilities.
- Estimated economic and employment effects of broadband stimulus grant applications.
- Estimated employment effects of an ATC-mobile satellite network deployment.
- Analyzed the impact of reducing international mobile phone roaming charges.
- Developed an auction platform for an electricity procurement auction.
- Analyzed the economic impacts of reduced mobile phone taxes in Africa and the Middle East.
- Evaluated the impact of reducing ethanol requirements on gasoline prices.
- Analyzed FRAND licensing requirements for intellectual property in the DTV standard.
- Advised bidder in Canadian AWS spectrum license auction.
- Advised bidder in FCC 700 MHz spectrum license auction.
- Evaluated a business plan for proposed dam removals.
- Assessed a business plan involving the WiMAX market.
- Estimated the value of a portfolio of spectrum licenses.
- Assessed the budgetary impacts of legislation to license TV white spaces.
- Analyzed the economics of the military's build versus buy decision for broadband satellite communications capacity.
- Advised bidder in FCC AWS spectrum license auction.
- Provided framework to estimate impact of the effect of designation of TV white spaces as unlicensed on 700 MHz auction receipts.

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- Analyzed Universal Service Fund expenditures.
- Analyzed cable franchising requirements.
- Valued proposals to re-band the Upper 700 MHz Band of radio spectrum.
- Analyzed proposed accelerated digital television transition impacts on society and the federal budget.
- Coauthored a report on the value of a portfolio of patents used to provide Voice over Internet Protocol (VoIP).
- Coauthored a report to the U.S. Chamber of Commerce on the economic effects of telecommunications deregulation.
- Assessed the business cases for IRU swaps of a large international fibre optic network owner.
- Examined the effects of unbundling regulations on broadband penetration internationally.

TESTIMONY AND DECLARATIONS

“Fourth Expert Report of Dr. Coleman Bazelon,” In the Matter of CC/Devas (Mauritius) Ltd., Devas Employees Mauritius Private Limited, and Telcom Devas Mauritius Limited, Case No. PCA2013-09, April 26, 2018.

“Witness Statement of Dr. Coleman Bazelon,” In the Matter of Certain Solid State Storage Drives, Stacked Electronics Components, and Products Containing Same, United States International Trade Commission, Washington, D.C., Investigation No. 337-TA-1097, March 2, 2018.

“Third Expert Report of Dr. Coleman Bazelon,” In the Matter of CC/Devas (Mauritius) Ltd., Devas Employees Mauritius Private Limited, and Telcom Devas Mauritius Limited, Case No. PCA2013-09, November 29, 2017.

“Testimony of Coleman Bazelon before the U.S. House of Representatives, Committee on Energy and Commerce, Subcommittee on Communications and Technology,” November 16, 2017. (5G Spectrum)

“Second Rebuttal Report – Reply to the Expert Report of J. Armand Musey in Opposition of Coleman Bazelon,” In the Matter of ATK Space Systems, Inc., et al., vs. U.S. Space LLC, Circuit Court of Loudon County, Virginia, Case No. CL-101847, November 10, 2017.

“Rebuttal Report of Coleman Bazelon, Ph.D.,” In the Matter of ATK Space Systems, Inc., et al., vs. U.S. Space LLC, Circuit Court of Loudon County, Virginia, Case No. CL-101847, October 20, 2017.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of ATK Space Systems, Inc., et al., vs. U.S. Space LLC, Circuit Court of Loudon County, Virginia, Case No. CL-101847, September 8, 2017.

Coleman Bazelon

“Second Expert Report of Dr. Coleman Bazelon,” In the Matter of CC/Devas (Mauritius) Ltd., Devas Employees Mauritius Private Limited, and Telcom Devas Mauritius Limited, Case No. PCA2013-09, July 31, 2017.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of Vertical Ventures II, LLC; Vertical Ventures V, LLC; LWH Network, LLC; L, W & C Network, LLC; and Spectrum Family 800, GP vs. Smartcomm, LLC; Smartcomm License Services, LLC; Smartcomm Management, LLC; Smartcomm Acquisitions, LLC; License Acquisitions, LLC; Big Wave Ventures, LLC; Spectrum Networks Group, LLC; M2M Spectrum Networks, LLC; Spectrum Acquisitions Group, LLC; Carlson Investment Group, LLC; Carole L. Downs; Barclay Knapp; and Joe Doe Transferees, Superior Court of Arizona Maricopa County, March 24, 2017.

“Expert Report of Dr. Coleman Bazelon,” In the Matter of CC/Devas (Mauritius) Ltd., Devas Employees Mauritius Private Limited, and Telcom Devas Mauritius Limited, Case No. PCA2013-09, January 16, 2017.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of Commonwealth of Virginia, *ex rel.* State Corporation Commission v. Darryl Gene Bank and Raeann Ann Gibson, Commonwealth of Virginia State Corporation Commission Hearing Examiner, Case No. SEC-2015-00020, November 4, 2016.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of Certain Beverage Brewing Capsules, Components Thereof, and Products Containing the Same, United States International Trade Commission, Washington, D.C., Investigation No. 337-TA-929, November 2, 2016.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of Securities and Exchange Commission v. Janus Spectrum LLC; David Alcorn; David Alcorn Professional Corporation; Kent Maerki; Dominion Private Client Group, LLC; Janus Spectrum Group, LLC; Spectrum Management, LLC; Spectrum 100, LLC; Prime Spectrum, LLC; Prime Spectrum Management, LLC; Daryl G. Bank; Premier Spectrum Group, PMA; Bobby D. Jones; Innovative Group, PMA; Premier Group, PMA; Prosperity Group, PMA; Terry W. Johnson; and Raymon G. Chadwick, Jr., United States District Court, District of Arizona, Docket No. CV- 15-609-PHX-SMM, May 13, 2016.

“Amended Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Sprint Corporation, Sprint Communications, Inc., Erik Prusch, John W. Stanton, William R. Blessing, Bruce A. Chatterley, Mufit Cinali, Jose A. Collazo, Hossein Eslambolchi, Dennis S. Hersch, Brian P. McAndrews, Kathleen H. Rae, Theodore H. Schell, Jennifer L. Vogel, Slade Gorton, Starburst I, Inc., and Softbank Corp., Court of Chancery, State of Delaware, C.A. No. 8508-VCL and ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Clearwire Corporation, Court of Chancery, State of Delaware, C.A. No. 9042-VCL, November 2, 2015.

“Rebuttal Report of Coleman Bazelon, Ph.D.,” In the Matter of ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Sprint Corporation, Sprint Communications, Inc., Erik Prusch, John W. Stanton, William R. Blessing, Bruce A. Chatterley, Mufit Cinali, Jose A. Collazo, Hossein Eslambolchi, Dennis S. Hersch, Brian P. McAndrews, Kathleen H. Rae, Theodore H. Schell, Jennifer L. Vogel, Slade Gorton, Starburst I, Inc., and Softbank Corp., Court of Chancery, State of Delaware, C.A. No. 8508-VCL and ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Clearwire Corporation, Court of Chancery, State of Delaware, C.A. No. 9042-VCL, October 23, 2015.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Sprint Corporation, Sprint Communications, Inc., Erik Prusch, John W. Stanton, William R. Blessing, Bruce A. Chatterley, Mufit Cinali, Jose A. Collazo, Hossein Eslambolchi, Dennis S. Hersch, Brian P. McAndrews, Kathleen H. Rae, Theodore H. Schell, Jennifer L. Vogel, Slade Gorton, Starburst I, Inc., and Softbank Corp., Court of Chancery, State of Delaware, C.A. No. 8508-VCL and ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Clearwire Corporation, Court of Chancery, State of Delaware, C.A. No. 9042-VCL, September 25, 2015.

“Expert Rebuttal Report on Domestic Industry of Coleman Bazelon, Ph.D.,” In the Matter regarding Certain Non-Volatile Memory Chips and Products Containing the Same, Investigation No. 337-TA-916, December 15, 2014.

“Expert Report on Remedy and Bonding of Coleman Bazelon, Ph.D.,” In the Matter regarding Certain Non-Volatile Memory Chips and Products Containing the Same, Investigation No. 337-TA-916, December 15, 2014.

“Expert Report on Public Interest of Coleman Bazelon, Ph.D.,” In the Matter regarding Certain Non-Volatile Memory Chips and Products Containing the Same, Investigation No. 337-TA-916, November 24, 2014.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter regarding Wynnchurch Capital Ltd., In the Court of Chancery of the State of Delaware, C.A. No. 10077-VCL, November 7, 2014.

“Third Amended Reply Report of Coleman Bazelon, Ph.D.,” On Behalf of Plaintiff-Intervenors Texas League of Young Voters Education Fund and Imani Clark, United States District Court for the Southern District of Texas Corpus Christi Division, Civ. No. 2:13-cv-00263, September 22, 2014.

“Reply Report of Coleman Bazelon, Ph.D.,” On Behalf of Plaintiff-Intervenors Texas League of Young Voters Education Fund and Imani Clark, United States District Court for the Southern District of Texas Corpus Christi Division, Civ. No. 2:13-cv-193 (NGR), August 15, 2014.

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“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of the Texas League of Young Voters Education Fund and Imani Clark v. State of Texas, Nandita Berry, in her official capacity as Texas Secretary of State; and Steve McGraw, in his official capacity as Director of the Texas Department of Public Safety, United States District Court for the Southern District of Texas Corpus Christi Division, Civ. No. 2:13-cv-00263, June 27, 2014.

“Rebuttal Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of the Companies’ Creditors Arrangement Act, R.S.C. 1985, c. C-36, As Amended, and in the Matter of a Plan of Compromise or Arrangement of Nortel Networks Corporation, Nortel Networks Limited, Nortel Networks Global Corporation, Nortel Networks International Corporation and Nortel Networks Technology Corporation United States Bankruptcy Court for the District of Delaware, Case No. 09-10138 (KG), February 28, 2014.

“Supplemental Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of Sky Angel U.S., LLC, against Discovery Communications, LLC, Animal Planet, LLC, United States District Court for the District of Maryland, Case No. 8:13-cv-00031-DKC, January 31, 2014.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of the Companies’ Creditors Arrangement Act, R.S.C. 1985, c. C-36, As Amended, and in the Matter of a Plan of Compromise or Arrangement of Nortel Networks Corporation, Nortel Networks Limited, Nortel Networks Global Corporation, Nortel Networks International Corporation and Nortel Networks Technology Corporation United States Bankruptcy Court for the District of Delaware, Case No. 09-10138 (KG), January 24, 2014.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of Sky Angel U.S., LLC, against Discovery Communications, LLC, Animal Planet, LLC, United States District Court for the District of Maryland, Case No. 8:13-cv-00031-DKC, December 6, 2013.

“Expert Report of Coleman Bazelon, Ph.D. and Armando Levy, Ph.D.,” In the Matter of LT Game International Ltd., against Shuffle Master, Inc., United States District Court for the District of Nevada, Case No. 2:12-cv-01216-JAD-GWF, October 4, 2013.

“Expert Report of Coleman Bazelon, Ph.D.,” In the Matter of Certain Electronic Devices, Including Wireless Communications Devices, Tablet Computers, Media Players, and Televisions, and Components Thereof, United States International Trade Commission, Investigation No. 337-TA-862 (Judge Shaw), July 5, 2013.

“Declaration of Coleman Bazelon” In the Matter of PTA-FLA, Inc, Daredevil, Inc., NTCH-WEST TENN., Inc., NTCH-WA, Inc., and Eric Steinmann against ZTE Corporation, and ZTE USA, Inc. Florida Arbitration, Case No.: 50-494-T-00665-11, February 26, 2013.

“Rebuttal Testimony of Coleman Bazelon,” In re: Petition for Suspension or Modification of Application of the Requirements of 47 U.S.C. § 251(b) and (c), pursuant to 47 U.S.C. § 251(f)(2) regarding Time

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Warner Cable Information Services (Maine) LLC's Request, State of Maine Public Utilities Commission, Docket No. 2012-198, Docket No. 2012-218, Docket No. 2012-219, Docket No. 2012-220, Docket No. 2012-221, October 12, 2012.

"Testimony of Coleman Bazelon, Ph.D.," In re: Petition for Suspension or Modification of Application of the Requirements of 47 U.S.C. § 251(b) and (c), pursuant to 47 U.S.C. § 251(f)(2) regarding Time Warner Cable Information Services (Maine) LLC's Request, State of Maine Public Utilities Commission, Docket No. 2012-198, Docket No. 2012-218, Docket No. 2012-219, Docket No. 2012-220, Docket No. 2012-221, August 20, 2012.

"Expert Report of Dr. Coleman Bazelon," *Salsgiver Communications, Inc., Salsgiver Telecom, Inc., and Salsgiver Inc. v. Consolidated Communications Holdings, Inc., North Pittsburgh Systems, Inc., and North Pittsburgh Telephone Company, Inc.*, Court of Common Pleas, Allegheny County, Pennsylvania, Civil Division, No. GD 08-7616, May 10, 2012.

"Effect of the Proposed Merger on Service Quality, Consumer Services, Employment, and California's Economy," Panelist on behalf of AT&T before the Public Utilities Commission of the State of California, Order Instituting Investigation on the Commissioner's Own Motion into the Planned Purchase and Acquisition by AT&T Inc. of T-Mobile USA, Inc., and Its Effect on California Ratepayers and the California Economy. Case No. I.11-06-009, July 22, 2011.

"Oral Testimony of Coleman Bazelon, The Brattle Group, Inc. before the U.S. House of Representatives, Committee on Energy and Commerce Subcommittee on Communication and Technology," April 12, 2011. (spectrum)

"Testimony of Coleman Bazelon, Principal, *The Brattle Group*, before the U.S. House of Representatives, Committee on Energy and Commerce, Subcommittee on Communications, Technology, and the Internet," June 17, 2010 (spectrum valuation).

"Supplemental Expert Report of Coleman Bazelon," *Gemalto PTE LTD and Gemplus S.A. v. Telecommunications Industry Association*, United States District Court for the Eastern District of Virginia, Alexandria Division, Case 1:08-cv-00776-LMB-TRJ, December 16, 2008.

"Expert Report of Coleman Bazelon," *Gemalto PTE LTD and Gemplus S.A. v. Telecommunications Industry Association*, United States District Court for the Eastern District of Virginia, Alexandria Division, Case 1:08-cv-00776-LMB-TRJ, November 6, 2008.

"Prefiled Rebuttal Testimony of Coleman D. Bazelon," In re: Complaint and Request for Emergency Relief Against Verizon Florida LLC for anticompetitive behavior in violation of Sections 364.01(4), 364.3381, and 364.10, F.S., and for failure to facilitate transfer of customers' numbers to Bright House Networks Information Services (Florida) LLC, and its affiliate, Bright House Networks, LLC, Florida Public Service Commission, Docket No. 070691-TP, July 25, 2008.

Coleman Bazelon

“Prefiled Direct Testimony of Coleman D. Bazelon,” In re: Complaint and Request for Emergency Relief Against Verizon Florida LLC for anticompetitive behavior in violation of Sections 364.01(4), 364.3381, and 364.10, F.S., and for failure to facilitate transfer of customers’ numbers to Bright House Networks Information Services (Florida) LLC, and its affiliate, Bright House Networks, LLC, Florida Public Service Commission, Docket No. 070691-TP, May 30, 2008.

“Declaration of Coleman Bazelon in Support of Plaintiffs’ Motion for Class Certification,” *Kenneth Stickrath, et al v. Globalstar, Inc.*, United States District Court for the Northern District of California, San Francisco Division, Case No. 07-CV-01941 TEH, April 25, 2008.

“Testimony of Coleman Bazelon, Principal, *The Brattle Group*, before the U.S. House of Representatives, Committee on Energy and Commerce, Subcommittee on Telecommunications and the Internet,” April 15, 2008 (reviewing the 700 MHz auction).

“Concerning the Meaning of ‘Fair and Reasonable Compensation’ in Section 253(c) of the Telecommunications Act of 1996 and the Comparability of the Rights-of-Way Fees Paid by Level 3 in Massachusetts and Elsewhere,” *The Massachusetts Turnpike Authority v. Level 3 Communications, LLC, et al.*, The United States District Court for the District of Massachusetts, Civ. Act. No. 06-11816, December 17, 2007.

“Concerning the Effects of the Fixed Rent Charged for Access to the Massachusetts Turnpike,” *The Massachusetts Turnpike Authority v. Level 3 Communications, LLC, et al.*, The United States District Court for the District of Massachusetts, Civ. Act. No. 06-11816, November 12, 2007.

“Affidavit of Dr. Coleman Bazelon,” *Gulfside Casino Partnership v. Mississippi Riverboat Council, et al.*, United States District Court for the Southern District of Mississippi, Southern Division, Cause No. 1:07-CV-110-LG-JMR, May 4, 2007.

“Rebuttal Report of Dr. Coleman Bazelon,” *Level 3 Communications, LLC, v. City of St. Louis, Missouri*, United States District Court for the Eastern District of Missouri, Eastern Division, Consolidated Case No. 4:04-CV-871 CAS, June 17, 2005.

“Affidavit of Dr. Coleman Bazelon,” *Informed Communications Systems, Inc. v. Intelogistics Corp., d/b/a Prosodie Interactive*, United States District Court, Southern District of Florida, Miami Division, Case No.: 04-61245 CIV Huck/Turnoff (October 12, 2004).

EXPERT DESIGNATIONS

- *Touch America, Inc. v. Qwest Communications International, Inc.*
 - o Designated as an expert in Arbitration (June 2003)

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- *Informed Communications Systems, Inc. v. Intelogistics Corp., d/b/a Prosodie Interactive*, United States District Court, Southern District of Florida, Miami Division, Case No.: 04-61245 CIV Huck/Turnoff
 - o Filed affidavit (October 12, 2004)
- *Level 3 Communications, LLC v. City of St. Louis, Missouri*, United States District Court for the Eastern District of Missouri, Eastern Division, Consolidated Case No. 4:04-CV-871 CAS
 - o Filed Rebuttal Report (June 17, 2005)
 - o Deposition (July 14, 2005)
- Cable Merger before the FTC
 - o Presented analysis to FTC staff (March 20, 2007)
- *Gulfside Casino Partnership v. Mississippi Riverboat Council, et al.*, United States District Court for the Southern District of Mississippi, Southern Division, Cause No. 1:07-CV-110-LG-JMR
 - o Filed affidavit (May 4, 2007)
- *Motorola, Inc. v. State of Mississippi Department of Information Technology Services and M/ACOM, Inc.*, Chancery Court of Hinds County, Mississippi, Cause No. G2006-2179 S/2
 - o Testified (May 23, 2007)
- *American Towers, Inc. v. Jackson & Campbell, P.C., et al.*, DC Superior Court, No. 003277-06
 - o Deposition (March 19, 2009)
 - o Filed Affidavit (May 22, 2009)
- *The Massachusetts Turnpike Authority v. Level 3 Communications, LLC, et al.*, The United States District Court for the District of Massachusetts, Civ. Act. No. 06-11816
 - o Filed Expert Report (November 12, 2007)
 - o Filed Rebuttal Report (December 17, 2007)
 - o Deposition (January 21, 2008)
- *Kenneth Stickrath, et al v. Globalstar, Inc.*, United States District Court for the Northern District of California, San Francisco Division, Case No. 07-CV-01941 THE
 - o Filed Declaration (April 25, 2008)
 - o Deposition (June 11, 2008)
- In re: Complaint and request for emergency relief against Verizon Florida LLC for anticompetitive behavior in violation of Sections 364.01(4), 364.3381, and 364.10, F.S., and for failure to facilitate transfer of customers' numbers to Bright House Networks

Information Services (Florida) LLC, and its affiliate, Bright House Networks, LLC, Florida Public Service Commission, Docket No. 070691-TP

- o Filed Direct Testimony (May 30, 2008)
 - o Filed Rebuttal Testimony (July 25, 2008)
 - o Deposition (August 13, 2008)
- *Gemalto PTE LTD and Gemplus S.A. v. Telecommunications Industry Association*, United States District Court for the Eastern District of Virginia, Alexandria Division, Case 1:08-cv-00776- LMB-TRJ
 - o Filed Expert Report (November 6, 2008)
 - o Deposition (December 2, 2008)
 - o Filed Supplemental Expert Report (December 16, 2008)
- *Salsgiver Communications, Inc., Salsgiver Telecom, Inc., and Salsgiver Inc. v. Consolidated Communications Holdings, Inc., North Pittsburgh Systems, Inc., and North Pittsburgh Telephone Company, Inc.*, Court of Common Pleas, Allegheny County, Pennsylvania, Civil Division, No. GD 08-7616
 - o Filed Damages Analysis (February 27, 2009)
 - o Deposition (April 3, 2012)
 - o Filed Expert Report (May 10, 2012)
 - o Testified (May 6, 2015; May 12, 2015)
- *Certain Products Containing Interactive Program Guide and Parental Control Technology* United States International Trade Commission, Investigation No. 337-TA-820 (Judge Bullock)
 - o Designated as an expert (June 8, 2012)
- In re: Petition for Suspension or Modification of Application of the Requirements of 47 U.S.C. § 251(b) and (c), pursuant to 47 U.S.C. § 251(f)(2) regarding Time Warner Cable Information Services (Maine) LLC's Request, State of Maine Public Utilities Commission, Docket No. 2012-198, Docket No. 2012-218, Docket No. 2012-219, Docket No. 2012-220, Docket No. 2012-221
 - o Filed Direct Testimony (August 20, 2012)
 - o Filed Rebuttal Testimony (October 12, 2012)
 - o Testified (October 23, 2012)
- In the matter of PTA-FLA, Inc , Daredevil, Inc., NTCH-WEST TENN., Inc., NTCH-WA, Inc., and Eric Steinmann against ZTE Corporation, and ZTE USA, Inc. Florida Arbitration, Case No.: 50-494-T-00665-11

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- o Filed Expert Report (February 26, 2013)
 - o Deposed (March 15, 2013)
 - o Testified (August 30, 2013)
- *Certain Electronic Devices, Including Wireless Communications Devices, Tablet Computers, Media Players, and Televisions, and Components Thereof*, United States International Trade Commission, Investigation No. 337-TA-862 (Judge Shaw)
 - o Filed Rebuttal Patent Infringement Testimony (July 5, 2013)
- In the matter of LT Game International Ltd., against Shuffle Master, Inc., United States District Court for the District of Nevada, Case No. 2:12-cv-01216-JAD-GWF
 - o Filed Expert Report (October 4, 2013)
 - o Deposed (November 12, 2013)
- In the Matter of Sky Angel U.S., LLC, against Discovery Communications, LLC, Animal Planet, LLC, United States District Court for the District of Maryland, Case No. 8:13-cv-00031-DKC
 - o Filed Expert Report (December 6, 2013)
 - o Filed Supplemental Report (January 31, 2014)
 - o Deposed (February 14, 2014)
 - o Testified (November 23, 2015)
- In the Matter of the Companies' Creditors Arrangement Act, R.S.C. 1985, c. C-36, As Amended, and in the Matter of a Plan of Compromise or Arrangement of Nortel Networks Corporation, Nortel Networks Limited, Nortel Networks Global Corporation, Nortel Networks International Corporation and Nortel Networks Technology Corporation United States Bankruptcy Court for the District of Delaware, Case No. 09-10138 (KG)
 - o Filed Expert Report (January 24, 2014)
 - o Filed Rebuttal Expert Report (February 28, 2014)
 - o Deposed (April 3, 2014; May 30, 2014)
 - o Testified (June 2, 2014; June 5, 2014)
- *State of Texas v. Eric H. Holder, Jr., in his Official Capacity as Attorney General of the United States*, United States District Court for the District of Columbia, Case No. 1:12-CV-00128
 - o Filed Expert Report (June 27, 2014)

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- o Filed Reply Report (August 15, 2014)
 - o Deposed (August 20, 2014)
 - o Testified (September 9, 2014)
 - o Filed Third Amended Reply Report (September 22, 2014)
- Certain Wireless Devices, Including Mobile Phones And Tablets II, United States International Trade Commission, Investigation No. 337-TA-905 (Judge Pender)
 - o Designated as expert April 16, 2014
- Wynnchurch Capital Ltd., In the Court of Chancery of the State of Delaware, C.A. No. 10077-VCL
 - o Filed Expert Report (November 7, 2014)
 - o Deposed (November 17, 2014)
- In the Matter of: Certain Non-Volatile Memory Chips and Products Containing the Same, United States International Trade Commission, Washington, D.C., Investigation No. 337 TA-916 (Judge Lord and Judge Essex)
 - o Filed Expert Report on Public Interest (November 24, 2014)
 - o Filed Expert Rebuttal Report on Domestic Industry (December 15, 2014)
 - o Filed Expert Report on Remedy and Bonding (December 15, 2014)
 - o Deposed (January 9, 2015)
- In the Matter of: Certain Non-Volatile Memory Chips and Products Containing the Same, United States International Trade Commission, Washington, D.C., Investigation No. 337 TA-922 (Judge Pender)
 - o Designated as expert December 19, 2014
- In the Matter of: Certain Footwear Products, United States International Trade Commission, Washington, D.C., Investigation No. 337-TA-936 (Judge Bullock)
 - o Designated as expert March 6, 2015
- In the Matter of ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Sprint Corporation, Sprint Communications, Inc., Erik Prusch, John W. Stanton, William R. Blessing, Bruce A. Chatterley, Mufit Cinali, Jose A. Collazo, Hossein Eslambolchi, Dennis S. Hersch, Brian P. McAndrews, Kathleen H. Rae, Theodore H. Schell, Jennifer L. Vogel, Slade Gorton, Starburst I, Inc., and Softbank Corp., Court of Chancery, State of Delaware, C.A. No. 8508-VCL and ACP Master, Ltd., Aurelius Capital Mater, Ltd., and Aurelius Opportunities Fund II, LLC, v. Clearwire Corporation, Court of Chancery, State of Delaware, C.A. No. 9042-VCL

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- o Filed Expert Report (September 25, 2015)
 - o Filed Rebuttal Report (October 23, 2015)
 - o Filed Amended Expert Report (November 2, 2015)
 - o Deposed (November 10, 2015)
 - o Testified (November 14, 2016)
- In the Matter of Securities and Exchange Commission v. Janus Spectrum LLC; David Alcorn; David Alcorn Professional Corporation; Kent Maerki; Dominion Private Client Group, LLC; Janus Spectrum Group, LLC; Spectrum Management, LLC; Spectrum 100, LLC; Prime Spectrum, LLC; Prime Spectrum Management, LLC; Daryl G. Bank; Premier Spectrum Group, PMA; Bobby D. Jones; Innovative Group, PMA; Premier Group, PMA; Prosperity Group, PMA; Terry W. Johnson; and Raymon G. Chadwick, Jr., United States District Court, District of Arizona, Docket No. CV- 15-609-PHX-SMM
 - o Filed Expert Report (May 13, 2016)
 - o Deposed (August 12, 2016)
 - o Filed Declaration of Coleman Bazelon in Support of Plaintiff Securities and Exchange Commission's Motion for Summary Judgment (October 6, 2016)
- In the Matter of Commonwealth of Virginia, ex rel. State Corporation Commission v. Darryl Gene Bank and Raeann Ann Gibson, Commonwealth of Virginia State Corporation Commission Hearing Examiner, Case No. SEC-2015-00020
 - o Filed Expert Report (November 4, 2016)
- In the Matter of Certain Beverage Brewing Capsules, Components Thereof, and Products Containing the Same, United States International Trade Commission, Washington, D.C., Investigation No.337-TA-929 (Eko Brands, LLC ("Eko Brands") and Espresso Supply, Inc. ("Espresso Supply" and collectively with Eko Brands "Respondents") (Judge Theodore Essex)
 - o Filed Expert Enforcement Proceeding Report (November 2, 2016)
 - o Deposed (November 18, 2016)
 - o Testified (January 11, 2017)
- In the Matter of CC/Devas (Mauritius) Ltd., Devas Employees Mauritius Private Limited, and Telcom Devas Mauritius Limited, Case No. PCA2013-09
 - o Filed Expert Report (January 16, 2017)
 - o Filed Second Expert Report (July 31, 2017)
 - o Filed Third Expert Report (November 29, 2017)

Coleman Bazelon

- o Filed Fourth Expert Report (April 26, 2018)
- o Testified (July 19-20, 2018)
- In the Matter of Vertical Ventures II, LLC; Vertical Ventures V, LLC; LWH Network, LLC; L, W & C Network, LLC; and Spectrum Family 800, GP vs. Smartcomm, LLC; Smartcomm License Services, LLC; Smartcomm Management, LLC; Smartcomm Acquisitions, LLC; License Acquisitions, LLC; Big Wave Ventures, LLC; Spectrum Networks Group, LLC; M2M Spectrum Networks, LLC; Spectrum Acquisitions Group, LLC; Carlson Investment Group, LLC; Carole L. Downs; Barclay Knapp; and Joe Doe Transferees, Superior Court of Arizona Maricopa County
 - o Filed Expert Report (March 24, 2017)
- In the Matter of ATK Space Systems, Inc., et al., vs. U.S. Space LLC, Circuit Court of Loudon County, Virginia, Case No. CL-101847
 - o Filed Expert Report (September 8, 2017)
 - o Filed Rebuttal Report (October 20, 2017)
 - o Filed Second Rebuttal Report – Reply to the Expert Report of J. Armand Musey in Opposition of Coleman Bazelon (November 10, 2017)
 - o Deposed (December 7, 2017)
 - o Testified (February 16, 2018)
- In the Matter of *Certain Solid State Storage Drives, Stacked Electronics Components, and Products Containing Same* United States International Trade Commission, Investigation No. 337-TA-1097 (Judge Dee Lord)
 - o Deposed (March 2, 2018)
 - o Testified (March 22, 2018)

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Auction Revenues are not the Only Revenues that Should Drive Spectrum Policy, Law Seminars International: Spectrum Management, Washington, DC, September 17, 2007.

Market Allocation for Radio Spectrum, International Telecommunications Union Workshop on Market Mechanisms for Spectrum Management, Geneva, Switzerland, January 2007.

Licensed vs. Unlicensed Spectrum: A New Economic Model for Determining the Trade-offs, 34th Annual Telecommunications Policy Research Conference (TPRC), Arlington, VA, September 30, 2006.

Decoding the Future of IP-TV, Northern California Chapter of the Federal Communications Bar Association, San Francisco, February 2006.

Accelerating the Digital Television Transition, COMPTel Executive Business & Policy Summit, Washington, DC, December 2005.

Regulated Unbundling of Telecommunications Networks: A Stepping Stone to Facilities Based Competition? Telecommunications Policy Research Conference, Arlington, VA, September 2005.

Sending the Right Signals: Promoting Competition Through Telecommunications Reform: A Report to the U.S. Chamber of Commerce, presentation of report to the US Chamber of Commerce, October 6, 2004.

Telecommunications Reform, presentation to the U.S. Chamber of Commerce's Technology Policy Committee, April 29, 2004.

Interlicense Competition, Telecommunications Policy Research Conference, Arlington, VA, September 2003.

Marketing & Legal Strategies: Hope, Hype & Crash Landings, WCAI 2003, Washington, DC, July 10, 2003.

Spectrum Policy Task Force Interference Recommendations, Manhattan Institute Conference, Washington, DC, February 13, 2002.

FCC License Auctions, Society of Government Economists Conference, Washington, DC, November 22, 2002.

Coleman Bazelon

Spectrum Management Panel, CTIA Wireless 2002, Orlando, FL, March 18, 2002.

A Note on Correlation, ASSA Annual Meetings, Atlanta, GA, January 6, 2002.

Regulatory Forbearance, Powerline Communications Conference, Washington, DC, December 13, 2001.

Spectrum License Valuations, CTIA Wireless Agenda 2001, Dallas, TX, May 2001.

Old Spectrum in the New Economy, with David Moore, invited paper, Society of Government Economists Conference “The New ‘Economy’: What Has Changed and Challenges for Economic Policy,” Washington, DC, November 2000.

Discounting Inside the Washington DC Beltway, Energy Information Agency Seminar Series, Washington, DC, March 2000.

Discounting Inside the Washington DC Beltway, Congressional Budget Office Seminar Series, Washington, DC, November 1999.

Completing the Transition to Digital Television, Telecommunications Policy Research Conference, Arlington, VA, September 1999.

Digital Television Transition, Congressional Budget Office Seminar Series, Washington, DC, April 1999.

The Budgetary Treatment of Asset Sales, briefing for the staff of the Senate Budget Committee, Washington, DC, February 1997.

The Value Added from Multilateral Bargaining Theory for Applied Research, with Greg Adams, Selected Paper, AAEA Annual Meeting, Baltimore, MD, August 1992.

The Importance of Political Markets in Formulating Economic Policy Recommendations, Selected Paper, AAEA Annual Meeting, Manhattan, KS, August 1991.

L.D.C. Debt and Policy Linkages in the Determination of World Commodity Prices, with Gordon Rausser, Selected Paper, AAEA Annual Meeting, Vancouver, B.C., Canada, August 1990.

REVIEWER

- American Journal of Agricultural Economics (1989 – 1994)
- Congressional Budget Office Reports
- Telecommunications Policy
- Telecommunications Policy Research Conference Program Committee (2011-2013)
- George Mason University

PROFESSIONAL AFFILIATIONS

- American Bar Association
- American Economic Association
- Federal Communications Bar Association
- National Research Council - Committee on a Survey of the Active Scientific Use of the Radio Spectrum

EDUCATION

Dr. Bazelon received his Ph.D. and M.S. in Agricultural and Resource Economics from the University of California at Berkeley. He also holds a Diploma in Economics from the London School of Economics and Political Science and a B.A. from Wesleyan University.

August 3, 2018

Dr. Renée Duplantis has more than 15 years of experience involving complex competition matters in Canada, the United States and Europe. She specializes in the empirical analysis of antitrust issues with a primary focus on quantifying the competitive effects of mergers. She has also been involved in several large competition matters involving allegations of abuse of dominance, exclusionary conduct, monopolization, collusion and price-fixing.

From 2011 through 2014, Dr. Duplantis was seconded to the Canadian Competition Bureau and in 2014 she served as the T.D. MacDonald Chair in Industrial Economics at the Bureau. During this time, she provided the Commissioner of Competition with advice on economic matters related to competition policy and participated in the economic analysis of high-profile investigations under the *Competition Act*, including two litigated cases, *Commissioner of Competition v. Tervita (CCS Corporation)* and *Commissioner of Competition v. Toronto Real Estate Board*.

PROFESSIONAL WORK EXPERIENCE

- Principal, The Brattle Group, June 2015 – present
- Principal, Microeconomic Consulting and Research Associates, Inc. (MiCRA), January 2015 – May 2015
- T.D. MacDonald Chair in Industrial Economics, Competition Bureau Canada, 2014
- Special Economic Advisor, Competition Bureau Canada, 2011 – 2013
- Competition Law Officer, Competition Bureau Canada, 2010 – 2011
- Senior Economist, Microeconomic Consulting and Research Associates, Inc. (MiCRA), 2007 – 2011
- Economist, Microeconomic Consulting and Research Associates, Inc. (MiCRA), 2003 – 2007
- Senior Consultant, IBM Business Consulting Services (including its predecessor, the Washington Consulting Practice of PricewaterhouseCoopers), 2001 – 2003

EDUCATION

Northeastern University, Ph.D. in Economics

Duke University, M.A. in Economics

University of Louisiana at Monroe, B.B.A. in Economics

PROFESSIONAL AFFILIATIONS

- Competition Policy Council, C.D. Howe Institute
- Non-government Advisor to the International Competition Network for the Competition Bureau Canada
- Editorial Board, *Canadian Competition Law Review*
- Canadian Bar Association, affiliate member
- American Bar Association, associate member

EXPERIENCE

Merger Analysis

- Retained as the outside expert for Superior Plus, LP in connection with its acquisition of the retail propane distribution business of Gibson Energy ULC (Canwest Propane), which involved empirically estimating the anti-competitive effects of the merger and conducting the section 96 trade-off analysis. Presented findings to the Competition Bureau.
- Retained as the Canadian outside expert for Agrium, Inc. in the review of its merger with PotashCorp of Saskatchewan, which involved empirically estimating the anti-competitive effects of the merger and conducting the section 96 trade-off analysis. Submitted findings to the Competition Bureau.
- Retained as one of the outside experts for Cintas Corporation in its acquisition of G&K Services Inc. Presented findings to the Competition Bureau.
- Retained as one of the outside experts for BCE, Inc. in its acquisition of Manitoba Telecom Systems Inc. Submitted findings to the Competition Bureau.
- Retained as one of the outside experts for Superior Plus Corporation in its proposed acquisition of Canexus Corporation. Presented findings to the Competition Bureau.
- Retained as the outside expert for the merging parties in the review of an acquisition in the landfill and bioremediation industry.
- Retained as the outside expert for the Competition Bureau in its review of an acquisition in the insulated metal panels industry.
- While seconded to the Competition Bureau, served as the Bureau's internal economist on its review of the acquisition of a hazardous waste landfill in northeastern British Columbia. This work included developing theories of harm, empirically estimating the anti-competitive effects from the merger, calculating the deadweight loss associated with the transaction and assisting with testimony before the Competition Tribunal. It also

involved assisting with the Bureau's submissions before the Federal Court of Appeal and the Supreme Court of Canada. *Commissioner of Competition v. Tervita (CCS Corporation)*.

- While seconded to the Competition Bureau, led the analysis of competitive effects for merger investigations in the following industries: grocery retailing; fertilizer manufacturing and retailing; newspapers; cement; fast food retailing; oriented strand board production; milk production; armored car services; broadcasting; telecommunications; sports and entertainment; lumber; car rental; equities trading and post-trade clearing services; upstream oil and gas; consumer auto products; mining consumables; and construction rental equipment.
- Led the empirical analysis of competitive effects for several mergers in the eyeglass and sunglass retailing and manufacturing markets. This involved developing and performing regression analysis for local geographic markets and predicting the competitive effects in those local markets.
- Led the empirical analysis of competitive effects in support of an expert for mergers in the following industries: passenger air travel; newspapers; newsprint production; nitrogen-based fertilizers; paint and chemical manufacturing; beer manufacturing; satellites; asphalt and aggregates; search engines and advertising; and bioremediation.

Monopolistic Practices

- While seconded to the Competition Bureau, served as the Bureau's internal economist on its review of rules implemented by Canada's largest real estate association regarding the use of MLS data on virtual office websites and its application to the Competition Tribunal under the abuse of dominance provision of the *Competition Act*. This work included developing theories of harm and assisting with testimony before the Tribunal. *Commissioner of Competition v. Toronto Real Estate Board*.
- While seconded to the Competition Bureau, served as the internal economist on civil investigations involving the following industries: broadcasting; professional sports leagues; grocery retailing; search advertising and optimization; and waste collection.
- Led the support of an expert testifying on the liability aspect of monopolization and foreclosure in the antisubmarine warfare aircraft refurbishment industry. *L-3 Communications v. Lockheed Martin*.

Price Fixing

- Empirically analyzed the effects of an alleged agreement between firms in the parcel-tanker shipping industry to determine if the agreement resulted in an undue lessening or prevention of competition.
- Led the empirical support of an expert testifying on the estimated overcharge resulting from the price fixing of carbon fiber. *Horizon Sports v. Newport Adhesives*.

- Led the support of an expert testifying on behalf of the defendants in the alleged price-fixing of the universal service fees. *In re: USF Telephone Billing Practices Litigation*.
- Led the empirical support of an expert analyzing the competitive effects of the alleged air cargo conspiracy for a defendant in the United States and the European Union.
- Led the empirical support of an expert analyzing the competitive effects of price fixing in the US maritime shipping industry.

Regulatory Matters

- *An Analysis of Broadband Services in Canada; Competition, Regulation, and Investment*, prepared for Shaw Communications Inc., in the Competition Bureau Market Study: Competition in Broadband Services, August 30, 2018, with Coleman Bazelon and Agustin J. Ros.

TESTIMONY

Canadian Radio-television and Telecommunications Commission: Testified on behalf of the Competition Bureau at Broadcasting Notice of Consultation 2014-190 Let's Talk TV Hearing, September 8, 2014.

HONORS AND FELLOWSHIPS

- *Who's Who Legal: Competition Economists*, 2018
- *Who's Who Legal: Consulting Experts*, 2018
- *Who's Who Legal: Canada*, 2017, 2018
- *Who's Who Legal: Competition – Future Leaders – Economists*, 2017
- Deputy Minister Merit Award Winner, Competition Bureau, 2015
- Commissioner Merit Award Winner, Competition Bureau, 2014, 2015
- Commissioner Merit Award Finalist, Competition Bureau, 2011, 2013
- Deputy Commissioner Merit Award, Competition Bureau, 2011, 2012, 2013, 2014, 2015
- Deborah Allen Fellowship, Duke University, 1999-2000
- Tuition Scholarship, Duke University, 1999-2000
- Academic Scholarship, University of Louisiana at Monroe, 1995-1998

PUBLICATIONS

"The Importance of Quantifying Non-Price Effects in Canada," with Ian Cass, *Concurrences Review*, No. 2-2017, pp. 51-57

“Economic Analysis of Retail Mergers at the Competition Bureau,” Competition Bureau White Paper, September 14, 2014

“Do Mergers Among Publishers of Academic Journals Affect Prices?” working paper, 2010

“Pass-Through of Non-sunk Fixed Costs with an Application to Fuel Costs,” working paper, 2010

“Merger Effects in Markets for Highway Construction,” working paper, 2010

“From Structure to Effects: the Economics of Merger Control,” *Global Competition Review*, June 2008, with R. S. Khemani and R. Warren-Boulton

PRESENTATIONS

“From market shares and form-based approach to unilateral effects in innovation and Intel – 15 years of competition economics,” Association of Competition Economists, Bologna, Italy, November 15, 2018.

“Evidentiary Standards in Mergers with Innovation,” International Competition Network Merger Workshop, Break-out Session, Tokyo, Japan, November 8, 2018.

“TREB, AMEX and the Future of Monopolization in Data-Driven Markets” Canadian Bar Association, 2018 Annual Fall Competition Law Conference, Ottawa, ON, September 27, 2018.

“Integrating Economics in Case Assessments – Lessons Learned from Experience,” International Competition Network Annual Meeting, moderator of Break-out Session, New Delhi, India, March 22, 2018

“Expanding the Right of Private Access,” Canadian Economic Association Meetings, Antigonish, NS, June 3, 2017.

“Economists of Scale and Scope – the Role of Expert Economists for Effective Enforcement,” International Competition Network Annual Meeting, Break-out Session, Porto, Portugal, May 12, 2017.

“Non-Price Effects in Competition Analysis: Fact or Fiction?” Canadian Bar Association, 2016 Annual Fall Competition Law Conference, Ottawa, ON, October 6, 2016.

“Economists and the ICN,” International Competition Network Chief/Senior Economists Workshop, Vancouver, BC, September 13, 2016.

“Mergin’ On Up: Current Issues in Vertical Transactions,” American Bar Association / Canadian Bar Association Brownbag Teleconference, May 25, 2016.

“Vertical Restraints in Online Markets,” International Competition Network Annual Meeting, Break-out Session, Singapore, April 27, 2016.

“Economists and the ICN,” International Competition Network Annual Meeting, Break-out Session, Singapore, April 27, 2016.

“Non-price Effects in Competition Assessment,” Competition Bureau Emerging Competition Issues Workshop, moderator, Ottawa, ON, January 18, 2016.

“A New World Order? Implications of the Supreme Court’s Decision in *Tervita* for Mergers?” Canadian Bar Association, 2015 Annual Fall Competition Law Conference, Ottawa, ON, October 2, 2015.

“The Relationship between Competition and Innovation,” Competition Bureau Innovation and Antitrust Workshop, Ottawa, ON, November 4, 2014.

“Issues in the Retail Environment,” Canadian Bar Association, 2014 Annual Fall Competition Law Conference, Ottawa, ON, September 18, 2014.

“The Use of Econometric Data in Merger Review,” American Bar Association International Section of Law / International Association of Young Lawyers Conference, Chicago, IL, June 7, 2014.

“Challenges in Merger Review: Price Discrimination,” Canadian Economic Association Meetings, Vancouver, BC, May 30, 2014.

“Notification in Aisle 5: A Cross-Border Survey of Econometric Trends and Tools,” American Bar Association / Canadian Bar Association Brownbag Teleconference, April 21, 2014.

“Structural Approaches vs. Competitive Effects – How the Canadian Competition Bureau Strikes a Balance,” Keynote Address, Canadian Bar Association Roundtable Event: Meet the Competition Bureau Economists, Toronto, ON, April 3, 2014.

“Managing Economics Experts,” Presentation to the Competition Bureau, Gatineau, QC, various dates 2012, 2014.

“Bureau’s Use of Econometrics in Merger Cases,” Competition Bureau / Canadian Bar Association Mergers Roundtable, Toronto, ON, May 10, 2013.

“Quantitative Methods for Competition Analyses,” with Dennis Lu, Presentation to the Mergers Branch, Gatineau, QC, May 22, 2013.

“Econometric Tools in Merger Reviews,” with Dennis Lu and Patrick Hughes, Presentation to the Commissioner of Competition, Gatineau, QC, February 6, 2013.

“The Rough Guide to the *Commissioner of Competition v. CCS et. al.*,” with Nikiforos Iatrou and Trevor MacKay, Competition Bureau Town Hall, Gatineau, QC, February 23, 2012.

LECTURES

“Tervita And the Acquisition of Complete,” Lecture to Ivey Business School at Western University, London, ON, 2016, 2017, 2018.

“*Commissioner of Competition vs. Toronto Real Estate Board (TREB)*,” Lecture to Western University Industrial Organization Honours Course, London, ON, 2016.

“Tervita and the Acquisition of Complete,” Lecture to Northeastern University Industrial Organization Doctoral Course, Boston, MA, 2016, 2018.

“The Economics of Cartels,” Competition Bureau Basic Industrial Organization Course, Gatineau, QC, 2014.

“The *Staples* Revolution,” Lecture to York University, Osgoode Hall Law School, Toronto, ON, 2014.

“The *Staples* Revolution,” Lecture to Western University Industrial Organization Honours Course, London, ON, various dates 2013, 2014, 2015.

AGUSTIN J. ROS

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Dr. Agustin J. Ros is a Principal of the Brattle Group with expertise in regulation and competition issues in telecommunications and energy. In telecommunications he has more than 25 year of experience working on fixed and mobile regulatory, competition and policy issues in the U.S., Canada and Latin America. His telecommunications consulting experience involves fixed and mobile cost of service ratemaking including fixed and mobile termination rates, cost of capital estimation, damages, performance-based regulation, spectrum allocation and valuation, and econometric modelling. He has provided expert testimony, reports and affidavits before regulatory and competition agencies throughout the world including the Federal Communications Commission, the Canadian Radio-television and Telecommunications Commission, the Federal Energy Regulatory Commission, the Mexican Institute of Telecommunications, the Mexican Competition Commission and the Colombian Communications Regulatory Commission.

Dr. Ros has worked as an economist at the Illinois Commerce Commission, the Federal Communications Commission and the Mexican Competition Commission. At the Illinois Commerce Commission he was Executive Assistant to the Chairman advising the Chairman on all economic matters before the Commission and was selected to participate in the Federal-State partnership in Telecommunications at the Federal Communications Commission in 1996 where he worked in the Common Carrier Bureau advising the Bureau and worked on the economic rules implementing the local competition provisions of the Telecommunications Act of 1996 including the economic and policy rules on interconnection, resale and unbundling network elements. In 2008-2010 he worked for the OECD and the Mexican Competition Commission co-leading a team of competition experts assessing competition in a number of key sectors of the Mexican economy including, aviation, banking, inter-city bus transport, energy, pharmaceutical, supermarkets, and telecommunications. The team made a series of policy recommendations to increase competition some of which were enacted into law.

Dr. Ros is an Adjunct Professor at the International Business School at Brandeis University where he teaches a course on global antitrust and economic regulation. His research includes examining competition issues in fixed and mobile telecommunications and retail electricity using econometric analysis and has published in academic, peer-reviewed journals such as *The Energy Journal*, *Journal of Regulatory Economics*, *Review of Industrial Organization*, *Review of Network Economics*, *Telecommunications Policy* and *Info*.

AREAS OF EXPERTISE

- Cost of Service, Demand and Pricing in Network Industries
- Competition Issues, Disputes and Damages in Network Industries
- Regulated Industry Policy and Restructuring
- Performance Based Ratemaking

EDUCATION

Ph.D. Economics, University of Illinois-Urbana Champaign	1994
M.S. Economics, University of Illinois-Urbana Champaign	1991
B.A. Economics, Rutgers University-Newark	1989

TEACHING POSITIONS

Brandeis University, International Business School, <i>Adjunct Professor</i>	2016-present
University of Anahuac, Mexico City, <i>Guest Lecturer</i>	2010
Northeastern University, <i>Adjunct Instructor</i>	2000

EXPERT REPORTS, TESTIMONIES AND AFFIDAVITS

Expert opinion on behalf of CFE International LLC before the U.S. Citizenship and Immigration Services and Department of Homeland Security: An Overview of the Mexican Energy Markets and Reforms, October 25, 2018.

Expert report on behalf of Shaw Communications before the Canadian Competition Bureau: An Analysis of Broadband Services in Canada, Competition, Regulation and Investment with Coleman Bazelon and Renée Duplantis, August 30, 2018.

Affidavit on behalf of CFE International LLC before the Federal Energy Regulatory Commission: market-based rate authority application on vertical and horizontal market power issues in U.S. electricity markets, with Judy Chang, June 13, 2018.

Expert report on behalf of the Australian Competition and Consumer Commission (ACCC), before the ACCC: International experiences in retail electricity markets, with Toby Brown, Neil Lessem, Serena Hesmondhalgh, James D. Reitzes and Haruna Fujita, June 2018.

Expert report on behalf of Transportadora de Gas Natural de la Huasteca, S. de R.I. de C.V. before the Mexican Energy Regulatory Commission: expert opinion on issues related to the appropriate allowed rate of return for the TGNH pipeline, with Paul Carpenter and Bente Villadsen, May 23, 2018.

Expert report on behalf of Infraestructura Marina del Golfo, before the Mexican Energy Regulatory Commission: expert opinion on issues related to the appropriate allowed rate of return for the IMG pipeline, with Paul Carpenter and Bente Villadsen, May 23, 2018.

Expert report on behalf of GCI Communications before the Federal Communications Commission: rate of return, cost of service and cross-subsidy analysis of GCI's Satellite-Based Services, with William Zarakas and Nicolas E. Powers, May 2018.

Expert report on behalf of GCI Communications before the Federal Communications Commission, In the Matter of Connect America Fund and Universal Service Reform, WC Docket No. 10-90 and WT Docket No. 10-208A: analysis of the FCC's Rural Health Care Program Funding and Recipients, with William Zarakas, David Kwok, and M. Elaine Cunha, September 2017.

Expert report on behalf of Teléfonos de Mexico before the Mexican Telecommunications Authority: measurement of total factor productivity for Teléfonos de Mexico, July 2014.

Expert report on behalf of Citibank, before the Honduran Competition Commission: expert report on the competitive effects of the FICHOSA – Citibank merger, April 2014.

Expert report on behalf of America Móvil before the Mexican Competition Commission: correcting the OECD's erroneous assessment of competition in the Mexican telecommunications sector, May 2013. With Professor Jerry A. Hausman.

Expert report on behalf of Leyde and LACTHOSA before the Honduran Competition Commission: expert report on the competitive effects of a joint venture between Leyde and LACTHOSA in the Honduran dairy sector, April 2013.

Expert report on behalf of Lowe's Mexico before the Mexican Competition Commission: economic analysis on market definition, market power and monopolistic practices in the market for home improvement products sold through superstores, October 2012.

Expert report on behalf of Comcel before the Regulatory Commission of Communications in Colombia: expert report on economic analysis of Resolution CRC 3139 2011 regarding on-net and off-net pricing and termination rates, November 9, 2011.

Expert report on behalf of ESSOSA and Puma before the El Salvador Competition Commission: expert report on the competition implications of assets sales in El Salvador, (with Ramsey Shehadeh) October 5, 2011.

Expert report on behalf of ESSOSA and Puma before the Honduran Commission for the Defense and Promotion of Competition: expert report on the competition implications of assets sales in Honduras, (with Ramsey Shehadeh) July 19, 2011.

Testimony before the state of Illinois on behalf of Northern Illinois Gas Company, Docket No. 11-0046, surrebuttal testimony regarding market definition, market power and public interest considerations, filed April 22, 2011.

Testimony before the Alberta Public Utility Commission, Proceeding 566 Electricity Rate Regulation Initiative, update, reply and PBR review study, filed February 22, 2011.

Testimony before the Alberta Public Utility Commission, Proceeding 566 Electricity Rate Regulation Initiative, total factor productivity study, filed December 30, 2010.

Testimony before the state of Illinois on behalf of Northern Illinois Gas Company, Docket No. 09-0310, rebuttal testimony regarding market definition, market power and public interest considerations, filed August 6, 2010.

Expert report before the Commission for the Supervision of Business Competition of the Republic of Indonesia on behalf of Singapore Telecommunications Limited and Singapore Telecom Mobile, "Competitive Assessment of the Indonesian Mobile Sector," (with William E. Taylor, Nigel Attenborough and Christian Dippon), filed October 15, 2007, rebuttal report filed January 11, 2008.

Expert report before the Ministry of Economic Affairs and Development on behalf of Cable and Wireless Barbados, "An Economic Assessment of Mandating Indirect Access in Barbados," (with Michael Khyefets and Loren Adler), November 14, 2007.

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSITPEL) on behalf of Telefonica de Peru, expert report on economic efficiency considerations with respect to termination rates and the impact of capacity-based charges, (with Jose Maria Rodriguez), filed October 17, 2007.

Expert report before the Canadian Radio and Telecommunications Commission (Telecom Public Notice CRTC 2006-14) on behalf of Bell Aliant Regional Communications, "Telecommunications Competition in the US: An Assessment of Wholesale Regulation Policy," (with William E. Taylor), filed March 15, 2007.

Expert report before the New York Public Service Commission (Case 06-C-0897) on behalf of Verizon New York, "Report on Competition for Retail Business Services," (with William E. Taylor and Harold Ware), filed report August 31, 2006. Supplemental Report filed October 2, 2006.

Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, response to Digicel's economic analysis of Interconnections costs and rates, filed May 12, 2006 (with Timothy Tardiff).

Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, expert report on interconnections costs in Trinidad and Tobago, filed May 4, 2006 (with Timothy Tardiff).

Expert report before the Telecommunications Authority of Trinidad and Tobago on behalf of Telecommunications Services of Trinidad and Tobago, expert report on Benchmark Mobile Termination Rates, Evaluation of the .Econ Report, filed February 10, 2006 (with Timothy Tardiff).

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSITPEL) on behalf of Telefonica de Peru, expert report on OSITPEL's imputation methodology, filed February 7, 2006 (with Jose Maria Rodriguez and Eduardo Prieto Kessler).

Expert report before the Comisión Federal de Telecomunicaciones de México, on behalf of Telcel, S.A., expert report measuring the cost Telcel incurs when providing interconnection services to operators, filed 22 June 2005.

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSITPEL) on behalf of Telefonica de Peru, final report regarding the estimation of Telefonica de Peru's total factor productivity for application in the 2004-2007 price cap regime (with José María Rodríguez Ovejero and Juan Hernández García), 21 June 2004.

Expert report before the Bahamas Public Utilities Commission, on behalf of the Bahamas Telecommunications Company, "Public Consultation on the Universal Service Obligation in The Bahamas," Comments filed 24 March 2004; Reply Comments filed 10 June 2004.

Expert report before the Canadian Radio-television and Telecommunications Commission on behalf of Aliant Telecom Inc., Bell Canada, MTS Communications Inc., Saskatchewan Telecommunications and Télébec, société en commandite, Public Notice 2003-10, "A Review of Rules and Regulations Governing Bundled Telecommunications Services." filed 12 March 2004, updated report filed 26 March 2004.

Expert report before the Bahamas Public Utilities Commission, on behalf of the Bahamas Telecommunications Company, "Public Consultation on Price Control of Bahamas Telecommunications Company," 19 September 2003.

Expert report before the Comisión Federal de Telecomunicaciones de México, on behalf of the Commission, "Telmex's 2003-2006 Price Cap Tariff Proposal," expert report in arbitration regarding the renewal of the price cap plan for Telmex (with William Taylor, Georgina Martinez, and Aniruddha Banerjee), 13 December 2002.

Expert report before the Honorable Arbitration Tribunal of Fairness in Guatemala, Case No. CENAC-A-01-2002, final report in arbitration regarding call termination costs in fixed and wireless networks (with José María Rodríguez Ovejero, Laurent Bensancon, and Juan Hernández García), September 2002.

Expert report before the Federal Communications Commission on behalf of BellSouth Corporation Docket Nos. 01-338, 96-98, 98-47 Reply Declaration (with William Taylor, Aniruddha Banerjee, and Charles Zarkadas) regarding unbundling obligations of local exchange carriers. Filed 17 July 2002.

Expert report before the Federal Communications Commission on behalf of Verizon Communications, Docket Nos. 01-339, 01-337, 02-33, Statement of 43 Economists on the Proper Regulatory Treatment of Broadband Internet Access Service, 3 May 2002.

Expert report before the New Zealand Commerce Commission on behalf of Telecom New Zealand, “Review of CostQuests’ Associates Benchmarking Survey” (with William Taylor, Greg Houston, Tom Hird, Jaime D’Almeida, and Carol Osborne), May 2002.

Testimony before the State of Illinois on behalf of Verizon North Inc. and Verizon South Inc., Docket No. 98-0195, surrebuttal testimony regarding investigation into certain payphone issues as directed in Docket 97-0225, 16 July 2001.

Expert report before the Supervising Agency for Private Investment in Telecommunications in Peru (OSIPTEL) on behalf of Telefonica de Peru, final report regarding the estimation of Telefonica de Peru’s total factor productivity for application in the 2001-2003 price cap regime (with Timothy Tardiff, José María Rodríguez Ovejero, and Juan Hernández García), 22 June 2001.

Testimony before the State of Illinois on behalf of Verizon North Inc. and Verizon South Inc., Docket No. 98-0195, rebuttal testimony regarding investigation into certain payphone issues as directed in Docket 97-0225, 20 April 2001.

Expert report before the New Zealand Commerce Commission, on behalf of Telecom New Zealand, “Costs of Telecommunications Competition Policies,” final report exploring the indirect economic costs of changing competition policy to a more regulatory approach (with Harold Ware, Timothy Tardiff, and Nigel Attenborough), May 2000.

Testimony before the State of Illinois on behalf of GTE North Incorporated and GTE South Incorporated, Docket No. 98-0195, direct testimony regarding investigation into certain payphone issues as directed in Docket No. 97-0225, 21 December 1999.

Expert report before the Federal Communications Commission on behalf of US West, An Economic and Policy Analysis of Efficient Inter-Carrier Compensation Mechanisms for ISP-Bound Traffic, 12 November 1999.

Expert report before the Pennsylvania Public Utility Commission on behalf of Bell Atlantic Pennsylvania, Promised Fulfilled: Bell Atlantic-Pennsylvania’s Infrastructure Development (with William Taylor, Charles Zarkadas, and Jaime D’Almeida), 15 January 1999.

Testimony before the State of Illinois on behalf of Illinois Gas Transmission Company, Docket No 98-0510, rebuttal testimony regarding certification of Illinois Gas Transmission Company as a Common Carrier by Pipeline and approval of rates and accounting, and for cancellation of the Certificate of Illini Carrier, LP, 11 January 1999.

Expert report before the Spanish Regulatory Commission on behalf of Telefónica, final report “Assessment of the methodology used by Telefónica in the calculation of the prices included in the interconnection reference offer and comparison with BT’s interconnection prices” (with Nigel Attenborough, David Robinson, Yogesh Sharma, and José María Rodríguez Ovejero), October 1998.

Expert report before the Italian Regulatory Commission on behalf of Telecom Italia, final report “Volume Discounts: A Report for Telecom Italia” (with Nigel Attenborough, Andrea Coscelli, and Andrea Lofaro), October 1998.

Expert report before the Federal Communications Commission on behalf of Bell Atlantic, Docket Nos. 96-262, 94-1, 91-213, 96-263, “An Analysis of the Effects of Exchange Access Reform on Demand Stimulation” (with Charles Zarkadas), 27 April 1997.

RECENT CONSULTING ENGAGEMENTS

Consulting work on behalf of a major electricity distribution company in the U.S.: cost study and competitive pricing principles of advanced metering services, 2018.

Consulting work on behalf of a Canadian electricity provider: benchmarking analysis of generation utilities in transmission and regulatory practices with respect to generation procurement practices, distributed energy resources and customer-specific pricing practices, 2018.

Consulting work on behalf of a U.S. generation and transmission electricity cooperative: embedded and marginal cost of service studies to support rate reform initiative, 2018.

Consulting work on behalf of a major electricity distribution provider in the U.S.: develop a locational distribution marginal cost-based cost of service study to support the value of distributed energy resource proceedings, 2017 - 2018.

Consulting report on behalf of major foreign electricity and gas distribution company: Rules and regulations applicable to the competitive U.S. retail electricity providers in the U.S. and Canada: A regulatory assessment, November 2017.

Consulting report on behalf of major foreign electricity and gas distribution company: Rules and regulations applicable to the competitive U.S. retail natural gas providers in the U.S. and Canada: A regulatory assessment, November 2017.

Consulting work on behalf of the Cities of Garland, Mesquite, Plano, and Richardson appealing the decision by North Texas Municipal Water District affecting wholesale water rates, Texas PUC Docket No. 46662 and SOAH Docket No. 473-17-4964.WS: economic analysis of whether wholesale water rate charged by the District adversely affects the public interest and rate design issues, 2017 – 2018.

AGUSTIN J. ROS

Consulting work on behalf of a major electricity distribution company in the U.S.: cost study and competitive pricing principles of advanced metering services, 2015 - 2016.

Consulting report for the Mexican National Center for the Control of Natural Gas: Electricity demand forecast for the National Mexican Electricity System for the period 2017-2030. December 2016. With Veronica Irastorza and Elvira Creel.

Consulting report for the Mexican Secretariat of Communications and Transport: “Econometric demand study of fixed and mobile broadband and telephony services and Pay-TV services using discrete choice analysis.” January 2016. With Kenneth Train and Douglas Umaña.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: recommended number of CFE gencos. September 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: Recommended optimal portfolio mix for the CFE gencos. September 2015. With Hamish Fraser and Willis Geffert.

Consulting report for the Mexican Secretariat of Energy, CFE horizontal generation split analysis: Identification of relevant markets within the Mexican wholesale electricity markets. August 2015. With Hamish Fraser and Willis Geffert.

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