

From:

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To:

Greg Lang

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August 30, 2018

**Re: Market Study Notice: Competition in Broadband Services**

Dear Mr. Lang,

I welcome the opportunity to submit these comments regarding the proposed Study to “better understand the competitive dynamics of Canada’s broadband internet services industry”.

I am a competition policy and telecommunications strategy expert with research interests in expanding broadband infrastructure, assessing the quality of broadband networks, and improving rural connectivity. I have also worked with all three levels of government and consumer advocacy groups on broadband affordability and infrastructure policy development. I therefore have some appreciation of the evolution of regulatory and market conditions underlying the Bureau’s concern that the “high prices in the broadband sector can have negative spill-over effects into a wide range of economic activity”.

This submission is based on my research program with colleagues at the Communication Technologies in the Information Society Research Group, Ted Rogers School of Information Technology Management, Ryerson University. The research upon which this submission is based has been funded by the Social Sciences and Humanities Research Council, the Canada Research Chairs program, the GRAND NCE and by Ryerson University. The submission includes 6 attachments, consisting of research articles that have been previously published in peer-reviewed academic journals on topics relating to questions posed in the Notice.

I am providing these comments as an individual, not as a representative of any organization with which I am affiliated. Thank you for considering my submission. Please do not hesitate to contact me if I can be of any assistance with the design and implementation of the Study.

Respectfully,

Dr. Reza Rajabiun

Regarding

## **Market Study Notice: Competition in Broadband Services**

Comments by Dr. Reza Rajabiun

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Rajabiun, R., & Middleton, C. (2017). Regulatory Federalism and Broadband Divergence: Implications of Invoking Europe in the Making of Canadian Telecom Policy. *Intereconomics*, 52(4), 217-225.

Rajabiun, R., & Middleton, C. (2015). Regulation, investment and efficiency in the transition to next generation broadband networks: Evidence from the European Union. *Telematics and Informatics*, 32(2), 230-244.

Rajabiun, R., & Middleton, C. (2015). Public Interest in the Regulation of Competition: Evidence from Wholesale Internet Access Consultations in Canada. *Journal of Information Policy*, 5, 32-66.

Rajabiun, R., & Middleton, C. (2015). Lemons on the Edge of the Internet: The Importance of Transparency for Broadband Network Quality. *Communications & Strategies*, (98).

Rajabiun, R., & Middleton, C. (2013). Multilevel governance and broadband infrastructure development: Evidence from Canada. *Telecommunications Policy*, 37(9), 702-714.

## I. Overview and Responses

1. **Legacy policy assumptions and Canada’s comparative decline as a broadband leader:** In the late 1990s and early 2000s Canada was recognized as a leader among advanced economies in deploying high-speed “broadband” networks (as opposed to dial-up connectivity), with comparatively high penetration rates for broadband services delivered on legacy copper telephone and cable TV networks.<sup>1</sup> Early successes with “infrastructure competition” continue to cast a long shadow on the structure of the industry and regulatory policies in Canada.<sup>2</sup> Since at least the mid 2000s however, federal policymakers have started to recognize signs of Canada’s comparative decline as a broadband leader and limited incentives to deploy ultra-high capacity (“next generation”) fiber access networks.<sup>3</sup> Purportedly in response to these concerns, the previous government’s 2006 Policy Direction directed the Canadian Radio-Television and Telecommunication Commission (CRTC) to implement competitively and technologically neutral regulations that rely on market forces to the maximum extent possible to promote the development of Canada’s telecommunications infrastructure.<sup>4</sup> The Notice for this Market Study appears to share key presumptions with the 2006 Policy Direction in characterizing regulation as a substitute, rather than a potential complement, to market forces and private sector investment/innovation. Canadian and international evidence on the development of broadband infrastructure provides little empirical support for the hypothesis that wholesale regulations necessarily counteract “market forces”, instead suggesting that incentive compatible regulations can actually promote capacity enhancement incentives and stimulate technological change from hard to scale legacy copper to ultra-high capacity fiber (and hybrid fiber/wireless) access networks.<sup>5</sup>

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<sup>1</sup> See e.g. Frieden, R. (2005). Lessons from broadband development in Canada, Japan, Korea and the United States. *Telecommunications Policy*, 29(8), 595-613. OECD Broadband Portal for historical data on broadband penetration. Available at: <http://www.oecd.org/sti/broadband/oecdbroadbandportal.htm> (Table 1.5).

<sup>2</sup> Rajabiun, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50. Available at: <https://www.sciencedirect.com/science/article/pii/S0308596117301143>

<sup>3</sup> See e.g. Telecommunications Policy Review Panel (2006). Final Report. Government of Canada. Retrieved from [http://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/tprp-final-report-2006.pdf/\\$FILE/tprp-final-report-2006.pdf](http://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/tprp-final-report-2006.pdf/$FILE/tprp-final-report-2006.pdf)

<sup>4</sup> Order Issuing a Direction to the CRTC on Implementing the Canadian Telecommunications Policy Objectives, P.C. 2006-1534, 14 December 2006.

<sup>5</sup> Rajabiun, R., & Middleton, C. (2015). Regulation, investment and efficiency in the transition to next generation broadband networks: Evidence from the European Union. *Telematics and Informatics*, 32(2), 230-244.

[https://www1.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/DGTP-002-2015-RajabiunMiddleton-Attachment3.pdf/\\$FILE/DGTP-002-2015-RajabiunMiddleton-Attachment3.pdf](https://www1.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/DGTP-002-2015-RajabiunMiddleton-Attachment3.pdf/$FILE/DGTP-002-2015-RajabiunMiddleton-Attachment3.pdf)

Rajabiun, R., & Middleton, C. (2017). Regulatory Federalism and Broadband Divergence: Implications of Invoking Europe in the Making of Canadian Telecom Policy. *Intereconomics*, 52(4), 217-225. [https://www.ceps.eu/system/files/IEForum42017\\_5.pdf](https://www.ceps.eu/system/files/IEForum42017_5.pdf)

2. **Network economics:** Due to the fixed costs of network deployment and positive demand side network externalities, well-designed public regulations that encourage risk and infrastructure sharing have the potential to enhance efficient investment incentives into next generation technologies and support their widespread diffusion in the future. In addition to countering the potential for “underinvestment” in new technologies, cooperation failures inherent in “infrastructure competition” can lead to inefficient duplication and “overinvestment” in old technologies (i.e. “sweating the copper” strategies). In the short term capital expenditures to upgrade legacy platforms may seem justified from an accounting cost minimization perspective in terms of improved headline speeds (i.e. “up to” x Mbps), but in the medium to long term capital expenditures on old technologies will have to be stranded as legacy copper degrades, decommissioned, and replaced with fiber. Private and public interest objectives can therefore vary and sub-optimal market equilibriums can persist without smart public interventions.<sup>6</sup> Sector specific factors accentuate traditional concerns documented in economic history and emphasized in theory regarding the rational incentives of firms with market power to degrade quality of their basic product/service offerings in order to extract higher prices from consumers with lower willingness/ability to pay.<sup>7</sup> The potential for “smart pricing” to have a negative impact on quality adjusted prices for basic Internet access services is particularly relevant to consider in assessing dynamics of competition in the “two-tiered” Internet, consisting of a best effort basic service access path to the open Internet and prioritized/sponsored “fast lanes” on the same capacity constrained physical infrastructure.<sup>8</sup>
  
3. **Policy assumptions and regulatory constraints:** Previous research documents that strategic choices of large network providers that dominate Canada’s regions, as well as provincial and local policies, have played a part in shaping variations in broadband infrastructure development within Canada.<sup>9</sup> Although not entirely too blame, flawed presumptions in the 2006 Policy Direction about the nature of the broadband market, followed by subsequent reluctance of the CRTC to adopt a robust regulatory strategy that promotes service-based competition and efficient investment into new technologies, partly explain growing concerns about affordability

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<sup>6</sup> Nevo, A., Turner, J. L., & Williams, J. W. (2016). Usage-Based Pricing and Demand for Residential Broadband. *Econometrica*, 84(2), 411-443.

<sup>7</sup> See e.g. Besanko, D., Donnenfeld, S., & White, L. J. (1987). Monopoly and quality distortion: effects and remedies. *The Quarterly Journal of Economics*, 102(4), 743-767.

<sup>8</sup> ; Brennan, T. (2011) Net Neutrality or Minimum Quality Standards: Network Effects vs. Market Power Justifications. In *Network Neutrality and Open Access* (pp. 61-80). Nomos Verlagsgesellschaft mbH & Co. KG. <https://papers.ssrn.com/abstract=1622226> ; Brennan, T. (2017). The post-internet order broadband sector: Lessons from the pre-open internet order experience. *Review of Industrial Organization*, 50(4), 469-486.

<sup>9</sup> Rajabiun, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50. Rajabiun, R., & Middleton, C. (2013). Multilevel governance and broadband infrastructure development: Evidence from Canada. *Telecommunications Policy*, 37(9), 702-714. <https://www.sciencedirect.com/science/article/pii/S0308596113000724>

and quality of Internet access services in Canada.<sup>10</sup> The 2006 Policy Direction has substantially constrained the range of policy design strategies the CRTC has been willing to consider in the past decade with respect to both fixed and mobile Internet access. If the federal government is committed to countering the “high prices” and mitigating the “negative spillovers” motivating this Study by the Competition Bureau, an updated Policy Direction to the CRTC that stipulates increased regulatory emphasis on affordability, quality, and universality of access is likely to be required.<sup>11</sup>

4. **Wholesale regulation and (lack of) service-based competition (Question 8 (a)):** In CRTC Telecom Decision 2008-17 the Commission interpreted the 2006 Policy Direction to extend wholesale access obligations to operators of cable broadband networks, but determined that to promote investment in next generation fibre access and transport facilities it would be better to forbear from obliging providers to offer third parties wholesale access to such facilities (e.g. service-based competitors/resellers, municipalities). Ignoring calls from rural and remote communities about their lack of access to affordable wholesale transport facilities, this aspect of the federal regulatory regime remains as a key barrier to entry for non-incumbents and/or public sector organization trying to improve quality and affordability of broadband access in their communities.<sup>12</sup> Importantly, the decision by the CRTC in 2008-17 not to adopt wholesale access obligations on fiber transport and access facilities was combined with its continued reliance on the so-called Phase II approach to determining regulated wholesale access prices of third party access to legacy copper-based services. Compared to other possible approaches to wholesale pricing (e.g. Equivalence of Inputs (EoI), retail-minus, etc), CRTC’s Phase II costing is relatively complex and non-transparent. Moreover, Phase II costing (plus up to 40% markup) can generate wholesale prices that can at times be higher than retail offers by the incumbents. For this reason, Phase II costing is particularly popular with incumbent operators and institutional investors in “the big three” who are accustomed to super-normal dividends they generate by mitigating the

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<sup>10</sup> Rajabiun, R., Ellis, D. and Middleton, C. (2016). Literature Review: Affordability of Communication Services. Prepared for the Canadian Radio-television and Telecommunications Commission (CRTC). Available at: <http://www.broadbandresearch.ca/ourresearch/lit-review-for-crtc-2016-affordability-rajabiun-ellis-middleton.pdf>

<sup>11</sup> Note that statutory objectives of the CRTC under Section 7 (b) of the *Telecommunications Act* already specify these objectives, but they have been subservient to the objective of promoting “infrastructure competition” and investment for a long time.

<sup>12</sup> While affordability and service quality problems are not just a rural problem and also exist in lower income/older urban/suburban neighbourhoods, for discussions of the design of the federal regulatory policy framework relating to challenges facing rural communities in Ontario see e.g. Submissions by the Government of Ontario, Eastern Ontario Wardens’ Caucus/Eastern Ontario Regional Network, and South Western Integrated Fiber Technology (SWIFT) respectively at:  
<https://services.crtc.gc.ca/pub/ListeInterventionList/Documents.aspx?ID=240852&en=2017-112&dt=i&lang=e&S=C&PA=t&PT=nc&PST=a>  
<https://services.crtc.gc.ca/pub/ListeInterventionList/Documents.aspx?ID=223915&en=2015-134&dt=f&lang=e&S=C&PA=t&PT=nc&PST=a>  
<https://services.crtc.gc.ca/pub/ListeInterventionList/Documents.aspx?ID=240760&en=2017-112&dt=i&lang=e&S=C&PA=t&PT=nc&PST=a>

threat of entry and rent skimming by third party resellers.<sup>13</sup> The relatively high regulated wholesale prices generated by the Phase II costing approach has been conducive to promoting incentives of Canada's DSL and cable broadband providers to invest in upgrading their legacy networks, but has evidently not been very hospitable to the development of over-the-top (OTT) service-based competition. In addition to Phase II based wholesale rates, the CRTC has proved reluctant to require infrastructure providers to offer third parties Layer 2 (only Layer 3) control over their customers' traffic, which limits the ability of service-based competitors to control the quality of services they deliver and to offer innovative services in order to differentiate themselves from the incumbents.<sup>14</sup>

5. Answers to Bureau's question under Section 8 (a) of this Notice regarding the limited ability of resellers to offer "competitively effective service offers" can largely be found in CRTC's decisions in the past to retain Phase II costing and not to require Layer 2 control in enabling third party access.<sup>15</sup> Lack of wholesale access obligations to fiber transport facilities (including dark fiber Indefeasible Right of Use (IRU) contracts) accentuates barriers to both infrastructure and service-based competition, particularly in rural and remote communities where access to affordable high-capacity transport facilities is scarce/controlled by the local incumbents.<sup>16</sup> Although resellers may have a marginal influence in enabling access to lower cost services in some urban markets, there is little evidence to suggest their presence has posed, or has the potential to pose, any material pricing discipline on dominant providers.
6. **Emerging retail price/quality regulations:** While this Study focuses on the "high price" of fixed broadband access, it is relevant to note that over the past few years the CRTC has faced a

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<sup>13</sup> See e.g. RBC Capital Markets. Telecom Scenario Report (2015). Available at: <https://openmedia.org/sites/default/files/rbcfttpreport2015.pdf>

<sup>14</sup> For an assessment of challenges to the emergence of service based competition in Canada that helps predict market conditions that have evolved over the past decade see Van Gorp, A. F., & Middleton, C. A. (2010). The impact of facilities and service-based competition on internet services provision in the Canadian broadband market. *Telematics and informatics*, 27(3), 217-230. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0736585309000811> ; For continued concerns about these elements of CRTC's new disaggregated wholesale access framework see New wholesale broadband access rules imposed in Ontario, Quebec. *Telegeography*. 21 Sept. 2016. Available at: <https://www.telegeography.com/products/commsupdate/articles/2016/09/21/new-wholesale-broadband-access-rules-imposed-in-ontario-quebec/>

<sup>15</sup> Due to regulated prices that make it unprofitable to resell Internet access services, some of the remaining resellers rely on special off "off-tariff" rates from incumbents. Resellers without access to these special offers are typically left with little option but to adopt relatively high oversubscription ratios to manage expensive wholesale capacity they can afford to provision. This wholesale pricing model ultimately reduces service quality levels of resellers can deliver relative to incumbents.

<sup>16</sup> See e.g. Submissions from the Southwestern Integrated Fiber Technology (SWIFT) to CRTC regarding the design of CRTC's new broadband subsidy mechanism: <https://services.crtc.gc.ca/pub/ListeInterventionList/Documents.aspx?ID=240760&en=2017-112&dt=i&lang=e&S=C&PA=t&PT=nc&PST=a>

multitude of calls for the adoption of mandated basic Internet service packages involving some sort of price ceiling/minimum quality standard in response to growing concerns about affordability of Internet access on both fixed and mobile markets. Although the CRTC has so far rejected these calls for retail price regulation on the fixed side, it is currently contemplating the adoption price regulated basic service packages on the mobile front; a policy strategy the Competition Bureau apparently supports.<sup>17</sup> Given the failures of wholesale access obligation to promote service-based competition and pricing discipline on the fixed side, moving towards retail price regulation may also emerge as a viable “second best” solution for counteracting “negative spillovers” from “high prices” motivating this Study. Furthermore, the CRTC has recently specified minimum service quality standards of universal access in terms of latency that it expects service providers to deliver.<sup>18</sup> Demand for maximum price/minimum service quality regulations in the private provision of access should not be surprising given that access to multipurpose broadband networks now represents an indispensable/essential input into the daily lives of the vast majority of people. This is precisely what happened with the development of copper-based telephone networks a century ago. Unless there are meaningful policy reforms at the wholesale level (e.g. mandated structural separation/Equivalence of Inputs (EoI) wholesale pricing; Layer 2 versus 3 control, etc.) that effectively promote pricing discipline among duopolies of incumbents that dominate local markets, demand for retail price/quality regulation is likely to become more pronounced. Given the near daily news in national and local media about misleading advertisements and abusive contractual practices targeting vulnerable consumers, increased focus on the regulation of non-price terms of standard-form retail broadband contracts may also be in the horizon.<sup>19</sup>

7. **Wholesale access regulation and investment incentives (Question 8 (c)):** The Notice asks about how network investment levels have changed as a result of the CRTC regulations aimed at enabling resellers to offer competitive services. The Canadian experience suggests wholesale access obligations under the CRTC 2008-17 regime on legacy copper networks have actually supported incentives of incumbents to invest in them. At the same time, regulatory forbearance from imposing wholesale access obligation on next generation fiber access technologies did not succeed in achieving its intended objective of incentivising their diffusion.<sup>20</sup> In the years that passed the CRTC 2008-17 decision, stated commitments of incumbent operators of legacy copper telephone/DSL networks at the time to accelerate fiber deployment did not materialize;

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<sup>17</sup> <https://www.canada.ca/en/competition-bureau/news/2018/06/competition-bureau-supports-increased-choice-in-the-canadian-wireless-industry.html>

<sup>18</sup> Telecom Decision CRTC 2018-241. Available at: <https://crtc.gc.ca/eng/archive/2018/2018-241.htm>

<sup>19</sup> See e.g. <https://www.cbc.ca/news/politics/crtc-telecom-sales-practices-investigation-1.4706260> ; <https://crtc.gc.ca/eng/phone/telsp.htm>

<sup>20</sup> Rajabiun, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50.  
Rajabiun, R., & Middleton, C. (2017). Regulatory Federalism and Broadband Divergence: Implications of Invoking Europe in the Making of Canadian Telecom Policy. *Intereconomics*, 52(4), 217-225.

even in Canada's relatively low cost/high revenue urban centres. With the notable exception of Atlantic Canada (where Bell Aliant determined it is more efficient to to deploy fiber-to-the-premises (FTTP) networks rather than upgrading century old copper), the vast majority of users in the rest of Canada's urban and rural areas continue to have little option but to rely on legacy copper last mile networks for their connectivity. By 2015 FTTP penetration rates in Canada remained below 5%, (which was about half of the U.S. and a third of average for OECD countries at the time).<sup>21</sup> At least in part, the decision by in CRTC 2015-326 to reverse course and adopt a technologically neutral approach to wholesale access regulation that includes both legacy copper and next generation fiber technologies should be viewed in the context of the failure of CRTC's 2008-17 forbearance strategy to achieve its objective of enhancing the efficiency of telecom capital expenditures (i.e. from old to new technologies).

8. **Policy signals and fiber investment incentives:** Despite threats by some large incumbent copper/DSL network providers that mandated wholesale to fiber access networks would lead them to reduce their investments, in the aftermath of the CRTC 2015-326 decision the “big three” announced new plans to finally start large scale FTTP deployments in some of Canada's large cities such as Toronto and Vancouver.<sup>22</sup> Notably, in the subsequent appeal of the CRTC decision to the Cabinet, various large cable based broadband providers actually changed their positions from earlier and became supporters of extending wholesale access to all technologies.<sup>23</sup> Comparable international data suggests that having stagnated at below 5% for a number of years, Canada's FTTP penetration rates have actually experienced significant growth since 2015 and reached just over 12% of the total subscriptions by end of 2017.<sup>24</sup> It is not clear if this trend is sustainable and Canada is still far away from near 80% FTTP penetration rates in some leading countries in Europe and East Asia, but existing evidence suggests there is a positive relationship between wholesale access regulation and FTTP investment incentives.
9. **Under versus over-investment:** In addition to the ineffectiveness of regulatory forbearance in fostering fiber diffusion under the 2008-17 regime, the Canadian experience is particularly instructive in understanding the potential for “overinvestment” in old technologies and inefficient duplication in the presence of “infrastructure competition” and ineffective wholesale

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<sup>21</sup> Rajabiun, R. & Middleton, C. (2015) Comments re Gazette Notice DGTP-002-2015. Petition to the Governor in Council concerning Telecom Regulatory Policy CRTC 2015-326. Available at: [http://www.broadbandresearch.ca/ourresearch/Rajabiun\\_Middleton\\_GiC2015.pdf](http://www.broadbandresearch.ca/ourresearch/Rajabiun_Middleton_GiC2015.pdf)

<sup>22</sup> Gigabit Fibe internet service launched in Ontario, Quebec, CBC News, August 5 2015. Available at: <http://www.cbc.ca/news/technology/bell-gigabit-fibe-internet-service-launched-in-ontario-quebec-1.3187499>  
Telus boosts Vancouver's internet network with \$1B upgrade, CBC News, Oct 2, 2015. Available at: <http://www.cbc.ca/news/canada/british-columbia/telus-upgrade-vancouver-1.3254403>

<sup>23</sup> Rajabiun, R., & Middleton, C. (2015). Public Interest in the Regulation of Competition: Evidence from Wholesale Internet Access Consultations in Canada. *Journal of Information Policy*, 5, 32-66.  
<https://www.jstor.org/stable/10.5325/jinfopoli.5.2015.0032>

<sup>24</sup> See OECD Broadband Portal. Table 1.10. Percentage of fiber connections in total broadband.  
<http://www.oecd.org/sti/broadband/broadband-statistics/>

access regulations.<sup>25</sup> Private sector capital expenditures levels on fixed telecommunications network assets in Canada have been consistently higher than most other advanced economies (including the U.S., which shares a broadly similar duopolistic market structure equally shared between DSL and cable, but there are few wholesale access/essential facilities regulatory obligation on incumbents).<sup>26</sup> Despite the fact that CRTC has had wholesale access obligations on both DSL and cable network infrastructure operators under CRTC 2008-17, incumbent operators in Canada have invested relatively more in upgrading the capacity of their legacy networks in response to growing user demand than their counterparts in many other advanced economies. The combination of wholesale access obligations and relatively high capital expenditures levels on fixed network assets in Canada contradicts the theoretical hypothesis that wholesale access regulations necessarily lead to “underinvestment”.<sup>27</sup> If the regulated wholesale price is too low, reduced incumbent infrastructure investments would be an obvious possibility to consider and monitor. Instead, the Canadian experience suggests poorly designed wholesale access regulations can actually lead to both “overinvestment” in old technologies and “underinvestment” in new ones (i.e. both false positives/negatives; Type I vs II errors).

10. **Policy optimization:** To optimize investment incentives in the Canadian market (balance Type I and II errors), during the proceeding that led to Telecom Regulatory Policy CRTC 2015-326, my colleagues and I recommended replicating a version of the wholesales access pricing strategy implemented in Japan in the early 2000s to stimulate decommissioning of copper and investments in advanced fiber access networks.<sup>28</sup> The type of wholesale regulatory strategy that Japan adopted in the early 2000s induced a substantive gap between wholesale price of access via slower/legacy copper versus faster/next generation fiber networks, disincentivizing investments in the latter and enhancing them in the former.<sup>29</sup> The CRTC has started to move in this direction to some extent under by cutting wholesale rates on legacy-based services, a move that led to an immediate outcry from institutional investors in the incumbents accustomed to high

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<sup>25</sup> Rajabiun, R., & Middleton, C. (2015). Regulation, investment and efficiency in the transition to next generation broadband networks: Evidence from the European Union. *Telematics and Informatics*, 32(2), 230-244.  
Rajabiun, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50.

<sup>26</sup> Rajabiun, R., & Middleton, C. (2017). Regulatory Federalism and Broadband Divergence: Implications of Invoking Europe in the Making of Canadian Telecom Policy. *Intereconomics*, 52(4), 217-225. Available at: <https://www.ceps.eu/content/european-digital-single-market>

<sup>27</sup> Rajabiun, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50.

<sup>28</sup> See submissions by Rajabiun, R. and Middleton, C. to CRTC 2013-551 proceeding. Available at: <https://services.crtc.gc.ca/pub/ListeInterventionList/Documents.aspx?ID=212300&en=2013-551&dt=i&lang=e&S=C&PA=t&PT=nc&PST=a>

<sup>29</sup> Minamihashi, N. (2012). Natural Monopoly and Distorted Competition: Evidence from Unbundling Fiber-Optic Networks. Bank of Canada Working Paper. Available at: <https://www.banqueducanada.ca/wp-content/uploads/2012/08/wp2012-26.pdf>

dividends enabled by their “sweating the copper” strategies.<sup>30</sup> In terms of access to faster fiber networks, the CRTC still has not finalized configurations and wholesale prices. However, having signalled that it will keep Phase II costing plus 40%+ markups for third party access to FTTP, the CRTC appears to have mitigated fears by institutional investors that the wholesale regime will promote any form of sustained/material competition and/or force the incumbents to sell third parties wholesale access without an attractive rate of return.<sup>31</sup> In theory, by varying wholesale markup rates across basic service/very-high speed services the CRTC has some power to enhance service-based competition and efficient investment simultaneously. In practice, past experience, Phase II costing, and lack of Layer 2 control over customer traffic will restrict the scope the emergence of substantive OTT/service-based competition on both legacy and next generation platforms. Given these institutional constraints on wholesale regulation, retail market regulation in the form of basic service packages with price ceilings and capacity/quality floors may emerge as the only option left for counteracting concerns about “high prices” of Internet access services in the Canadian market.

11. **Implementation challenges/opportunities:** Beside extending essential facilities obligations to non-duplicable fiber access networks of the future, in CRTC 2015-326 the telecom agency determined that a shift to a “disaggregated” approach to connecting third parties to incumbent facilities would be appropriate. Following the flawed logic that regulatory forbearance promotes investment incentives, the CRTC did not however impose wholesale access obligations on high capacity fiber transport facilities that a reseller/service-based competitor would need to aggregate traffic from its customers across geographically dispersed communities into the network. The underlying logic and wisdom of the CRTC’s approach remain unclear. Regardless of its motives, three years after the decision the level of “disaggregation”, configurations for interconnection with incumbent facilities, and pricing under the new regime remain the subject of a series of follow-up proceedings at the CRTC. In addition to creating some concern about the capacity of the CRTC as a regulatory agency to implement its own decisions in an effective manner, challenges to the implementation of the new regime create considerable doubt about the capacity of the new disaggregated wholesale regime to promote service-based competition; particularly outside of urban cores where competitive middle mile/transport options may be available to resellers. At the same time, implementation challenges also create opportunities for adjusting elements of the wholesale regime in order to balance competing policy objectives (e.g. changing the wholesale pricing model to EoI, Layer 2 versus 3 control, virtual versus disaggregated wholesale access).<sup>32</sup> Given continued constraints posed by the 2006 Policy Direction, taking

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<sup>30</sup> See e.g. CRTC’s move to slash wholesale rates could hurt revenue, network investment. Financial Post. October 2016. <https://business.financialpost.com/technology/crtcs-move-to-slash-wholesale-rates-could-hurt-revenue-network-investment-analysts>

<sup>31</sup> See e.g. RBC Capital Markets. Telecom Scenario Report (2015). Available at: <https://openmedia.org/sites/default/files/rbcfttpreport2015.pdf>

<sup>32</sup> Kerpez, K., & Ginis, G. (2014, March). Software-defined access network (SDAN). In *Information Sciences and Systems (CISS), 2014 48th Annual Conference on* (pp. 1-6). IEEE. Available at: [https://www.researchgate.net/profile/George\\_Ginis/publication/265645718\\_Software-Defined\\_Access\\_Networks/links/577ef3ff08ae01f736e178eb.pdf](https://www.researchgate.net/profile/George_Ginis/publication/265645718_Software-Defined_Access_Networks/links/577ef3ff08ae01f736e178eb.pdf)

advantage of these opportunities may require a new Policy Direction to the CRTC that prioritizes concerns about “high cost” and “negative spillovers” motivating this Competition Bureau Study. Political commitment to addressing these concerns will be critical to the success of both agencies in tackling this file, either as substitutes or complements.

12. **Consumer behavior:** Question 8 (b) asks about consumers’ reactions to competitive alternatives to incumbents. From an economic perspective, the failure of the resellers to expand their market shares in a sustainable manner beyond 10-15% in the retail residential market reflects the revealed preferences of consumers for the incumbent branded services. A key insight from the long term development of the broadband industry is that in the early stages of the development of high-speed connectivity in the late 1990s/early 2000s, Internet service providers had relatively strong incentives to price discriminate to expand market share (i.e. low cost/basic service packages). This enabled those with lower incomes/willingness to pay to join the information society and gain from all the economic advantages it offers. However, as Internet access services have evolved from a luxury to a necessity, consumer demand has become increasingly less elastic to price growth in mature markets such as Canada where broadband penetration is reaching a maximum threshold. Lower cost service plans that were available in the market from incumbents a few years ago to help them expand market share have essentially disappeared from the Canadian market.<sup>33</sup> Price insensitivity of demand enables dominant providers to increase prices of basic service packages in a sustainable manner with little risk of reduced revenue and makes it easier to sustain substantive price growth, sometimes in a lockstep fashion with the other large incumbents.<sup>34</sup> Why consumers do not switch to resellers that may be advertising lower prices than the incumbents should similarly be viewed in the context of the growing essentiality of Internet access to people’s daily lives. Importance of high speed and reliable connectivity to families and businesses makes risk averse consumers conscious of procuring their Internet access from various competitive resellers versus well-established brands of large incumbents at a premium. Extensive investments in advertising and public relations by dominant Internet access providers is driven precisely by the critical importance of perceived trust in maintaining their structural dominance. Even if Canada develops a wholesale regime with the potential to promote service-based competition (e.g. with EoI pricing, Layer 2 control), the ability of smaller competitors to compete with incumbents in the mass residential and business markets will require significant investment in brand and reputation building. It would be incorrect to associate the limited success of Canada’s wholesale access regime/resellers with a lack of awareness by consumers about potential competitive options as their advertisements are plentiful in both old and new media. With risk aversion, perceived trust in the ability of the reseller to deliver services of sufficient reliability compared to the incumbents further restricts

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<sup>33</sup> Rajabiun, R., Ellis, D. and Middleton, C. (2016). Literature Review: Affordability of Communication Services. Prepared for the Canadian Radio-television and Telecommunications Commission (CRTC). Available at: <http://www.broadbandresearch.ca/ourresearch/lit-review-for-crtc-2016-affordability-rajabiun-ellis-middleton.pdf>

<sup>34</sup> See e.g. CBC News. Big telcos set to hit many Canadians with internet price hikes. March 2018. Available at: <https://www.cbc.ca/news/business/internet-bell-rogers-telus-price-hike-1.4564644>

the feasibility of service-based competition, even with an optimally designed wholesale access policy strategy.

13. **Imperfect contracting and dynamic efficiency:** Question 8 (b, iii) asks about industry contractual practices and their impact on consumer behavior. In broad terms, retail broadband contracts are offered on a “best effort”/”up to x Mbps” basis, without any warranties of minimum speed/service quality levels by the seller to the subscriber. In the transition of broadband from a luxury to a necessity over the past two decades, “best effort” retail contracts (i.e. “up to” x Mbps in speed, subject to varying network conditions) have provided Internet service providers with significant flexibility in managing capacity in response to growing consumer demand for network resources. From the perspective of consumers, these “best effort” services remain “good enough” when using first generation Internet applications such as email and simple web-browsing. Over time however, a wide variety of advanced Internet applications have emerged that require better than best effort service standards for reliable use (i.e. minimum effective bandwidth/speed, symmetry, Quality of Service (QoS) guarantees). Service Level Agreements (SLAs) that commit the ISPs to delivering some minimum service performance guarantee may be feasible to obtain by some large organizations and/or in particular local markets (e.g. on FTTP). However, in the residential and small/medium size business retail markets “best effort” contracts that emerged to support first stages of Internet infrastructure development in the 1990s remain as the basic standard contractual formulation governing the obligations of the sellers to their subscribers. From the perspective of subscribers/buyers, less than expected actual speeds/service quality levels represent the primary source of contractual friction with service providers.<sup>35</sup> This contractual imperfection creates some scope for ISPs with lower speed/quality services to adopt business strategies that advertise attractive “up to x Mbps” speed services compared to their higher quality/speed competitors, but then under-provision/underinvest in capacity needed to meet the subscribers’ expectations. Imperfect contracting has both static (rent extraction from consumer by service provider overpromising/underdelivering) and dynamic efficiency implications (by reducing ex ante incentives of higher quality suppliers to invest in capacity and new technologies because ex post they expect the “noise” from lower quality supplier will make it challenging to signal the superiority of their services to potential subscribers).<sup>36</sup> From an economic perspective, the fact that incomplete “best effort” broadband contracts allocate the risks of under-provisioning to unsuspecting users (party with little capacity to impact network provisioning decisions of sellers) undermines capacity investment incentives of suppliers (the party with legal authority and technical capacity to provision sufficient capacity). Furthermore, economic theory suggests that the type of information asymmetries

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<sup>35</sup> Rajabiun, R. & Scurato, C. (2018) When Best Effort is Not Good Enough: Incomplete Contracting, Risk Allocation, and Demand for Consumer Protection in the Market for Broadband Access Services. Research Conference on Communications, Information and Internet Policy, TPRC46, American University Washington College of Law, Washington DC. Available at: <https://ssrn.com/abstract=3142048>

<sup>36</sup> Rajabiun, R., & Middleton, C. (2015). Lemons on the Edge of the Internet: The Importance of Transparency for Broadband Network Quality. *Communications & Strategies*, (98). Available at: <https://ideas.repec.org/a/idt/journal/cs9805.html>

around imperfect standard form retail contracts that are the norm in the broadband market tend to be robust to the presence of competition and can enable sustainable rent extraction.<sup>37</sup>

14. **Minimum service quality standards and universal access:** In a hypothetical world with binding/verifiable SLAs/performance guarantees, it is possible to imagine market forces aligning buyers' expectation of service quality ex post and ex ante capacity investment/provisioning incentives of suppliers. This "first best" solution is technologically feasible today with advanced network control technologies that enable fine grained service quality and price differentiation. Minimum quality of service standards represents a viable "second best" option for reducing the incentives of some Internet infrastructure providers to exploit imperfections in the "best effort" retail contract by investing too little in basic service capacity/quality they deliver to their customers. Implementation of verifiable minimum service quality standards is particularly important for high cost/low income areas where private sector incentives to compete on quality and deploy next generation fiber/hybrid fiber/mobile broadband technologies is relatively limited. Ongoing efforts by the CRTC to implement minimum quality of service standards should be viewed in the context of the broader imperfect contracting problem in the provision of broadband access services and under-provisioning incentives it can create in some suppliers.<sup>38</sup>
15. **International perspectives (Question 8 (d)):** The Notice asks about the experience in other countries. International evidence suggests that countries with higher penetration of over-the-top (OTT) service-based competitors might have relatively lower aggregate capital expenditures levels, but tend to have higher speed networks and fiber penetration rates.<sup>39</sup> As a result, policymakers around the world are increasingly recognizing that higher investment inputs do not necessarily translate into better market outcomes (e.g. accelerated fiber/advanced mobile deployment rates, higher effective speeds, lower prices). A recent report commissioned by the European Parliament succinctly summarizes the implication of the international evidence in this area:

*“With all things considered, the level of capital expenditures is only one determinant of long term broadband market outcomes. The relevant point here is whether or not operators are able to translate their capital expenditures into real improvements in the quality of the network. For instance, market power of incumbents can lead to higher investments on lower quality established technologies and the upgrade of current technologies has a substantial replacement effect ..... , while the lack of rights of access*

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<sup>37</sup> See e.g. Tirole, J. (2009). Cognition and incomplete contracts. *American Economic Review*, 99(1), 265-94. Available at: <http://econ.lse.ac.uk/staff/lfelli/teach/Tirole%20AER%202009.pdf>

<sup>38</sup> Telecom Decision CRTC 2018-241. Available at: <https://crtc.gc.ca/eng/archive/2018/2018-241.htm>

<sup>39</sup> Rajabiun, R., & Middleton, C. (2017). Regulatory Federalism and Broadband Divergence: Implications of Invoking Europe in the Making of Canadian Telecom Policy. *Intereconomics*, 52(4), 217-225. Rajabiun, R., & Middleton, C. (2015). Regulation, investment and efficiency in the transition to next generation broadband networks: Evidence from the European Union. *Telematics and Informatics*, 32(2), 230-244.

*or entrants to existing facilities can lead to inefficient duplication of existing infrastructures.”<sup>40</sup>*

16. **Horizontal integration and retail price/quality regulation:** A key Canadian and international lesson is that the existence of wholesale access regulations may not be sufficient to promote over-the-top (OTT)/service-based competition as scale economies in the marketing and managements of broadband networks are extensive. Questions of trusting new competitive brands versus well-established incumbents by consumers accentuate barriers to the emergence of service-based competition. Infrastructure sharing, rather than “infrastructure competition” has increasingly emerged in Canada and many other countries as an efficiency enhancing organizational arrangements in reducing private sector risks and stimulating investments into ultra-high capacity next generation fiber/hybrid fiber/wireless networks. Extensive infrastructure sharing arrangements between two of Canada’s “big three” (Bell and Telus) that enable them to offer national mobile and business data services represent a good example of the importance of infrastructure sharing in the efficient allocation of telecom investments. In addition to making it feasible and profitable for providers to serve customers in places where they have not deployed their own infrastructure, a key economic benefit of infrastructure sharing is that it restricts the scope for inefficient and costly duplication associated with infrastructure competition. Infrastructure competition is therefore not necessarily feasible, nor economically desirable, as it can induce persistent delays in creative destruction from old to new broadband technologies. Infrastructure monopolies however can require some sort of price/quality regulation to counteract economic incentives to degrade basic service quality in order to charge higher prices from buyers with a low willingness/ability to pay.<sup>41</sup> Where wholesale access obligations have not been sufficient to promote product differentiation and competitive discipline on pricing, retail price/quality regulation may emerge as a viable solution for counteracting the “negative spillovers” from “high-prices” emphasized by the Competition Bureau in this Market Study Notice. Another key lesson from the international experience is that strategically varying wholesale access prices across legacy and new technologies can be an effective tool for reducing private sector incentives to overinvest in old technologies and promote their incentives to invest in next generation FTTP networks.
17. **Vertical integration and structural separation:** Canadian Internet service providers have been particularly successful in leveraging their “sweating the copper” strategies to invest in other types of assets (mobile networks, media assets, etc.).<sup>42</sup> This vertical integration helps monetize

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<sup>40</sup> European Parliament. Directorate General for Internal Policies (2016). Reforming EU Telecoms Rules to create a Digital Union. Page 27-30, citations omitted. Available at: <https://publications.europa.eu/en/publication-detail/-/publication/9d8aa519-ec17-11e5-8a81-01aa75ed71a1/language-en>

<sup>41</sup> See e.g. Besanko, D., Donnenfeld, S., & White, L. J. (1987). Monopoly and quality distortion: effects and remedies. *The Quarterly Journal of Economics*, 102(4), 743-767.

<sup>42</sup> See Winseck, D. et al. (2015-2018). Media and Internet Concentration in Canada Report, 1984 – 2014; and updates. Available at: <http://www.cmcrp.org/media-and-internet-concentration-in-canada-report-1984-2014/>

sunk investments in network infrastructure, but also enhances the profitability of engaging in exclusionary anticompetitive practices with respect to both Internet access resellers and competing third party providers of Internet based applications and services without extracting some sort of payment from them (i.e. paid prioritization/sponsored data). From an internal corporate strategy perspective, vertical integration has some opportunity costs in terms of efficiency gains that are available through specialization and reallocates scarce capital from network capacity provisioning and new broadband technologies to other ventures. This is why investors in some telecom companies voluntarily choose to remain specialized in their core-competencies, rather than adopting the type of vertical agglomeration strategies common among large Canadian and U.S. broadband providers. International evidence suggests that less vertically integrated telecom network operators tend to be more efficient in delivering value to their investors and improving speeds compared to their vertically integrated counterparts.<sup>43</sup> Concerned about perverse anticompetitive and underinvestment incentives that vertical integration can generate, policymakers in various countries have imposed structural separation mandates on network operators. Although somewhat effective in promoting wholesale and retail pricing discipline, in some countries structural separation mandates have not been very successful in promoting incumbents' incentives to deploy fiber access networks. Adoption of a wholesale regime with an Equivalence of Inputs (EoI) effectively induces some measure of structural separation, but can limit the ability of the telecom regulator to vary wholesale prices/markup in order to optimize investment incentives (i.e. counteract overinvestment in old technologies and underinvestment in new ones). Building on the empirical literature on the international experience with structural separation and wholesale access regulation in broadband sector, a 2016 OECD report summarizes lessons that might be relevant as the Competition Bureau explores policy options available for mitigating “negative spillovers” from “high prices” that motivate the proposed Study:

*“The relationship between regulation and structural separation is complex: the two can be complementary but also substitutes in their effects. The 2001 report drew a clear Dichotomy between access regulation, on the one hand, and full ownership separation, on the other. Nonetheless, it foresaw a complementary relationship between lesser forms of separation and access regulation, whereby the former may facilitate the task of the latter. A recurrent theme across a number of recent empirical studies is the pre-eminent importance of robust and effective regulation within liberalised and liberalising market, which may take higher priority than structural reorganisation. Conversely, there is evidence that effective regulation may help to ameliorate the co-ordination problems that can arise from vertical separation. Accordingly, as the Recommendation recognises, any discussion of the merits of structural separation cannot occur in a vacuum, but instead must take account of existing and potential future sectoral regulation. Any such*

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<sup>43</sup>. See e.g. Bruno, C. (2012). Functional Separation and Economies of Vertical Integration in European Fixed Telecoms (No. 03). Working Paper. Rajabian, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50.

*balancing exercise must, additionally, be cognisant of the “better regulation” and “smart regulation” movements in effect in many jurisdictions.”*<sup>44</sup>

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<sup>44</sup> See. OECD (2016). Structural separation in regulated industries Report on implementing the OECD Recommendation. Pages 12-13, citations omitted. Available at: <https://www.oecd.org/daf/competition/Structural-separation-in-regulated-industries-2016report-en.pdf>

## II. Research Summaries

**Rajabiun, R., & Middleton, C. (2013). Multilevel governance and broadband infrastructure development: Evidence from Canada. *Telecommunications Policy*, 37(9), 702-714.**

### Abstract

This paper investigates the contributions of digital infrastructure policies of provincial governments in Canada to the development of broadband networks. Using measurements of broadband network speeds between 2007 and 2011, the paper analyzes potential causes for observed differences in network performance growth across the provinces, including geography, Internet use intensity, platform competition, and provincial broadband policies. The analysis suggests provincial policies that employed public sector procurement power to open access to essential facilities and channeled public investments in Internet backbone infrastructure were associated with the emergence of relatively high quality broadband networks. However, a weak essential facilities regime and regulatory barriers to entry at the national level limit the scope for decentralized policy solutions.

**Rajabiun, R., & Middleton, C. (2015). Lemons on the Edge of the Internet: The Importance of Transparency for Broadband Network Quality. *Communications & Strategies*, (98).**

### Abstract

Network performance measurements from OECD countries between 2007 and 2012 document a significant increase in the variability of broadband infrastructure quality, which helps explain growing demand for technologies and policies that counteract information asymmetries between network operators and end users. A cross-country analysis documents the negative association between quality uncertainty and variations in digital infrastructure quality. The analysis suggests public policies and business models that promote market transparency can enhance the efficiency of the broadband access market on the edge of the internet and stimulate incentives for the diffusion of next generation platforms.

**Rajabiun, R., & Middleton, C. (2015). Public Interest in the Regulation of Competition: Evidence from Wholesale Internet Access Consultations in Canada. *Journal of Information Policy*, 5, 32-66.**

Abstract

How do private interests try to shape public interest competition regulations? Focusing on debates about the design of wholesale Internet access obligations, the authors employ Natural Language Processing (NLP) tools to evaluate a multi-stakeholder policymaking process in Canada. Using NLP, they analyze 40 formal interventions in the CRTC's 2013–551 review of its wholesale broadband policy. They classify major interest groups, map key concepts, and quantify asymmetries in stakeholders' influence. They conclude that by reducing the costs of regulatory participation, deploying NLP technologies can help offset the advantages large incumbent organizations already have in shaping law and policy.

**Rajabiun, R., & Middleton, C. (2015). Regulation, investment and efficiency in the transition to next generation broadband networks: Evidence from the European Union. *Telematics and Informatics*, 32(2), 230-244.**

Abstract

This article explores the impact of public policy on technological change and the development of broadband infrastructure in EU member countries. The analysis explores contradictory findings in previous empirical literature on the interplay between regulation, competition, and investment, noting the importance of the construction of indicators employed to evaluate these interactions. Furthermore, the article points out that the traditional policy model and related empirical literature treat fixed capital inputs in networks as a measure of broadband infrastructure quality. However, relatively higher capital inputs do not necessarily translate into the development of relatively higher quality broadband networks. Using broadband network performance measurements between 2007 and 2012, the article addresses this contradiction in the literature and evaluates the determinants of broadband infrastructure quality in the EU. The analysis suggests countries that have been more effective at promoting entry and competition in the provision of Internet access services have developed relatively higher quality broadband networks.

**Rajabiun, R., & Middleton, C. (2017). Regulatory Federalism and Broadband Divergence: Implications of Invoking Europe in the Making of Canadian Telecom Policy. *Intereconomics*, 52(4), 217-225.**

Abstract

Stakeholders in Canadian telecom policy debates increasingly point to the European experience with broadband infrastructure development, both as a cautionary tale and as an example to emulate. This article investigates the relevance to Canadian policy debates of competing conceptualizations of the European approach to the design of wholesale Internet access regulations and their application to next generation fibre access technologies. Despite a unified regulatory framework and EU-wide broadband speed targets, network performance measurements document growing divergence and clustering in the quality of Internet connectivity within Europe, indicating there is no single European approach that could be used to justify a particular regulatory course of action. Regulatory federalism and the differentiated outcomes it has produced in Europe do offer a rich body of evidence for policymakers searching for regulatory strategies that promote the pace of creative destruction in broadband network development, but policymakers should examine this evidence carefully to understand how particular outcomes have been achieved.

**Rajabiun, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50.**

Abstract

This article investigates how infrastructure competition among broadband network infrastructure operators in Canada and the U.S. has influenced their incentives to increase fixed broadband connection speeds and invest in next generation fiber-to-the-premises (FTTP) technologies. The evolution of measured broadband speeds since the late 2000s documents growing differences in the incentives of dominant broadband operators to respond to demand for higher speed connectivity by increasing connectivity speeds they deliver to their customers. Dominant network operators in Canada have shown relatively stronger incentives than their counterparts in the U.S. to invest in and increase the capacity of legacy platforms. In the U.S. FTTP deployment incentives have been somewhat stronger, but network operators have been more reluctant to upgrade legacy technologies to deliver higher speeds. Diversity of strategic choices by large operators helps explain increasing regional and local broadband infrastructure gaps within the two countries. A high dividend payout financial strategy and increasing vertical integration appear to enhance the potential for overinvestment and inefficient duplication in legacy platforms by competing infrastructure providers.

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