Connecting Canadians: Ensuring Universal Access to Wireless Services

by
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M.A. (Economics), Carleton University, 2014

Project Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Public Policy

in the
School of Public Policy
Faculty of Arts and Social Sciences

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SIMON FRASER UNIVERSITY
Spring 2019

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Ethics Statement

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Abstract

The market for wireless services in Canada is characterized by the presence of significant market power of the three national service providers: Bell, Rogers and Telus. This reduces consumer welfare through reduced access to high quality wireless services in underserved areas. I conduct an empirical analysis to find that reduced mobility of subscribers, as illustrated by the low churn rate, contributes to greater profit margins, and thus market power. Using this and information gathered from expert interviews, I identify low subscriber mobility, and unutilized spectrum owing to the existing regulatory framework as factors contributing to welfare loss. I recommend that ISED create Tier 5 service areas for spectrum licenses immediately. I also recommend that ISED create a secondary market for unused spectrum once the Tier 5 service areas are fully implemented. Together these policy recommendations will ensure universal access to wireless services for all Canadians and increase welfare.

Keywords: wireless services; spectrum licenses; service areas; market power; national providers; secondary market mechanisms
Executive Summary

This capstone addresses the policy problem that there is a loss of consumer welfare due to significant market power of the national service providers in the provision of wireless services. I empirically analyze publicly available secondary data from the CRTC and the national providers to identify the factors that contribute to the market power of the national providers. I find that churn rate has a significant and negative effect on the profitability of the service providers. I also conduct expert interviews as part of the secondary methodology to validate the empirical findings.

Three policy options are developed to address this policy problem based on the analysis: Secondary Market Mechanisms, Tier 5 Service Areas and ‘Use it or lose it’ Licenses. I use six criteria: equity, consumer choice, efficiency, administrative feasibility, budgetary impact and stakeholder acceptance to evaluate the options.

My recommendation is to employ a sequential implementation system of Tier 5 service areas and secondary market mechanisms. ISED should immediately create a new set of smaller, Tier 5 service areas for spectrum licensing. This will increase rural connectivity, consumer choice and increase spectrum utilization rates. Next, ISED, in collaboration with CRTC and Competition Bureau, should promote the development of a secondary market. This will ensure effective reallocation and distribution of these spectrum licenses.
Acknowledgements

I would like to thank everyone who have supported, encouraged and believed in me over the years.

To my best friend and husband, Ziad, thank you for believing in me on the days that I did not believe in myself. You have been my greatest supporter and my harshest critic.

To my parents, thank you for instilling in me the values that make me who I am.

I would like to thank Dr. Dominique M. Gross for her guidance and feedback throughout this process. The numerous drafts that you have gone through have improved my work significantly. I would also like to thank Dr. Nancy Olewiler for accommodating and mentoring me.

I would also like to acknowledge the help of the interview participants who offered their time and knowledge to inform my analysis.
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<tr>
<th>Acronym</th>
<th>Full Name</th>
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<tbody>
<tr>
<td>5G</td>
<td>Fifth Generation</td>
</tr>
<tr>
<td>ARPU</td>
<td>Average Wireless Revenue Per Subscriber Unit</td>
</tr>
<tr>
<td>BDU</td>
<td>Broadcasting Distribution Undertakings</td>
</tr>
<tr>
<td>CCTS</td>
<td>Commission for Complaints for Telecom-Television Services</td>
</tr>
<tr>
<td>CRTC</td>
<td>Canadian Radio-Television and Telecommunications Commission</td>
</tr>
<tr>
<td>CWTA</td>
<td>Canadian Wireless Telecommunications Association</td>
</tr>
<tr>
<td>FBP</td>
<td>Facilities Based Provider</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>FWA</td>
<td>Fixed-Wireless Access</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile Communications</td>
</tr>
<tr>
<td>HHI</td>
<td>Herfindahl-Hirschman Index</td>
</tr>
<tr>
<td>ISED</td>
<td>Innovation, Science and Economic Development Canada</td>
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<tr>
<td>LTE</td>
<td>Long Term Evolution</td>
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<tr>
<td>MVNO</td>
<td>Mobile Virtual Network Operator</td>
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<tr>
<td>PIAC</td>
<td>Public Interest Advocacy Centre</td>
</tr>
</tbody>
</table>
Chapter 1. Introduction

Telecommunications services play a crucial role in the lives of all the residents of Canada in this digital age. Canadians are increasingly using these services for a broad range of activities such as banking, education, health, access to government services and entertainment. Improvements in the access to and availability of telecommunications services will strengthen Canada’s social and economic fabric and enable all Canadians to participate in the digital economy.

The wireless service market is the largest sector in the telecommunications industry, accounting for over half of the total revenues in 2016 and enjoying nearly 31 million subscribers (CRTC, 2017a). This market is dominated by three national providers: Bell, Rogers and Telus who have significant market power (henceforth, “the national providers”). In 2015, Canadian households spend an average of $87.25/month on wireless services. Only 69.9 per 100 households in the bottom quintile are wireless subscribers compared to 96.7 per 100 households in the top quintile (Government of Canada, 2018b). This indicates that these services are not affordable for all income groups. There is also a wide divergence in the average monthly household expenditure on wireless services between and within rural communities and urban centers across the provinces. The policy problem is that there is a loss of welfare for consumers of wireless services due to the market power of the national service providers. The loss of welfare arises from oligopolistic pricing and insufficient access to high quality wireless services for remote and rural areas of Canada.

This report uses a fixed effect panel model to understand the factors affecting service providers’ market power, which is proxied by their profit margin. Data is collected from the Canadian Radio-Television and Telecommunications Commission (CRTC) and the publicly available financial statements of the national providers. Subscriber mobility is captured by churn rate which is calculated by dividing the number of subscribers that have left a wireless service
by the total number of wireless service subscribers. Churn rate and a dummy for spectrum auctions are significant at the 1% and 5% level of significance. I find that low churn rates contribute to greater market power for the national service providers by increasing their profitability. The presence of a spectrum auction has a negative effect on profitability. Low subscriber mobility and under-utilization of spectrum due to the prevailing regulatory regime contribute to the loss of consumer welfare.

The quantitative analysis is complemented by information gathered from expert interviews. The recommendation is to immediately create smaller service areas, termed Tier 5. It is also recommended to use secondary market mechanisms to effectively allocate spectrum after full implementation of the Tier 5 service areas. I also considered mandating a “Use it or lose it” approach for spectrum licenses, but do not recommend it.

The report is organized as follows: chapter 2, 3 and 4 provide the context for the issue; chapter 5 presents the policy problem and the relevant stakeholders. Chapter 6 discusses the methodology and, chapter 7 presents the results of the analysis; chapters 8 and 9 discuss potential policy alternatives, their evaluation and a policy recommendation, and chapter 10 closes with concluding remarks.
Chapter 2. Wireless Services in Canada

Canada’s communication system is divided into broadcasting and telecommunications services. Telecommunications services are further divided into wireline and wireless services. The term “wireless” refers to technologies that use over-the-air transmitters and receivers for communication, and are categorized as mobile, fixed-wireless access (FWA) or satellite technologies. The wireless telecommunication carriers (except satellites) are firms operating and maintaining switching and transmission facilities to provide direct communication services via the airwaves (Government of Canada, 2018c). Mobile wireless technologies include cellular phone services delivered over third, fourth generation (3G, 4G) and 4G-Long Term Evolution – LTE networks by these carriers (Joseph, 2018). The focus of this report is on the effect of market power of the national providers for the consumers of wireless services in Canada. Figure 1 maps the structure of the Canadian communication system.

Figure 1: Canada’s Communication System

(Author, 2019)
The telecommunications sector has seen unprecedented changes in technology that has led to the creation and adoption of wireless services and the decline in the demand for fixed wireline services. The wireless service market is the largest sector in this industry, with over half of the total telecommunications revenues in 2016 and nearly 31 million subscribers (CRTC, 2017a). It is important to note that the rates for retail telecommunications services, including mobile wireless services, are not regulated by the CRTC (CRTC, 2014). This is because the CRTC refrains from regulation when it finds that a service is subject to ‘sufficient’ competition or where refraining is consistent with the Canadian telecommunications policy objectives. This is known as exhibiting ‘forbearance’ (CRTC, 2016b).

In 2016, approximately 95 percent of all telecommunications revenues were from services whose rates, terms and conditions are not set out in a commission-approved tariff. Compared to this, between 2011 and 2016, 100 percent of the revenue generated by wireless services were ‘forborne’, or simply put not subjected to a commission-approved tariff (CRTC, 2016). However, CRTC has imposed certain conditions on the provision of wireless services, such as the Wireless Code which was imposed in 2013. Commission for Complaints for Telecom-Television Services (CCTS) has also been established as an avenue for consumers to lodge and resolve complaints about their service providers.

2.1. The Wireless Code

The CRTC established the Wireless Code in 2013 as a mandatory code of conduct for wireless service providers and applies to all wireless services provided to customers (CRTC, 2013b). The code came into effect as of June 3, 2015 to ensure that consumers of wireless services are better informed of their rights and the contracts with their service provider. Under this code, the service
providers are required to unlock wireless devices, to limit contract terms to a maximum of two years and to offer a trial period for wireless contracts. They are required to set caps on data overage and data roaming charges, and to limit early cancellation fees. The objective was to create a more dynamic wireless market and make it easier for customers to understand their contracts. This code was updated in December 2017 to provide customers with unlocked devices, give families more control over data charges. The code sets minimum usage limits for the trial period, and states that data is a key contract term that cannot be changed during the commitment period without the customer’s consent (CRTC, 2017c).

A public opinion research in conducted in spring 2018 (CRTC & TNS Canada, 2018) found that the wireless code has a positive impact for customers as the number of complaints have decreased. However, the report also found that 49 percent of wireless users report having paid data overages in the last 12 months, and 29 percent of the consumers have complained about data charges. It is important to note that, among the respondents of this survey, there were significant demographic differences between Canadians aged 18-54 and Canadians over 55 years and between different levels of education. For instance, younger Canadians are more likely to experience bill shocks compared to their older counterparts. Younger Canadians are also more likely to have text, calling minutes and data included in their wireless plans. Canadians with a university degree or higher find their contracts easier to understand, and are more likely to have changed their service provider. Those with university degrees or higher also are more likely to have complained to their service provider in the last 12 months. This points toward a need for further improvements in the Wireless Code to address these demographic differences.
2.2. Role of the Commission for Complaints for Telecom-Television Services (CCTS)

The Commission for Complaints for Telecom-Television Services (CCTS) was created in 2007 as an independent, industry-funded agency to resolve complaints from consumers about all aspects of their home phone, long distance, internet, wireless services and TV services. The CCTS accepted 14,272 complaints in between August 1, 2017 and July 31, 2018 and resolved almost 92% of these complaints. Bell Canada faced 33.2 percent of all the complaints received by CCTS while Rogers and TELUS accounted for 10.2 percent and 6.6 percent accordingly. The total number of complaints in 2017-2018 was 57 percent higher than the number of complaints received in 2016-2017 (CCTS, 2018).

Wireless services accounted for 41.5 percent of the total number of complaint issues, which stood at 12,757 out of 30,734 and had increased by 49 percent since the last reporting period. The majority of the complaints that arose for wireless services were for issues with billing and contract disputes, accounting for 42 percent and 38 percent of the total number of issues with wireless services. Almost 18 percent of all issues raised by wireless customers were about misleading information or non-disclosure of key terms by a service provider to the customers, which is a breach of the Wireless Code (CCTS, 2018). This indicates that asymmetric information is benefitting the service providers in the form of higher charges, which results in a loss of consumer welfare.

2.3. Role of Mobile Virtual Network Operators

A mobile virtual network operator (MVNO) is a service provider/reseller that does not own spectrum or operate its own radio access network, but instead relies on the spectrum and the network of a larger service provider (the host network) to provide wireless services to consumers. This process is defined as
the ‘wholesale mobile wireless roaming services’ that allow subscribers of MVNOs to use the host network when they travel outside their home network’s radius. A popular example of an MVNO is Wind Mobile which was eventually acquired by Shaw Communications.

The flanker brands of Bell, Rogers and TELUS (Virgin, Fido and Koodo respectively) are also MVNOs as they do not own their own spectrum but rely on that of the parent company. In 2015, CRTC found that refraining from mandated wholesale roaming would not be consistent to the policy objectives set out in the Act as there is not a sufficient level of competition to protect the interests of the subscribers. Despite that, CRTC decided to not mandate wholesale mobile wireless roaming access for the MVNOs to the facilities owned and controlled by Bell, Rogers and TELUS because it believed it would negatively affect the investment in facilities by these market leaders.

The CRTC believes that strong facilities-based competition will eventually result in resale competition pointing to the heavy reliance on market forces and the reluctance to introduce new regulatory tools. Thus, the CRTC put in place the Wholesale Wireless Framework, to be evaluated in 2020, but admits that since then there has been limited resale competition. Earlier this year, CRTC decided to undertake a review of the framework and the MVNO access policy within 2020 to ensure that there is a sufficient degree of choice of affordable mobile wireless services in the Canadian market, particularly for low income households. This decision was partly prompted by the challenges presented by the pending transition to fifth generation (5G) networks (CRTC, 2018b).

2.4. Windows of Opportunity

There are three developments that have the potential to reshape the landscape of telecommunications and wireless services in Canada: the Broadband Fund, the Federal Broadcasting and Telecommunications Legislative Review and the Public Hearing regarding the retail sales practices of Canada’s
large telecommunications service providers. The sub-sections below describe in
detail these developments and their implications for the wireless services
industry.

2.4.1. The Broadband Fund

In 2016, the CRTC established a universal service objective that
Canadians in rural and remote areas as well as in urban centers have access to
voice services and broadband internet access services on fixed and mobile
wireless networks (Government of Canada, 2018d). The CRTC has announced
the creation of the Broadband Fund: $750 million over five years to achieve this
new objective. The objective of the Broadband Fund is to fund projects to build or
upgrade access and transport infrastructure for fixed and mobile wireless internet
access services to achieve the universal service objective in order to close the
gap in connectivity in underserved areas. In addition to bridging the gap in
broadband services, the universal service objective also mandates the availability
of the latest generally deployed mobile wireless technology (LTE) on as many
major transportation roads as possible in Canada. The fund creates the potential
for greater access to better quality wireless services.

2.4.2. Federal Broadcasting and Telecommunications Legislative
Review

The federal government recognized in Budget 2017 that the regulations
governing the broadcasting and telecommunications industry has not kept pace
with the evolution of the technology and the landscape (Government of Canada,
2018e). To ensure that Canadians can benefit from the advancements in these
sectors, the government launched a holistic review to examine the existing
legislative framework and recommend the changes required to benefit from the
technological progress in the future. A joint review is important as these sectors
are intertwined. With the Federal Broadcasting and Telecommunications and
Legislative Review underway as of June 5th, 2018 (Government of Canada, 2018a), there is a brief policy window to reform regulations to improve the provision of wireless services in Canada.

The Legislative Review Panel has been tasked to study the Broadcasting Act, the Telecommunications Act and the Radiocommunication Act with four broad themes in mind and to make recommendations to the Minister of Innovation, Science and Economic Development and the Minister of Canadian Heritage. Two of those four themes are directly related to the provision of wireless services: to reduce barriers to access by all Canadians to advanced telecommunications network, and to renew the institutional framework for the communications sector. The terms of reference binding the panel responsible for the review include concerns of competition and innovation, universal access and affordability for consumers, effective spectrum regulation, and effective governance and administration by CRTC and other government departments (Government of Canada, 2018e).

The panel has been tasked to conclude whether legislative changes are warranted to better promote competition, innovation and affordability in the telecommunications and broadcasting industry in Canada. The panel will comment whether the right legislative tools are in place to further the objective of affordable access to high-quality wireless services for all Canadians, regardless of their geographic locations. These questions are derived from the telecommunications policy vision priorities of quality, coverage and price. The objectives are to provide high quality, affordable, modern and reliable services to Canadians wherever they live and work.

There is recognition that without competitive prices and choices, Canadians cannot afford to use these services. The future deployment of 5th generation (5G) technologies in 2021 means that the panel has to investigate whether the right legislative tools exist to roll out new wireless technologies as they become available, primarily through their spectrum management framework. They are also questioning if the current allocation of responsibilities between the CRTC and other government departments is appropriate to support competition
in the market. The panel is expected to present the final report and recommendations by January 31st, 2020 (Government of Canada, 2018f).

2.4.3. Hearing on the Retail Sales Practices of Canada’s Large Telecommunications Carriers

The Governor in Council has issued an Order in Council that requires the CRTC to report on the retail sales practices of Canada’s large telecommunications carriers (Government of Canada, 2018g). CRTC has identified Bell, Bragg Communications Inc (now Eastlink), Cogeco Connexion Inc., Northwestel Inc., Rogers, SaskTel, Shaw Communications Inc., TBayTel, TekSavvy Solutions Inc., TELUS, Videotron Ltd., and Xplornet Communications Inc. as part of the proceedings. This has been necessitated by the numerous complaints from Canadians over the misleading and/or aggressive sales practices employed by these carriers. The CRTC report (2019) concluded that there are misleading or aggressive retail sales practices in the telecommunications service provider market in Canada, and to some extent in the television service provider market. These practices exist in all types of sales channels, including in store, online, over the telephone and door to door. These practise are harming all consumers, and particularly vulnerable Canadians. CRTC states that consumer protections should be strengthened to address the occurrences of said practices.

The CRTC report (2019) put forth a number of recommendations. To protect vulnerable Canadians, CRTC will consider the creation of an Internet Code, that can potentially extend some of the consumers protections that wireless and television customers get to internet customers. CRTC will also consider accessibility related discounts to be offered in addition to any general offer or promotion. The CRTC also plans to develop its own secret shopper program to target specific sales channels or locations across Canada. They intend to publish these results for consumers to use as additional information in
decision making. In addition, the CRTC intends to create new consumer tools that will provide a road map of rights and remedies for Canadians who have experienced misleading sales practices. The CRTC is relying on the service providers own initiatives to identify and incorporate best practices in their sales strategies.

It is thus timely and imperative to investigate the market for wireless services in Canada and the loss of consumer welfare.
Chapter 3. Market Structure of Wireless Services

This chapter focuses on the market characteristics of wireless services: market share controlled by the major service providers and revenue and profit margins. It will also discuss the prices charged and what the implications are for the state of market power in the wireless services market.

3.1. Characteristics

This industry has been historically regulated as a monopoly (Dachis & Schwanen, 2016), but over time, it has evolved into an oligopolistic one. This is because the industry is dominated by a small number of service providers who own and/or operate transmission-based facilities. Though the market leader varies from province to province, Bell, Rogers and TELUS are the national providers. Some other providers include: Videotron, SaskTel, and Freedom Mobile. Table 1 illustrates the share of the national wireless subscribers that the national providers control. It is evident that there has not been a fourth major player in the market between 2011 and 2016.

Table 1: National Wireless Subscriber Market Share in Canada, 2011-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Bell</th>
<th>Rogers</th>
<th>TELUS</th>
</tr>
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<tbody>
<tr>
<td>2011</td>
<td>28%</td>
<td>37%</td>
<td>27%</td>
</tr>
<tr>
<td>2012</td>
<td>28%</td>
<td>34%</td>
<td>28%</td>
</tr>
<tr>
<td>2013</td>
<td>28%</td>
<td>34%</td>
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<tr>
<td>2015</td>
<td>28%</td>
<td>33%</td>
<td>29%</td>
</tr>
<tr>
<td>2016</td>
<td>28%</td>
<td>33%</td>
<td>28%</td>
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(CRTC, 2012-2017)
In a bid to gain more market share, national service providers have created their own flanker/extension brands to provide lower priced alternatives to their services. Popular examples of flanker brands include: Fido and Chatr for Rogers, Virgin Mobile for Bell and Koodo Mobile for TELUS. CRTC (2015) calculated that 82% of the revenue and 72% of the total subscribers are derived by the primary brands, while 17% of the revenue and 28% of the subscribers are derived by the flanker/extension brand.

A motivation for market dominance is the highly vertically and horizontally integrated nature of these national providers. This was made possible by the presence of network externalities in service provision and switching costs for consumers (Fuentelsaz, Maicas & Polo, 2012). Another likely reason is the increase in the use of ‘bundles’ of a wide range of services that the service providers offer to their customers at a discounted rate. As these service providers have their own broadcasting and internet services, they often bundle home internet and cable TV plans with the wireless services.

Wu et al. (2008) finds that if customers place different values on the contents of the bundle, it is better to allow the customers to choose the content and the corresponding price. This would lead to greater efficiency gains and higher profitability for the firm. This finding is important as the number of subscriptions with bundled services (two or more services with one company) stands at 9.6 million as of 2016 (CRTC, 2017). The public hearing on retail sales practices have focused on examining the bundles provided to consumers by the service providers and whether they caused any confusion. It will also ask consumers if there are any gaps in existing consumer protection regulation in regards to sale of telecommunications services or bundles of telecommunications services (Government of Canada, 2018g).

Wireless services account for almost half of the revenue generated by telecommunications services, standing at $24.4 billion in 2016 (CRTC, 2017a). Table 2 illustrates the profit margin as a percentage of total network revenue for wireless services for the national providers from 2012-2017. The data indicates that these service providers enjoy large economies of scale that allow them to
reap high profit margins for their wireless services. For the national providers, profit margins have been relatively stable over the period 2012-2017. The margins have been consistently over 40% throughout the entire period, which is indicative of market power and dominance. Market power is defined as the ability of a firm to impose unilaterally and profitably a significant non-transitory price increase within the relevant market (Government of Canada, 1994).

Table 2: Profit margin for wireless services as a % of network revenue, 2012-2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Bell</th>
<th>Rogers</th>
<th>TELUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>41.5</td>
<td>45.6</td>
<td>46</td>
</tr>
<tr>
<td>2013</td>
<td>43.6</td>
<td>46.8</td>
<td>46.2</td>
</tr>
<tr>
<td>2014</td>
<td>44.9</td>
<td>48.1</td>
<td>45.4</td>
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<tr>
<td>2015</td>
<td>45.3</td>
<td>46.9</td>
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<tr>
<td>2016</td>
<td>45.5</td>
<td>45.3</td>
<td>44.4</td>
</tr>
<tr>
<td>2017</td>
<td>44.6</td>
<td>45.8</td>
<td>44.5</td>
</tr>
</tbody>
</table>

(Bell, Rogers and TELUS Financial Statements, 2012-2017)

The retail revenue from wireless services grew by 19% for the industry between 2012 and 2016: from $19.5 billion to $23.2 billion (CRTC 2013a; CRTC 2017a). In terms of the revenues earned by the national service providers, Table 3 illustrates the trend between 2012 and 2017. It is evident that the national providers have experienced an increase in their revenues from wireless services, with Bell leading the way with approximately 41 percent growth over this period. Both TELUS and Rogers have trailed behind with 29 percent and 15 percent growth rates in their revenue from wireless services.
Table 3: Total Annual Operating Revenues (in millions of $) for wireless services, 2012-2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Bell</th>
<th>Rogers</th>
<th>TELUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>5573</td>
<td>7280</td>
<td>5886</td>
</tr>
<tr>
<td>2013</td>
<td>5849</td>
<td>7270</td>
<td>6177</td>
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<tr>
<td>2014</td>
<td>6241</td>
<td>7305</td>
<td>6641</td>
</tr>
<tr>
<td>2015</td>
<td>6876</td>
<td>7651</td>
<td>6994</td>
</tr>
<tr>
<td>2016</td>
<td>7159</td>
<td>7916</td>
<td>7173</td>
</tr>
</tbody>
</table>

(Bell, Rogers and TELUS financial statements, 2012-2017)

This section demonstrates that the market for wireless services is dominated by the national providers as they service almost 90 percent of the total subscribers in Canada. They operate at significantly high profit margins and earn substantial revenues from their wireless services, indicating strong market power.

3.2. Prices and Competition

Empirical research from around the world demonstrates that in a duopolistic mobile services industry, prices tend to be higher than the competitive levels (Busse, 2000; Parker & Roller, 1997, Fullerton, 1998; Gans et al., 2005). Although Canada differs slightly in that there are currently a minimum of three service providers at the provincial and national levels, prices have been found to be highest in Canada compared to countries in the G7 and Australia (Nordicity Group Ltd., 2017). Between 2012 and 2016, the average revenue per subscriber per month (ARPU) for wireless services increased by 7.4 percent; from $54.9 to $64 (CRTC 2013a; CRTC 2017a). Table 4 outlines the ARPU for the national
providers from 2008-2017. It is evident that there has been an increase in the average revenue earned by the national providers.

Table 4: Average revenue ($) per wireless subscriber per month, 2008-2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Bell</th>
<th>Rogers</th>
<th>TELUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>54.29</td>
<td>64.34</td>
<td>62.73</td>
</tr>
<tr>
<td>2009</td>
<td>51.70</td>
<td>63.59</td>
<td>58.46</td>
</tr>
<tr>
<td>2010</td>
<td>52.03</td>
<td>62.62</td>
<td>57.63</td>
</tr>
<tr>
<td>2011</td>
<td>53.55</td>
<td>60.2</td>
<td>59.09</td>
</tr>
<tr>
<td>2012</td>
<td>55.82</td>
<td>59.79</td>
<td>60.39</td>
</tr>
<tr>
<td>2013</td>
<td>57.25</td>
<td>59.58</td>
<td>61.38</td>
</tr>
<tr>
<td>2014</td>
<td>60.07</td>
<td>59.41</td>
<td>63.13</td>
</tr>
<tr>
<td>2015</td>
<td>63.09</td>
<td>59.71</td>
<td>63.45</td>
</tr>
<tr>
<td>2016</td>
<td>65.46</td>
<td>60.42</td>
<td>65.10</td>
</tr>
<tr>
<td>2017</td>
<td>67.77</td>
<td>62.31</td>
<td>67.05</td>
</tr>
</tbody>
</table>

(Bell, Rogers and TELUS Financial Statements, 2012-2017; Hyndman & Parmeter, 2012)

A study commissioned by the CRTC found that in areas of high competition, wireless prices were lower by 31 percent than the national average (Government of Canada, 2017). This indicates that firms are not providing affordable wireless telecommunication services to all Canadians equally, but are likely to be price discriminating based on geographical locations. There is evidence that the wireless service subscriber market in Canada is geographically fragmented, with different market leaders in different provinces and territories (CRTC, 2017a). A concern with market leaders is the presence of market power, i.e. the ability of a firm to impose unilaterally and profitably a significant non-transitory price increase within the relevant market (Government of Canada, 1994).

The Competition Bureau (2014) has maintained that the national providers have retail market power which allows them to maintain prices above competitive levels for a significant period of time. The Bureau argued that increased retail competition from an additional national mobile wireless provider can result in
gains of approximately $1 billion per year for Canada (Competition Bureau, 2014). The Bureau concluded that the retail mobile wireless services markets are characterized by high concentration, above-normal profits, low penetration levels and high barriers to entry and expansion. They warn of a risk of coordinated conduct in these markets. They recommend that CRTC impose regulatory measures to ensure that Canadians enjoy benefits of greater competition.

The CRTC found that the national providers possess market power at the national level for Global System for Mobile Communications (GSM) based wholesale roaming (Government of Canada, 2015b). Presence of such market power alludes to the absence of competition. In an empirical study on 30 OECD countries, Agiakloglou & Polemis (2017) found that competition has positive effect on the performance of the telecommunications industry. The regulatory reform arising out of the 2006 Policy Direction was aimed to increase competition but has not brought about the stipulated benefits (Janigan, 2010). Dachis & Schwanen (2016) identified that CRTC’s framework to prevent anticompetitive behavior is not sufficiently rigorous. Dachis & Schwanen (2016) recommended that CRTC defer to Competition Bureau in identifying and addressing anticompetitive practices and evaluation of market power and nature of competition in the market.
Chapter 4. Use of Spectrum Auctions to Increase Competition

Numerous attempts have been made by Innovation, Science and Economic Development Canada (ISED, previously Industry Canada) to stimulate competition in the sector by encouraging new entrants through the use of spectrum management. The Radiocommunication Act defines the radio spectrum as a subset of the electromagnetic waves that lie below 3000 gigahertz (GHz). Spectrum is used for wireless communications and is considered to be a finite natural resource. The Spectrum Policy Framework for Canada first released in 1992, and updated in 2007 outlines the guiding principles for the Canadian Spectrum Management Program (Government of Canada, 2007).

The objective is to maximize the economic and social benefits that Canadians derive from the use of the radio frequency spectrum resource. The framework emphasizes the use of market forces and minimally intrusive regulations to allocate spectrum to provide effective telecommunications and broadcasting services. Spectrum licenses are provided for geographical service areas. There are currently four tiers for which licenses are available. Tier 1 is a single national service area, covering the whole of Canada. Tier 2 consists of 14 provincial and large regional service areas. Tier 3 consists of 59 smaller regional service areas, and Tier 4 comprises of 172 localized service areas (Industry Canada, 2015). Tier 1 and Tier 2 are dominated by the national service providers.

Appendix A provides a complete list of the spectrum auctions and the winners in Canada from 1999-2018. In the Advanced Wireless Services (AWS) spectrum auction in 2008 and in the 700 Megahertz (MHz) wireless spectrum auction in 2014, ISED took measures to promote competition. This was achieved by the use of set-aside auctions, which are a set of regulatory policies used to increase competition by creating new providers. One 30 Megahertz block of
AWS-3 spectrum (to be used to deliver next generation wireless services) in 2014 was set aside exclusively for wireless carriers with less than 10 percent national and 20 percent provincial/territorial wireless subscriber market share in those license areas (Government of Canada, 2015c). This spectrum cap prohibited bids from incumbents with market shares greater than these limits and was expected to create a fourth wireless player in every region across the country. However, this has not materialized yet. Rather, national providers have bought out licenses from the smaller service providers. For the 600 MHz auction scheduled in March 2019, 84 MHz of spectrum has been repurposed, freeing up 70 MHz of spectrum. This will be auctioned for flexible use of commercial mobile, fixed or broadcasting services (ISED, 2018c). A total of 30 MHz of spectrum, approximately 40 percent will be set aside for eligible entities in the auction process.

Hyndman & Parmeter (2012) conducted an empirical analysis to find that consumers have benefited from this set-aside policy as prices were lowered. Hyndman & Parmeter (2012) argue that social welfare may eventually increase further if the increase in competition is sustained in the long term as it would result in greater degree of choice and lower prices. Table 4 in Chapter 3 illustrates that this has not been the case. ARPU has increased for the national provider from 2008-2017. There are indirect effects of the set asides on consumers as well. In an alternative scenario if there were no set-asides spectrum blocks, there would have been an efficiency loss of approximately $400-$500 million, which would have been passed on the consumers in terms of higher prices (Hyndman & Parmeter, 2012). Church and Wilkins (2013) argue that the decision to set aside spectrum in the 2008 AWS was unproductive as the focus was on talk and text and not on data, resulting in a suboptimal allocation of spectrum. This was unproductive as the incumbent providers did not get the spectrum to increase their speed and capacity for data, leading to higher prices and lower quality of service.
Another concern brought to attention was the amount of spectrum that was not deployed after the auctions. For example, Shaw entered into an agreement with Rogers to sell its spectrum once the restrictive period that prevents incumbents from purchasing spectrum expired in 2014 (Hyndman & Parmeter, 2012). Hazlett and Munoz (2009) conclude that this is an important source of inefficiency. Church and Wilkins (2013) argue that efforts to create competition in the market will not be sustainable in the long run as smaller service providers leave the market and/or consolidate to reduce competition and increase their profit margin.

Joseph (2018) concluded that despite the execution of 11 major auctions since 1999, the majority of the spectrum remains controlled by the larger service providers. As of 2016, the national providers control 76% of the National Commercial Mobile Spectrum License compared to 85% in 2010 (Canadian Spectrum Policy Research, 2016). This difference is explained by a four percentage point increase in the share of licenses of Vidéotron, and Wind mobile buying five percent of the licenses. The change in the share of the national providers between 2010 and 2016 do not indicate increase in competitiveness as Wind mobile was bought by Shaw communications in 2016. Joseph (2018) also established that use of spectrum outside of urban areas is very low, pointing to divergences in the quality of service provided to urban and rural consumers. He recommends that ISED should remove spectrum usage rights from companies that cannot bring forth the expected benefits for Canadians. Dachis & Schwanen (2016) recommend that ISED streamline the radio spectrum allocation and remove foreign ownership restrictions which is generally seen as a barrier to invest in the industry and thus restricts competition in the market for wireless services.
Chapter 5. Policy Problem and Stakeholders

The policy problem is that there is a loss of welfare for consumers of wireless services due to the market power of the national service providers. The loss of welfare arises from oligopolistic pricing and insufficient access to high quality wireless services for remote and rural areas of Canada. As discussed earlier, there is recognition that the national service providers have significant market power. There are also concerns with unutilized spectrum that result in poor coverage for remote and rural areas. The public hearing regarding the retail sales practices of Canada’s large telecommunications service providers are an indication of a wider problem in the industry.

The current Federal Broadcasting and Telecommunications Legislative Review provides a small policy window to address these issues. A review of the wireless services market finds that the national providers command almost 90 percent of the wireless subscriber market (Table 1), leaving a small room for a fourth national player. Their dominance is also exhibited by the revenue they earn from said services and their wide profit margin (Table 2, Table 3). Average revenue per wireless subscriber per month has also increased, despite attempts by ISED to introduce competition through spectrum auctions (see Table 4).

The two major stakeholders in this issue are the service providers and the consumers of the wireless services in Canada. Households who are the end users of these services are stakeholders because any change in policy would impact them. It must be noted that households from all socio-economic levels are users of mobile wireless services. Those in the first income quintile spend a larger share of their income on wireless services than those in the top quintile. This indicates a regressive effect of the pricing policy of the service providers. Public Interest Advocacy Centre (PIAC) is a non-profit organization that advocates for the fair and balanced interpretation and application of Canadian law to protect the public interest. They have previously advocated for the rights of
Canadians before the CRTC and Industry Canada and are currently doing so in the public hearings. PIAC will be considered as the organization representing consumer interests in the area of telecommunications policy for this policy problem.

Canadian Wireless Telecommunications Association (CWTA) represents companies that provide wireless services and products and is the authority on wireless issues, developments and trends in Canada. Members of this association include both the national and the smaller services providers. Any proposed change in policy would require all the service providers to comply with it. CWTA represents the industry before governments and various regulatory agencies such as the CRTC and ISED. This provides them with sufficient lobbying power and influence on the policy direction and adoption. Thus, CWTA will represent the shared interests and concerns of the service providers of proposed policy options.
Chapter 6. Research Design

The objective of this analysis is to explain what factors influence the market power of the national providers and the resulting implications for the welfare of Canadian consumers. There are two types of analysis conducted. The major one is a quantitative methodology to identify the explanatory variables that explain the profit margin of the national providers: Bell, Rogers and Telus. The secondary methodology is qualitative in nature that evaluates the importance of the explanatory variables for the profitability through expert interviews. This section first describes the primary quantitative methodology, followed by the secondary qualitative methodology.

6.1. Quantitative Methodology and Data

A quantitative analysis is conducted using secondary data collected from publicly available quarterly financial reports of the national providers, Bell, Rogers and Telus. The data is collected for 30 quarters from 2011.2 to 2018.3. This time period is chosen as the data was available for all the variables of interest. The resulting balanced panel data set contains a total of 90 observations as there are 30 time periods for the three providers. R Studio is used for the analysis of this panel data set. The major limitation of this analysis is that the sample size is too small to provide sufficiently robust results. This is due to the lack of comparable data for service providers such as SHAW Communications, Videotron and others. In addition, the number of explanatory variables is also limited by the degree to which they are comparable across the three providers.

As a result, the explanatory variables include average revenue per subscriber unit, capital intensity, churn rates and a dummy variable for auctions. These variables are used to explain the variation in the dependent variable: the
profit margin of the service providers. This methodology is adapted from Sung (2014). Sung (2014) constructed a panel dataset to examine the relationship between market concentration and competition for 24 OECD member states between 1998 and 2011.

The following sub-sections explain in greater detail the reasons behind the selection of the dependent and the independent variables.

6.1.1. Dependent Variable

The Competition Bureau (2014) has shown that providers possess market power in retail mobile wireless service markets. The objective of this analysis is to explain what contributes to that market power. The dependent variable is the profit margin for the service providers – the profits as a percentage of total revenue earned from wireless services by these service providers. Profit margin in their financial statements is earnings before interest, taxes, depreciation and amortization: EBITDA margin. It is assumed that these three providers calculate their margin homogenously. EBITDA margin is used as a proxy for market power and as the dependent variable in this study. This choice is made on the assumption that the presence of market power would allow the service providers to set prices greater than competitive levels, and thus earn higher profits.

The Competition Bureau (2014) has argued that market power is demonstrated by above-normal profits in wireless service provision, which is the largest and the most profitable segment for these service providers. The Bureau argues that direct indicators of market power are profitability and evidence of supra-competitive pricing. Supra-competitive prices are those that are greater than what can be sustained in a competitive market. Because pricing data is not publicly available, the EBITDA margin is used as an indicator of market power. Sung (2014) uses EBITDA margin as a proxy variable to measure the profitability of the service providers in the OECD countries. EBITDA margin is also widely used as an applicable measure for international comparisons of profitability.
As of 2016, the EBITDA margins of the four national providers in the US ranged from approximately 35% for T-Mobile to 53% for Verizon Wireless (FCC, 2017).

Figure 2 illustrates how the Profit Margin evolved over time. Bell's profit margin increased by 7.5 percentage points compared to a 0.6 percentage point increase for Rogers from 2011.2 to 2018.3. Despite that, Rogers had the highest profit margins among these three providers consistently over the entire period, with a few exceptions, while that for Telus decreased by 0.8 percentage points. Bell appeared to have the lowest margins among the three until 2014, when it caught up with TELUS. The profit margins for Bell and TELUS seem to be very similar over 2014 to 2018. In Table 5, the mean and the median for Profit Margin are given as 43% and 43.6% respectively, thus resembling a normal distribution.

Figure 2: Quarterly Profit Margins of Wireless Service Providers, 2012-2018

(Bell, Rogers and TELUS Financial Statements, 2012-2018)

6.1.2. Independent Variables

This study attempts to demonstrate that there is a loss of consumer welfare due to the market power in the wireless sector. However, there is no
reliable or available data on prices paid by consumers of wireless services. There is also no publicly available data for individual disposable incomes which would enable me to create a proxy variable to estimate loss of consumer welfare. Therefore, I have identified four explanatory variables, to deduce if it increases the profit margin, vis-à-vis market power at the expense of consumer welfare. All the variables discussed below are reported on by Bell, Rogers and Telus every quarter and have the same definition. Table 5 describes the summary statistics for the dependent and the independent variables.

Table 5: Summary Statistics for Variables

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Median</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profit Margin</strong></td>
<td>43.0 %</td>
<td>51.3 %</td>
<td>30.8 %</td>
<td>43.6%</td>
<td>4.30</td>
</tr>
<tr>
<td><strong>ARPURate</strong></td>
<td>0.1 %</td>
<td>5.4 %</td>
<td>-18.6 %</td>
<td>0.86%</td>
<td>3.87</td>
</tr>
<tr>
<td><strong>CHURNRate</strong></td>
<td>1.2 %</td>
<td>2.1 %</td>
<td>0.8 %</td>
<td>1.17%</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>CapInt</strong></td>
<td>12.0 %</td>
<td>22.6 %</td>
<td>7.7 %</td>
<td>11.2%</td>
<td>2.82</td>
</tr>
</tbody>
</table>

The first explanatory variable is the growth rate of Average Revenue per Subscriber Unit (ARPURate). ARPU is the average revenue earned from a wireless subscriber every month. The absolute dollar value of ARPU is transformed to obtain the growth rate of ARPU every quarter for each provider which results in the ARPURate. The hypothesis is that due to the presence of market power, service providers will charge prices greater than competitive prices, leading to an increase in the ARPU. This would lead to an increase in their profit margin; thus it has an expected positive sign. The median and the average value for ARPURate are very different, indicating that the distribution is skewed to the left. The minimum and maximum values also have a large difference.

The second variable captures the loss of subscribers (CHURNRate). It is measured by the number of subscriber units disconnected during a given period divided by the average number of subscriber units on the network during the
period, and expressed as a percentage per month. I use only the churn rate for postpaid subscribers as the blended churn rate was not available for all three providers. Blended churn rates take into account both the prepaid and the postpaid subscribers on a service providers network. This rate is crucial in this analysis as it is an indicator of customer mobility. If the rate is high, this indicates that customers are moving to competitors or leaving the market entirely and vice versa. In reality, these rates are very low, averaging at 1.2% as opposed to a higher churn rate for prepaid customers. For example, the prepaid churn rate was 4.28% for Q1 of 2018 for Rogers. In table 5, the minimum and maximum CHURNRate are given as 0.8% to 2.1% respectively. The mean and the median are very close, thus indicating a normal distribution. The low CHURNRate indicates that postpaid customers tend to stay with their service provider and not switch to other providers. This is not necessarily due to quality of service that they receive from their providers, as there are a large number of complaints about the national providers lodged to CCTS annually. The grandfathering of the voice, text and data offerings could be a possible reason.

Churn rates can serve as a proxy of price elasticity for post-paid mobile wireless services, as it indicates the responsive of the customers. The hypothesis is that lower churn rates contribute to increased profitability as the providers use their market power to lock in customers into their postpaid plans. There is also a behavioral aspect to this postpaid customer inertia. It is likely that customers are risk-averse and are uncertain about the costs and benefits associated with a new provider. Incomplete or a lack of information about a competing postpaid plan contributes to this uncertainty. While some customers can access some of this information by contacting competing service providers, it may not be possible for all the customers to do so. Therefore they may not be very responsive to the changes in the price of wireless services, resulting in low churn rates. So it is expected to have a positive sign.

The third variable investigates the impact of capital intensity (CAPInt). It is measured by the expenditure on capital required for wireless services as a
percentage of the total revenue from wireless services. The hypothesis is that
greater capital expenditure as a share of wireless revenue would allow the
providers to improve their infrastructure, which would allow them to provide better
service, thereby increase their profit margin. It has been determined that these
service providers are facilities-based providers, and derive market power from
their infrastructure. They also restrict MVNO’s access to their facilities or charge
high wholesale rates to impede competition. However, there is expected to be a
lag between the time the investment takes place to the time the improved
facilities are operational. In the short run, these service providers may pass on
the cost of investment in their facilities to the consumers to stabilize their profit
margin. Because there are two opposing effects, the expected sign could be
either positive or negative. Since the provision of wireless services are capital
intensive the model does not include the impact of labor intensity.

The fourth variable is a dummy (DAuction). This is a dummy variable to
account for the purchase of spectrum licenses by these three providers during
the time period in consideration. The hypothesis is that successfully bidding and
acquiring spectrum licenses in the ISED spectrum auctions would give the
providers a competitive edge over the providers who were not successful. This
would allow them to serve their customers better. For a time period where a
service provider had a successful bid in a wireless spectrum auction, the dummy
is assigned to a value of 1, and 0 otherwise. It must be noted that there is also
the potential to pass on the high cost of acquisition of the spectrum to the
customers leading to loss in consumer welfare. It is expected that there will be a
lag between when the spectrums are acquired and when they are deployed,
leading to a difference in the effect on their profit margin in the short versus the
long run. So there can be a positive or negative expected sign.

6.2. Specifications of the Model

Using the dependent and the independent variables identified in the
previous section, the following model is proposed to explain how the factors
influence the market power of the service providers and the resulting implications. A fixed effects model is used as the service providers are heterogeneous. Thus the equation for the fixed effects model is as follows:

\[
\log(\text{Profit Margin}_{i,t}) = c + \beta_1 \log(\text{Growth of ARPPU}_{i,t}) + \\
\beta_2 \log(\text{Churn Rate}_{i,t}) + \beta_3 \log(\text{Capital Intensity}_{i,t}) + \beta_4 \text{Auction}_{i,t} + \epsilon_{i,t}
\]

where, \(i\) denotes the service provider with \(i = 1\) (Bell), 2 (Rogers) and 3 (TELUS), and \(t\) denotes the quarterly period from 2011.2 to 2018.3; \(\epsilon_{i,t}\) is the error term.
Chapter 7. Analysis

In this section, I present the results of the data analysis conducted using the software R Studio. I then provide the description and results of a summary of the interviews I conducted with experts from the industry that complement the information collected from the data analysis.

7.1. Results from Estimation

Table 6 displays the results for a fixed effects model that was specified in the previous section.

Table 6: Results from Analysis

<table>
<thead>
<tr>
<th></th>
<th>Profit Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constants</strong></td>
<td></td>
</tr>
<tr>
<td>Bell</td>
<td>53.35***</td>
</tr>
<tr>
<td></td>
<td>(22.18)</td>
</tr>
<tr>
<td>Rogers</td>
<td>59.00***</td>
</tr>
<tr>
<td></td>
<td>(24.69)</td>
</tr>
<tr>
<td>TELUS</td>
<td>53.13***</td>
</tr>
<tr>
<td></td>
<td>(26.00)</td>
</tr>
<tr>
<td><strong>ARPU Rate</strong></td>
<td>0.20*</td>
</tr>
<tr>
<td></td>
<td>(1.76)</td>
</tr>
<tr>
<td><strong>CHURN Rate</strong></td>
<td>-7.47***</td>
</tr>
<tr>
<td></td>
<td>(-5.34)</td>
</tr>
<tr>
<td><strong>Cap Int</strong></td>
<td>-0.24*</td>
</tr>
<tr>
<td></td>
<td>(-1.85)</td>
</tr>
<tr>
<td><strong>DAuction</strong></td>
<td>-2.59**</td>
</tr>
<tr>
<td></td>
<td>(-2.47)</td>
</tr>
<tr>
<td><strong>Number of</strong></td>
<td>90</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Adjusted R^2</strong></td>
<td>0.28</td>
</tr>
<tr>
<td><strong>LM serial</strong></td>
<td>51.19</td>
</tr>
<tr>
<td><strong>correlation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>LM</strong></td>
<td>2.87</td>
</tr>
<tr>
<td><strong>heteroskedasticity</strong></td>
<td></td>
</tr>
</tbody>
</table>

Absolute t-values in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%
Growth Rate of ARPU (ARPURate)

The positive relationship indicates that increased revenue per subscriber of wireless services adds to the service providers’ profit margin. The estimate for the co-efficient is significant at 10% confidence level. This estimate indicates that for a 1 percentage point increase in the growth rate of ARPU every quarter will increase the profit margin of the service provider by 0.2 percentage points in that quarter. The implication is that service providers may have an incentive to charge higher prices to increase their profit margin.

The Competition Bureau (2014) estimated that more competition in the retail mobile wireless services markets would increase consumer surplus in Canada by approximately CDN $1 billion per year. This would arise out of a higher number of wireless subscribers and a reduction in incumbent providers’ average price by approximately 2%. The finding of this analysis is crucial as it demonstrates a positive relationship of average revenue per subscriber with high profit margins. This also supports the thesis that consumer surplus is lost due to higher prices driven by the providers’ profit motive.

Churn Rate (CHURNRate)

The strong negative relationship indicates that when their postpaid subscribers move to a competing service provider, profitability declines. The estimated coefficient indicates that a 1 percentage point increase in the churn rate in any given quarter would result in a 7.47 percentage point decrease in their profit margin. This could be an indication that postpaid customers are locked into their contracts with these providers. It is in the interest of the service providers to hold on to these customers and keep churn rates low. This could be achieved by preventing the mobility of these customers to switch between the national service providers as well as erecting high barriers to entry to deter any potential entrants. Customer mobility could be reduced by changing contract terms. One such example would be to offer the device at a reduced price but penalizing early termination of contract by requiring the customer to repay the discount they
received. High entry barriers in the form of higher wholesale access rates for MVNOs would stifle competing offerings. The estimated co-efficient is significant at 1% confidence level.

This is crucial for this policy problem, as it indicates that the national service providers may engage in deterring competition by reducing consumer mobility. The Competition Bureau maintains that the reason supra-competitive prices are effective is because consumers are not responsive to the prices. The low responsiveness or the price inelasticity is demonstrated by consumers not switching to another service provider even after the high prices they currently pay.

This can also be an indicator of coordinated conduct between these three national service providers to reduce churn rates. The coordinated conduct would be in the form of price coordination between the providers. However, with the advent of the Wireless Code, consumers now have slightly increased mobility due to reduction in contract periods from three to two years. The effect of churn rate on profit margins can motivate the providers to extend their coverage to include consumers in underserved areas. This can offset the loss of subscribers in the more densely populated areas where more competitors operate.

**Capital Intensity (CapInt)**

The national providers in consideration are all facilities-based providers. The negative relationship for the fixed effects model indicates that investment in their facilities/infrastructure would result in a decrease in profit margin. The estimated co-efficient is significant at 10% significance level, with a value of -0.24. This means that a 1 percentage point increase in capital intensity will decrease the profit margin by 0.24 percentage points. This provides some support to the argument by the service providers that mandating access for smaller service providers to their own networks will reduce their incentive to invest in their own infrastructure. There may be a lagged positive effect on
profitability in the longer run. However, the speculation about the long term effect cannot be confirmed as the data is only available for 2012-2018.

**Dummy Auction (DAuction)**

This variable is a dummy variable, taking on a value of 1 for the time period where the service provider successful bids in a wireless spectrum auction, and 0 otherwise. There is a negative relationship between a successful auction and the profit margin. This is significant at 5% confidence level, with an estimated coefficient of -2.59. This negative relationship indicates that when firms successfully bid and acquire spectrum licenses, they experienced a decline in their profitability by 2.59 percentage points. The fact that the spectrum is costly and that service providers buy a large number of licenses can have an adverse effect on profit margin. This also implies that there may be a lagged positive impact of acquiring these licenses. In other words, profit margin may increase in the long run after deployment. There are varying deployment periods ranging from 5 to 20 years depending on the conditions set by ISED. However, the speculation about the long term effect cannot be confirmed as the data is only available for 2012-2018. In the Spectrum Outlook (ISED, 2018b), ISED mentions the next bands that will be auctioned over the next couple of years. Service providers will compete in acquiring these licenses and this will have an impact on their profit margin as illustrate by this finding. The providers who will be successful in acquiring these licenses will experience a decrease in their profit margin and may resort to increasing their average revenue from subscribers (ARPU) to maintain their high margins in the short run.

The results of the data analysis indicate that the churn rate has the most important effect on determining the service providers profit margin compared to the other explanatory variables. Acquiring successful bids at the wireless spectrum auctions come in second, followed by the percentage change in ARPU and the capital intensity. While there are concerns that the fixed effects model is not sufficiently robust, these variables are important in determining the profit margin. For this analysis, the adjusted R squared equals 0.28. This means that
28 percent of the variation in profit margins can be explained by these explanatory variables. The test statistics for serial correlation and heteroskedasticity indicate that there is a presence of both serial correlation and heteroskedasticity. In the presence of these, I used the model proposed by Driscoll and Kraay (1998) which computes robust standard errors for panel data models. This approach corrects for autocorrelation as well as heteroskedasticity simultaneously.

I recognize that the predictive power of this model could be improved if there were more variables and a larger time period, but the data was unavailable. For an in-depth analysis, including more providers, adding province level data to distinguish between national and regional providers and a larger time period would result in more robust results.

7.2. Qualitative Methodology

As the secondary methodology for this study, I conducted five semi-structured interviews with individuals who are experts in the field of telecommunications, through work experience, research experience or both. The interviews lasted between 30 minutes and 1 hour. I did not record these interviews using a voice recorder. Selected interview questions are listed in Table 5. I used these interviews to understand the importance of the independent variables identified in the previous section.

During the interviews, I asked the respondents whether the current market for wireless services were competitive or not. I inquired about any geographical difference in prices paid by consumers for the same wireless plan. I questioned the respondents on the effect of the introduction of the Wireless Code and the use of spectrum auctions. I ended the discussion by asking them of their expert opinion on alternative spectrum arrangements and updating the wireless code. The profile of the interviewees are as follows:
1. John Lawford, the Executive Director and General Counsel for the Public Interest Advocacy Centre (PIAC).

2. A high-ranking representative of the telecommunications industry, referred to as Participant 2.


4. An analyst with extensive work experience in designing spectrum policy, referred to as Participant 4.

5. Professor Dwayne Winseck, School of Journalism and Communication, Carleton University and Director of the Canadian Media Concentration Research Project.

Table 7: Selected Interview Questions for Participants

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Is the current market for wireless services in Canada competitive or not competitive?</td>
</tr>
<tr>
<td>2.</td>
<td>Is there a difference in the prices paid by consumers for the same wireless plan by geographical location?</td>
</tr>
<tr>
<td>3.</td>
<td>Do you agree or disagree that the current regulations are sufficient to ensure competition in the market for wireless services?</td>
</tr>
<tr>
<td>4.</td>
<td>Is the Wireless Code having a positive or a negative impact on consumers?</td>
</tr>
<tr>
<td>5.</td>
<td>Are spectrum auctions an efficient way to ensure competition in the wireless market? If yes, why? If no, what would be the alternative(s)?</td>
</tr>
</tbody>
</table>

The next section presents the analysis of these informational interviews.
7.3. **Interview Results**

The interviews complement the information gathered from the statistical analysis. The purpose of these interviews is to identify the relevant factors that contribute to the policy problem identified in previous sections.

### 7.3.1. Competition and Prices

Participant 2 and Mr. Goldberg both state that there is sufficient competition as there are strong regional players alongside the national providers. Participant 2 argues that there is no specific number of providers that would deem the market competitive, and says that there can be only three to four economically viable players in the market, as is the case in the United States. Mr. Goldberg is critical of the notion of having a fourth national player, and points to sufficient and strong regional competition in provinces such as Quebec, Saskatchewan, Manitoba and Western Canada for the three national providers. Participant 4 however, states that the market is concentrated, and would be better described as an oligopoly, with market leaders that dictate the market conditions.

Mr. Lawford argues that markets for wireless services function better in areas where there are strong regional players. He states that the national providers collectively control the whole market. He points to Videotron in Quebec and EastLink for Atlantic Canada. This behavior is also seen in dense urban centers where there is a threat of loss of market share for the national providers. Low churn rates are a constraint for the providers to gain more market share as suggested by participant 2. Mr. Lawford, argues that it is rather an indication of consumer inertia. Prof. Winseck points to the quantitative indicators such as the concentration ratio and the Herfindahl-Hirschman Index (HHI) that exhibit extremely concentrated national and regional markets. He points to Quebec as the only exception to this. Videotron has provided an interesting dynamic by
operating as the fourth player in the market in Quebec. Prof. Winseck states that there are high levels of diagonal and vertical integration in the telecommunications industry, which is evident in the profit margins for wireless services. He suggests that analyzing all the segments of the telecommunications industry would provide greater evidence of concentration.

Mr. Lawford argues that competition could be increased through the presence of MVNOS as has been the case in Europe. He states that a CRTC hearing regarding mandating access to MVNOs to the facilities of the national providers may take place in Spring 2019. Participant 4 also agrees that mandated access to MVNOs would increase their access and increase competition. Participant 2 disagrees and concludes that such legislation would have a devastating effect on the industry by reducing the incentive to invest for the national providers.

While all participants agreed that there are variations in prices across Canada, there were different rationales provided. Participant 2 states that prices in Canada are in line with the quality of service that Canadians get with the fastest network in the G7 and fourth fastest in the world. This validates the higher price, as it is reflective of the massive investment in the infrastructure. The price differences across Canada are thus predictable and not unusual. Mr. Goldberg argues that price differentials are actually an indication of competition and behavioral responses of the consumers. Participant 4 says that in addition to the differences in prices, there are also differences in the quality of service received by the consumers across Canada.

To answer if there are price variations, Prof. Winseck points to the example of Manitoba Telecom Services (MTS) which was recently acquired by Bell. MTS has just phased out unlimited service offerings. This, he argues is a display of market power of the providers as they are setting prices above what existed before the consolidation. He points to section 36 of the Charter of the Canadian Charter of Rights and Freedoms that necessitate the provision of equal opportunities to all Canadians across Canada. He alleges that that the current
state of the wireless services market fails to uphold this as there are clear
differences in quality of service and access.

It was not possible to conduct an empirical analysis for the differences in
quality of service and prices across different regions as the data was not
available. However, all interview participants concluded that there are marked
differences between different regions. Generally, Quebec, Saskatchewan and
Manitoba were illustrated as areas with strong regional players and lower prices.

7.3.2. Regulatory Environment

Participant 2, Mr. Lawford and Participant 4 agree that the Wireless Code
has a positive impact for the consumers. These benefits are in the form of
reduced bill shocks, lower fees and reduction in contract terms for subsidized
handsets. Participant 2 indicates that the service providers did have an internal
voluntary code before the Wireless Code came into effect. Thus it was a
duplication of efforts. Mr. Goldberg states that the current environment is
excessively regulatory. He cautions against the unintended consequences of
regulation, arguing that that the Wireless Code is costly for both consumers and
service providers.

Both Participant 2 and Mr. Goldberg mentioned that the reduction in
contract terms from three years to two years, made amortization difficult for the
service providers. This meant that the costs were passed on to the customers in
the form of increased prices. Mr. Lawford and Prof. Winseck however argue that
this has enabled consumers to switch providers faster and has given them more
certainty and choice. Mr. Lawford points to the recent hearings on sales practices
of service providers and concludes that wireless services are shielded from these
activities due to the Wireless Code. Participant 4 cautions that increasing the
number of regulations do not necessarily translate to increased competition.
Despite the progress made so far, the number of players in the market is still low
according to Participant 4. However, Participant 4 points towards new regulatory
changes such as the adoption of the Wireless Code that has positive effect on the consumers. Participant 4 concludes that the current regulatory framework is designed to ensure free and fair competition, albeit with limited success.

Prof. Winseck argues that the regulatory efforts are not sufficient to increase competition in the wireless services market. He argues that CRTC places too much emphasis on the 2006 directive and refrains from introducing new regulations. He identifies this as a severe constraint and proposes that the role of the regulators be entrenched in the legislation. This is important as the market mechanism will not ensure the delivery of the socially desirable mix of services. He recommends that the regulator build a robust tool kit to reign in the market power of the national service providers and not shy away from using them.

### 7.3.3. Spectrum Allocation

According to Mr. Lawford, the spectrum auctions should be designed to exclude the national providers as they already possess a majority of the spectrum. He also adds that as there is a network sharing agreement between Bell and Telus, any spectrum gained by either provider effectively serves them both. This acts to embed their market power. Participant 2 states that spectrum auctions are the appropriate course of action, as long as there are given sets of rules. Participant 2 also argues that the use of set-asides is inefficient as there is no open competition. Church and Wilkins (2014) argue that it is likely that there will be minimal bidding competition for the set-aside spectrum. Hyndman and Parmeter (2015) find that the use of set-asides in the 2008 AWS auction let to a total profit loss of 10%.

Participant 2 is critical of the set-asides as they suppress the prices of the spectrum by distorting the market. This leads to loss of revenue for the government, which is deemed as inefficient. Winners of set-asides may fail, and end up transferring their licenses as they lack the facilities to provide the
services. This is counterintuitive to the intention of the set-aside. Mr. Goldberg sees set-asides as subsidies to the smaller service providers. He argues that these small providers do not necessarily require these provisions. Participant 2 also argues that many such small providers are companies with high market capitalization and should not be considered for set-asides. Participant 4 says that it is very difficult to conclude if set-asides are the most efficient way of encouraging participation of the smaller service providers. Participant 4 believes that there are no better alternatives to the auctions to allocate the spectrum as of now.

Both Participant 2 and Mr. Goldberg argue that the objectives of the spectrum auctions have not been consistent. They are unsure if the objective is to create a fourth player in every region, or to provide higher quality, universal service all Canadians, or to simply provide cheaper service. Mr. Lawford proposes that rural connectivity should be one of the objectives of the spectrum policy. So far, it has not been a priority for providers as it is costly with low pay-offs. Mr. Goldberg argues that if the spectrum blocks were divided differently, rural connectivity could be achieved.

Prof. Winseck makes the point that while set-asides have been somewhat successful. He argues that the set-asides have to be sensitized to make it easier for smaller service providers to acquire smaller license areas. Currently, these providers have to compete with the large national or regional providers to acquire licenses that lump together both dense, urban and remote, rural areas. He argues that this model short-changes the sparsely populated communities by benefiting the densely populated ones. This form of licensing service areas is negatively affecting the smaller providers as it restricts the supply of spectrum. He recommends creating smaller license areas that will separate the urbanized areas from the rural ones. This he argues would enable smaller local providers to provide service to the rural, remote communities. He points to Tbaytel, a municipally owned telecommunications company in Thunder Bay, Ontario, which provides service to Northern Ontario as an admirable example of a local provider.
In summary, the analysis of the interview and data indicate two major issues. The first is the low churn rate for consumers which indicate low consumer mobility and high profits for providers. The second is the structure of the regulatory regime that leads to unutilized spectrum and poor coverage. In the next part, policy options are presented to address these two major issues by priority. They are then analysed and ranked by how well they satisfy the criteria.
Chapter 8. Policy Objectives, Criteria, and Measures

The overarching objective is to ensure universal access to wireless services for all Canadians. This means that all Canadians must have access to reliable, affordable and high quality services in both urban and rural areas in all regions of Canada. This is achieved by increasing efficiency and consumer choice. Greater efficiency would enable the service providers to serve their customers better, lower costs and increase profits through the adoption of improved technology. Efficiency also increases through the complete utilization of all spectrum licenses that are held by service providers. Increased consumer choice will increase their welfare and directly address the policy problem.

The policy options introduced in the following sub-sections can be implemented fully in the short run. This means that full implementation will be achieved in three to five years. These options will not require any modification once they are initially implemented. Thus, it is expected that the performance of a specific policy option for the entire implementation period would be the same year to year. While there are short and long term goals for these policy options, I only consider the short term in analyzing the performance using the criteria discussed in the next section. This helps me identify the option that has the best performance in the first year, which is consistent for the remaining implementation period. The options will be evaluated on the basis of their ability to satisfy these objectives in the short run as their long-term implications could be nullified if they are not initially effective.
8.1. Criteria and Measures for Policy Analysis

The policy options are compared based on seven criteria that measure equity, consumer choice, efficiency, administrative feasibility, cost to government and stakeholder acceptance. Each criterion is given a specific measure, or a number of measures to determine the extent to which it meets the objective. Each of the criteria is scored on a scale of Low (1), Medium (2), and High (3). Measures for each level for the criteria are described below. For criteria with several measures, the average of the scores are used as they are given equal weight. This analysis is undertaken to identify the policy option that best addresses the policy problem. Table 8 summarizes the criteria, their definitions, the measures and the benchmark.

Regarding Equity, it is evaluated by the access of consumers of wireless services in the underserved areas to these services. It is measured by the percentage increase in the number of subscribers from underserved areas following the policy implementation. An increase of less than 5% will receive a low score (1). This is based on the current growth rate of national wireless subscribers, which is 3.30%. An increase between 5% and 10% inclusive, receives a medium score (2). An increase in number of subscribers from underserved areas by more than 10% can result in a high score (3) as it would be three times the current growth rate.

For Consumer Choice, the criterion analyzes the level of choice consumers have in selecting a service provider. This is measured using churn rates. A churn rate greater than 2% (above the current maximum churn rate) gets a high score (3), as it would indicate increased choice and mobility. A churn rate between 1.5% to 2 % inclusive has a medium score (2). A churn rate less than 1.5% results in a low score (1). This is because it is close to the current average, thus indicating minimal effect on consumer choice.
Two criteria evaluate *Efficiency*. First, higher investment made in new physical infrastructure to support improved technology will indicate greater efficiency. This is measured by capital intensity. Capital intensity levels greater than 22%, which is the maximum level of capital intensity in the panel dataset, will result in a high score (3). Capital Intensity levels less than 12% will receive a low score (1) as it is the current average. Capital intensity levels between 12% and 22% inclusive will receive a medium score (2). The second criterion to evaluate *Efficiency* is the increase in the use of licensed spectrum through faster deployment. If less than 30% of the spectrum is deployed following the policy implementation, then it receives a low score (1). This is based on the finding that approximately 29% of the licenses in the 700 MHz are undeployed (Joseph, 2018). If the percentage of spectrum deployed is between 30% and 60% inclusive, then it receives a medium score (2). If the percentage of spectrum deployed is greater than 60% then it receives a high score (3), as it is double the current deployment rate.

For *Administrative Feasibility*, the criterion focuses on evaluating the extent of regulatory changes required to adopt the policy option. If it is possible to implement the option within the current regulatory framework, it receives a high score (3). If the implementation requires some amendment to the framework, it receives a medium score (2). If a new regulatory framework is required, then it receives a low score (1).

For *Budgetary Impact* of the policy option, it is difficult to calculate the exact dollar figure that would constitute as low, medium, or high impact. This is due to a lack of data and prior research in this domain. The criterion used is the annual net spending by ISED on their Spectrum, Telecommunications and the Digital Economy program (renamed as Spectrum and Telecommunications Program in 2018-19). The benchmarks are created based on their net spending for the period 2013-14 to 2017-18. If the net spending is less than $113 million per year, it receives a high score (3). The rationale is that the policy does not result in additional cost to ISED as the net spending for this program in 2017-18
was $113 million. If the net spending is more than $124 million per year it receives a low score (1). This is approximately a 10% increase from the current level, and is the highest net spending in the last five years. If the net spending is between $113 million and $124 million, it receives a medium (2) score.

Finally, *Stakeholder Acceptance* indicates the percentage of support from each of two major stakeholders, the consumers and the service providers. A two-thirds majority rule is applied here to determine the performance of the option. ISED can conduct surveys of the providers and the consumers through the PIAC and the CWTA during the consultation phase. If over 67% of the consumers support the option, the score is high (3). If between 50% and 67% of the consumers support the option, the score is medium (2). If less than 50% of the consumers support the option, the score is low (1). The same benchmarks are used for evaluating the support of the providers.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Measure</th>
<th>Benchmark</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Equity</td>
<td>Increase access to wireless services for consumers in underserved areas</td>
<td>Percentage increase in number of wireless subscribers from underserved areas</td>
<td>Growth of subscribers &gt; 10%</td>
<td>High =3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5% ≤ Growth of subscribers ≤ 10%</td>
<td>Medium=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Growth of subscribers &lt; 5%</td>
<td>Low=1</td>
</tr>
<tr>
<td>Consumer Choice</td>
<td>Increase consumers’ choice and mobility with regards to the wireless service provider</td>
<td>Churn rate</td>
<td>Churn Rate &gt; 2.0%</td>
<td>High =3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.5% ≤ Churn Rate ≤ 2.0%</td>
<td>Medium=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Churn Rate &lt; 1.5%</td>
<td>Low=1</td>
</tr>
<tr>
<td>Efficiency</td>
<td>Investment made in new physical infrastructure to support improved technology</td>
<td>Capital Intensity (expenditure on capital as a share of total revenue)</td>
<td>Capital Intensity &gt; 22%</td>
<td>High =3</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>12% ≤ Capital Intensity ≤ 22%</td>
<td>Medium=2</td>
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<td></td>
<td></td>
<td>Capital Intensity &lt; 12%</td>
<td>Low=1</td>
</tr>
<tr>
<td></td>
<td>Increase the use of licensed spectrum through faster deployment</td>
<td>Percentage of spectrum licenses deployed by each licensee</td>
<td>Percentage deployed &gt; 60%</td>
<td>High =3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30% ≤ Percentage deployed ≤ 60%</td>
<td>Medium=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Percentage deployed &lt; 30%</td>
<td>Low=1</td>
</tr>
<tr>
<td>Administrative Feasibility</td>
<td>Reduce the need for new regulations</td>
<td>Extent of regulatory changes needed to adopt the policy option</td>
<td>Within current regulatory framework</td>
<td>High =3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Requires amendment to the framework</td>
<td>Medium=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Requires new regulatory framework</td>
<td>Low=1</td>
</tr>
<tr>
<td><strong>Budgetary Impact</strong></td>
<td>Minimize annual net spending by ISED to implement each option</td>
<td>Annual net spending by ISED to implement each option</td>
<td>Annual net spending &lt; $113 million $113 million &lt; Annual net spending &lt; $124 million Annual net spending &gt; $124 million</td>
<td>High =3 Medium=2 Low=1</td>
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</tr>
<tr>
<td><strong>Stakeholder Acceptance</strong></td>
<td>Whether consumers accept the proposed policy option</td>
<td>Percentage of consumers that support the option</td>
<td>More than 67% of the consumers support Between 50% and 67% of the consumers support Less than 50% of the consumers support</td>
<td>High =3 Medium=2 Low=1</td>
</tr>
<tr>
<td>Whether producers accept the proposed policy option</td>
<td>Percentage of producers that support the option</td>
<td>More than 67% of the producers support Between 50% and 67% of the producers support Less than 50% of the producers support</td>
<td>High =3 Medium=2 Low=1</td>
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8.2. Policy Options

Policy alternatives are designed from the problems identified earlier. For the purpose of this analysis, the following options are analysed independently to determine which alternative is the best addition to the current regulatory regime to address the policy problem.

8.2.1. Option 1: Secondary Market Mechanisms

Unutilized spectrum and poor coverage are linked to low churn rates for consumers. A well-functioning system of secondary markets would address these problems. It will encourage licensees to be more efficient by trading their rights to unused spectrum capacity, either leasing it temporarily, or on a longer-term basis, or selling their rights to unused spectrum at the discretion of the providers. This will allow the market to allocate spectrum from areas of low demand to high demand. Consumers in underserved areas would benefit from increased wireless connectivity and choice. Developing a secondary market by creating the appropriate set of rules would benefit all stakeholders.

The Fall 2018 Auditor General Report on rural connectivity found that there does not exist a well-functioning market for smaller internet service providers to sub-license unused spectrum from license holders as third-party licenses (Office of the Auditor General, 2018). As of June 2018, the national providers held 1,351 spectrum licenses that could potentially be sub-licensed. Only 108 out of these 1,351 licenses, or approximately 8 percent were subordinated to regional and smaller service providers. Joseph (2018) finds that spectrum has been concentrated in the hands of large players and usage of spectrum is low outside of urban areas. While there is an established framework relating to transfers, divisions and subordinate licensing of spectrum licenses for
commercial mobile spectrum, it was last updated in 2013 (Industry Canada, 2013) and has a low uptake.

ISED will need to ensure that the design of the secondary market actually encourages the deployment of the unused spectrum. The current licensing procedure for spectrum licenses state that the review period will be at least 12 weeks or longer. The most recent transfer that ISED approved for spectrum licenses held by Telus to SaskTel took over 16 weeks. This option will streamline the approval process so that the leases or transfers between providers will take place faster. While there is the risk of anti-competitive behavior that could arise out of the development of a secondary market, ISED, CRTC and Competition Bureau can create appropriate guidelines that will prohibit such behavior. They can look to their contemporaries in the US, to identify the best practices (see Appendix C).

8.2.2. Option 2: Tier 5 Service Areas

Tier 5 service area licenses will ensure that service providers work with smaller geographical areas, instead of allocating large regional portions to the successful bidders. This will allow small service providers who are already operational in these areas to successfully bid in the spectrum auctions. This will reduce the number of un-deployed licenses. This will also create more competition in the regional areas as service providers will have to compete for a higher number of licenses if they want to retain their dominance. This will be beneficial for rural and remote areas as it will uncouple dense urban areas from these service areas. This can increase the number of providers in those areas after deployment and promote competition in the market. Churn rates are therefore expected to increase. Resulting price wars to retain existing and attract new subscribers can benefit the consumers by increasing their consumer surplus. However, Competition Bureau will need to prevent national providers
from engaging in predatory pricing and other anti-competitive behavior that can push smaller providers out of the market. ISED has recently announced their consultation framework on the creation of Tier 5 service areas (ISED, 2018a) to address these concerns.

Rural areas tend to be underserved because of low density leading to low demand and high setup costs. Thus, it is difficult to meet the universal objective of high quality, affordable service to all Canadians. This issue is compounded by the definition of service areas for spectrum licenses. Tier 1 and Tier 2 are dominated by the national service providers. Even with set asides, it is difficult for small service providers to acquire spectrum for these tiers. Also, the cost of deployment for such a large geographical area is immense for these small providers. This is why dividing the service areas into smaller sections will allow the small providers to successfully bid and acquire licenses. In addition, the price of the spectrum license is based on the population in the coverage area. However, the national and regional providers may not have the incentive to bid for Tier 5 service areas licenses as the opportunity cost may outweigh the benefits of acquiring additional spectrum for small, remote areas. This will encourage small providers to participate, increasing spectrum utilization and churn rates.

**8.2.3. Option 3: ‘Use it or lose it’ spectrum licenses**

This option addresses the issue of undeployed spectrum and low churn rates for consumers. The deployment period for low-density areas is longer in contrast to the shorter period for high-density areas. This provides a perverse incentive to discriminate against the rural consumer to benefit the urban consumer. The ‘use it or lose it’ approach punishes non-deployment by revoking the usage rights from the licensees in the event of a failure to deploy. Revoking the licenses mean that the cost of acquiring the spectrum would not be recouped.
This can provide motivation to the service providers to deploy their spectrum faster, increasing consumer choice and churn rate. If they do not deploy, they will have to relinquish their spectrum usages rights. In Canada to date, no licensee had their rights revoked because of non-compliance with deployment conditions.

Current compliance and enforcement measures include warnings, monetary penalties, legal action, license amendments or suspensions. These would still be preserved under the ‘use it or lose it’ approach, but will require stricter enforcement. For the 600 MHz auction in March 2019, the deployment requirement states that licensees’ will be reviewed at the end of year 5, year 10 and year 20 to assess whether their spectrum has been utilized. The ‘use it or lose it’ approach will initiate such reviews half-way through the period. This would mean the reviews are conducted after year 2, in year 5 and in year 10. Service providers will have sufficient time to take action and deploy their unused spectrum. Failure to do so, would result in a loss of licenses.

Thus, generally, the first option develops a well-functioning secondary market for unused spectrum. The second one creates a new smaller set of service areas for spectrum licensing called Tier 5. And the last one proposes adopting a ‘use it or lose it’ approach for spectrum licenses. Next is the evaluation of the performance of these policy options based on the given criteria.
Chapter 9. Analysis of Policy Options

In this chapter each policy option is evaluated based on all the criteria. The analysis for each policy option is presented in individual sub-sections. The results of the analysis are in Table 9. The recommendation follows the analysis.

9.1. Option 1: Secondary Market Mechanisms

*Equity:* This option is expected to increase access to wireless services for consumers in underserved areas. Service providers who want to serve consumers will seek out the corresponding spectrum licenses from the sellers in the secondary market. This demand for spectrum licenses will be satisfied by those service providers who were unable to deploy that spectrum after acquiring them. The score is high (3).

*Consumer choice:* The secondary market through the sale and lease of the unused spectrum will allow more service providers to enter the market as they will have increased access to spectrum. It could be in the form of new providers, or expansion of the existing small providers or both. This will increase consumer choice and increase the churn rates as consumers will be more mobile between providers. The score is high (3).

*Efficiency:* There will be an increase in the service providers’ investment in physical infrastructure as there will be revenue generated from the sale/lease of their undeployed spectrum. This source of revenue will be welcomed by the providers as they need to invest in infrastructure for adopting 5G technology. The score is high (3). Regarding the deployment of spectrum, there will be an increase in the spectrum utilization rates as the market will reallocate them better. The score is high (3).
**Administrative Feasibility:** The development of a secondary market will require a new regulatory framework. A high degree of coordination between ISED, CRTC and Competition Bureau is necessary in creating this new regulatory regime. This makes implementation very difficult. The score is low (1).

**Budgetary Impact:** There will be substantial costs associated with this policy option. The annual net spending by ISED will increase by more than $124 million. There will be a need to create a new sub-division to oversee the secondary market mechanisms. This will require hiring of new personnel to staff the sub-division. The score is low (1).

**Stakeholder Acceptance:** More than two-thirds of the consumers will support this option as this will create competition and may reduce the prices they pay. The score is high (3). Similarly, more than two-thirds of the service providers will support this option. This is because it is not mandatory and allows them to reduce their cost by leasing the undeployed spectrum at their discretion. The score is high (3).

### 9.2. Option 2: Tier 5 Service Areas

**Equity:** This option will also increase the access to wireless services for consumers in underserved areas. Smaller providers will buy the licenses for rural and remote areas instead of competing with larger providers to acquire regional licenses. This works to ensure that consumers in underserved areas have the choice of high quality wireless services. In addition, this option can be expected to take effect as soon as the technical framework for the next auction is announced. The score is high (3).
Consumer choice: If smaller service providers acquire licenses in tier 5 service areas, the consumers have greater choice in choosing their provider. The churn rate for the incumbents will increase due to increased competition from new entrants. This can lead to lower prices and better service quality as incumbents attempt to retain their customers. The score is high (3).

Efficiency: Tier 5 license areas will separate the dense, urban areas from the less dense, rural and remote areas. As a result, the national providers would be able to focus solely on providing services to the urban areas. This will increase capital intensity to increase the coverage in the urban areas, or to improve service quality or both as the national providers will have to invest heavily in new physical infrastructure. The new entrants and the small providers who successfully bid on Tier 5 licenses will also have to invest in developing the infrastructure. The score is medium (2). With regard to the spectrum utilization rates, the providers who acquire these tier 5 service area licenses will deploy them to enter and/or to retain control the market. The score is high (3).

Administrative Feasibility: This option requires some amendment to the regulatory framework. The new tier could be introduced in the forthcoming technical auction framework. ISED has already launched their consultation for Tier 5 service areas in November 2018. This is indicative of the high feasibility of this option. The score is medium (2).

Budgetary Impact: It is expected to have very low budgetary impact. This is because ISED has already launched consultation for Tier 5 service areas. Thus the cost of this consultation process has already been accounted for in the budget. The score is high (3).

Stakeholder Acceptance: Consumers are likely to support this option as it can increase their choice and subsequently their welfare. It can be expected that over two-thirds of the consumers will support the option. The score is high (3). National service providers and some regional service providers will resist this policy option to prevent loss of market share. Smaller service providers are
expected to support this option. This can result in between 50% and 67% of the providers supporting this option. The score is medium (2).

9.3. Option 3: ‘Use it or lose it’ spectrum licenses

*Equity:* There is uncertainty regarding the effect on equity for this option. To capitalize on their investment and increase market share, some providers will choose to deploy the unused spectrum. Other providers may elect to suffer the loss of spectrum rights to avoid the cost of deployment. The net effect on the access to wireless services for underserved areas will depend on the strength of these two opposing forces. My prediction is that most providers will be unwilling to lose their rights, and deploy the unused spectrum. The score is medium (2).

*Consumer choice:* If producers deploy the spectrum within the license period to adhere to the condition of ‘use it or lose it’, then consumers will have increased choice. If producers choose to lose their usage rights, then consumers will lose out. It is predicted that the number of producers who choose to deploy will be greater than those who will not. The score is medium (2).

*Efficiency:* There can be unintended consequences of revoking the spectrum usage rights. Providers may attempt to recoup their loss by rolling back on future investment in the facilities. This will reduce their capital intensity and reduce their ability to adopt improved technology. The score is low (1). Additionally, if the loss of spectrum usage rights is greater than the additional spectrum deployed due to the adoption of this option, it will reduce the spectrum utilization rates. The score is low (1).

*Administrative feasibility:* This option requires a small number of regulatory changes and can be implemented in the forthcoming auctions. However, it will need significant monitoring and enforcement measures from the regulator. As a result, I give it a medium (2) score.
**Budgetary Impact:** For this option, there will be some impact on the budget. As the option required strong monitoring and enforcement efforts, it will increase the net spending by ISED over the current amounts. It is expected to be more than $113 million but less than $124 million. The score is medium (2).

**Stakeholder Acceptance:** Consumers are likely to support this if they perceive it as an attempt to increase their choice and affordability. However, consumers will also worry about losing their services if the licenses for service providers in their area are revoked. Thus, between 50% and 67% of the consumers will support this option. The score is medium (2). Service providers will strongly oppose this option as they might perceive this as unnecessarily punitive. The score is low (1).

The table below summarizes the outcomes of the analysis. It is evident from the table that the option to create a new set of smaller service areas for spectrum licensing outperforms the other options. The next section discusses the policy recommendations.
Table 9: Analysis of Policy Options

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Secondary market mechanisms</th>
<th>Tier 5 Service areas</th>
<th>Use it or lose it licenses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity</strong></td>
<td>Increase access to wireless services for consumers in underserved areas</td>
<td>H (3)</td>
<td>H (3)</td>
<td>M (2)</td>
</tr>
<tr>
<td><strong>Consumer Choice</strong></td>
<td>Increase consumers’ choice and mobility with regards to the wireless service provider</td>
<td>H (3)</td>
<td>H (3)</td>
<td>M (2)</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>Investment made in new physical infrastructure to support improved technology</td>
<td>H (3)</td>
<td>M (2)</td>
<td>L (1)</td>
</tr>
<tr>
<td></td>
<td>Increase the use of licensed spectrum through faster deployment</td>
<td>H (3)</td>
<td>H (3)</td>
<td>L (1)</td>
</tr>
<tr>
<td><strong>Administrative Feasibility</strong></td>
<td>Reduce the need for new regulations</td>
<td>L (1)</td>
<td>M (2)</td>
<td>M (2)</td>
</tr>
<tr>
<td><strong>Budgetary Impact</strong></td>
<td>Minimize annual net spending by ISED to implement each option</td>
<td>L (1)</td>
<td>H (3)</td>
<td>M (2)</td>
</tr>
<tr>
<td><strong>Stakeholder Acceptance</strong></td>
<td>Whether consumers accept the proposed policy option</td>
<td>H (3)</td>
<td>H (3)</td>
<td>M (2)</td>
</tr>
<tr>
<td></td>
<td>Whether providers accept the proposed policy option</td>
<td>H(3)</td>
<td>M (2)</td>
<td>L(1)</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td>H (3)</td>
<td>H-M (2.5)</td>
<td>L (1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>14</td>
<td>16</td>
<td>10.5</td>
</tr>
</tbody>
</table>
9.4. Policy Recommendation

I find that the policy to create Tier 5 service areas outperforms the other two options in reducing the loss of consumer surplus due to significant market power of the national service providers. With regards to Equity and Consumer Choice, Tier 5 service areas and secondary market mechanisms perform equally. They both increase access to wireless services for consumers in underserved areas and consumers’ choice and mobility. There were two criteria to evaluate Efficiency: increasing the use of licensed spectrum and increasing investment. Tier 5 service areas outperforms the other options in increasing the spectrum utilization rates. However, it performs moderately with respect to increasing investment in new infrastructure. While secondary market mechanisms increase the capital intensity the most, the average performance of Tier 5 service areas and secondary market mechanisms with regards to Efficiency is comparable.

As ISED has already launched the consultation for Tier 5 service areas, and will need to amend the current regulatory framework, this option is moderately Administratively Feasible. While ‘use it or lose it’ licenses are also moderately feasible, secondary market mechanisms come in last in terms of feasibility. Unlike secondary market mechanisms and ‘use it or lose it’ licenses, the option to implement Tier 5 service areas is expected to have the lowest Budgetary Impact as the cost of this consultation process has already been accounted for in the budget.

Finally, in terms of Stakeholder Acceptance, it is expected that over two-thirds of the consumers will support the creation of Tier 5 service areas. Smaller providers are more likely to support the Tier 5 service areas than the larger providers. This divergence results in lower overall support from all the providers for Tier 5 compared to secondary market mechanisms. However, the average of the support from the two stakeholders is similar for secondary market mechanisms and Tier 5 service areas.
Based on these criteria, Tier 5 service areas comes in at the top, secondary market mechanisms comes in second, and ‘use it or lose it’ approach secures the last position. My recommendation is to employ a sequential implementation system of Tier 5 service areas and secondary market mechanisms. ISED should create tier 5 service areas for spectrum licensing immediately, as it is the clear winner among the three options. Once the technical framework for spectrum auctions in tier 5 license areas have been created, ISED, in collaboration with CRTC and Competition Bureau, should promote the development of a secondary market. This will ensure effective reallocation and distribution of these spectrum licenses if the initial allocation is no longer efficient. Secondary market mechanisms will make the industry more dynamic, responsive and adaptable. See appendix C for additional information on how secondary market mechanisms can be used to achieve this.

Based on the analysis conducted, adopting this sequential system of implementation will establish a coherent framework for regulation of wireless services and resolve the policy problem.
Chapter 10. Conclusion

Canadians rely heavily on the use of wireless services for a range of activities such as banking, education, health, access to government services and entertainment. Thus, improvements in the access to wireless services will enable all Canadians to equally participate in today’s digital economy. This research addresses the policy problem that there is a loss of consumer welfare due to significant market power of the national service providers in the provision of wireless services. I empirically analyze publicly available secondary data from the CRTC and the national providers to identify the factors that contribute to the market power of the national providers. I also conduct expert interviews as part of the secondary methodology to validate the empirical findings. The limitations in this analysis stem from the lack of publicly available data.

Three policy options are developed to address this policy problem. My recommendation is to employ a sequential implementation system of Tier 5 service areas and secondary market mechanisms. ISED should immediately create a new set of smaller, Tier 5 service areas for spectrum licensing. This will be easier to implement as it is cost-effective and administratively feasible. This will increase rural connectivity, consumer choice and increase spectrum utilization rates. Next, ISED, in collaboration with CRTC and Competition Bureau, should promote the development of a secondary market. This will ensure effective reallocation and distribution of these spectrum licenses.

This sequential implementation system will create a coherent framework for regulation of wireless services. It will require commitments by ISED, CRTC and Competition Bureau but it will be successful in increasing consumer welfare by restraining the market power of the national service providers.

The empirical analysis was limited by the lack of data for other service providers, and the small time period in consideration. There is a need to increase
the amount of publicly available data to facilitate more research to understand the wireless services market. A future study that utilizes province level data to distinguish between national and regional providers and factors that contribute to their market power and increases the time period will provide more robust results and result in more effective policies.
References


CRTC. (2014). *Communications Monitoring Report*. Ottawa: CRTC.


Websites consulted


Appendix A

*Winners of Spectrum Auctions in Canada, 1999-2018*

<table>
<thead>
<tr>
<th>Spectrum</th>
<th>Year</th>
<th>Winners</th>
<th>Number of winning bids</th>
<th>Share of winning bids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auction of the 24 and 38 GHz Frequency Bands</td>
<td>1999</td>
<td>Videotron Telecom Ltd</td>
<td>92</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Terago Networks</td>
<td>70</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Norigen Wireless Communications Inc.</td>
<td>37</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AT&amp;T Canada Telecom Services</td>
<td>21</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
<td>40</td>
<td>15%</td>
</tr>
<tr>
<td>Auction of Additional PCS Spectrum in the 2 GHz Frequency Range</td>
<td>2001</td>
<td>Bell</td>
<td>20</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rogers</td>
<td>23</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Telus</td>
<td>5</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>W2N</td>
<td>3</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thunder Bay Telephone</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Auction of the 2300 MHz and 3500 MHz Frequency Bands</td>
<td>2004</td>
<td>Bell Canada</td>
<td>138</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vcom Inc</td>
<td>60</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pathcom Wireless Inc</td>
<td>37</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rogers Wireless</td>
<td>33</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9107-1365 Quebec Inc</td>
<td>19</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Saskatchewan Telecommunications</td>
<td>15</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Telus communications</td>
<td>11</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northwestel Inc.</td>
<td>10</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
<td>69</td>
<td>18%</td>
</tr>
<tr>
<td>Residual License Auction in the 2300 MHz and 3500 MHz Frequency Bands</td>
<td>2004-2005 &amp; 2009</td>
<td>Bell Canada</td>
<td>234</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tele-Mobile Company</td>
<td>131</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4253311 Canada Inc.</td>
<td>88</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rogers Wireless</td>
<td>82</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vcom Inc.</td>
<td>60</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pathcom Wireless Inc</td>
<td>37</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mipps Inc.</td>
<td>35</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>YourLink Inc.</td>
<td>29</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others</td>
<td>156</td>
<td>18%</td>
</tr>
<tr>
<td>Auction of Spectrum Licences for the Advanced Wireless Services (AWS) and other spectrum in the 2</td>
<td>2008</td>
<td>Rogers</td>
<td>59</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Telus</td>
<td>59</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bell Mobility Inc.</td>
<td>54</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Globalive Wireless</td>
<td>30</td>
<td>11%</td>
</tr>
<tr>
<td>GHz Range</td>
<td>2009 Auction for the Spectrum Licences in the Bands 849-51 MHz and 894-96 MHz for Air-Ground Services</td>
<td>2014 Auction for the Spectrum Licences in the 7000 MHz band</td>
<td>2015 Auction of Spectrum Licences for the Advanced Wireless Services in the Bands 1755-1780 MHz and 2155-2180 MHz (AWS-3)</td>
<td>2015 Auction of Spectrum Licences for Broadband Radio Service (BRS):2500-2690 MHz Band</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bragg Communications</td>
<td>SkySurf Canada Communications Inc.</td>
<td>Rogers</td>
<td>Bell Mobility Inc.</td>
<td>Telus Communications Company</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>22</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>7%</td>
<td>100%</td>
<td>23%</td>
<td>33%</td>
<td>38%</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>17</td>
<td>Bell*</td>
<td>Telus*</td>
</tr>
<tr>
<td>61</td>
<td></td>
<td>16</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>22%</td>
<td></td>
<td>7</td>
<td>Videotron</td>
<td>Others</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>7%</td>
<td></td>
<td>7%</td>
</tr>
<tr>
<td>*In addition, Bell and Telus each had 14 unpaired licenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Author, 2019)
Appendix B

I. Tier 4 service areas (British Columbia to Manitoba, including Yukon, Northwest Territories, and Nunavut)

(Industry Canada, 2015)

II. Tier 4 service areas (Ontario to Newfoundland and Labrador)

(Industry Canada, 2015)
Appendix C

Secondary Market for Spectrum Trading

This appendix serves as additional information for the regulator to design a well-functioning secondary market.

Xavier and Ypsilanti (2006) set out a range of tasks for the regulator to regulate spectrum trade. Some of the relevant steps that have not been discussed in the text earlier are discussed below:

i. Revising rules and processes to facilitate transferability of spectrum usage rights,

ii. Minimize transaction costs and time associated with completing agreements for transfer or lease of spectrum usage rights,

iii. Establishing clear and detailed rules for all parties,

iv. Maintaining detailed online registries for trade,

v. Preventing speculative hoarding and avoiding fragmentation of spectrum,

vi. Minimizing administrative overhead and processing time to increase efficiency,

vii. Harmonizing operating rules for similar services to promote spectrum substitutability, and

viii. Enforcing competition rules, detecting and preventing anti-competitive behavior and controlling concentrations of market power.

Mayo and Wallsten (2010) set out the following preconditions for secondary markets for spectrum leasing to be effective:

i. There has to be clearly defined economic rights,

ii. All participants must have complete information on the prices and the spectrum available in the market,
iii. The mechanism of bringing together buyers and sellers to transact should come at a minimum administrative cost and delays,
iv. Both buyers and sellers must have easy entry and exit to this market,
v. There must be many buyers and sellers to create effective competition.

An example of a regulator who has promoted secondary markets is the FCC. Spectrum leasing is part of FCC’s secondary market initiatives introduced in 2003, to remove regulatory barriers and increase access to spectrum. There are two different arrangements for licensees that hold exclusive rights to transfer to third parties. These include spectrum manager leasing and de facto transfer leasing. These can be either a short-term lease (individual or combined term of less than 1 year) or a long term lease (individual or a series of combined terms greater than 1 year). Under spectrum manager leasing, the licensee must retain both de jure control and de facto control over the spectrum that is leased. The term of a lease cannot exceed the term of the license authorization (but can be extended at the time the licensee renews its license authorization). Under de facto transfer leasing, the licensee retains de jure control of the license while transferring de facto control of the leased spectrum and the associated rights to the spectrum lessee for a defined period of time.

There is also scope for a private commons arrangement. In this system, a licensee, spectrum lessee, or spectrum sublessee is permitted to make certain spectrum usage rights available to third-party users employing advanced communications technologies that involve device-to-device communications and do not involve the end-to-end physical network infrastructure of the licensee, spectrum lessee, or spectrum sublessee. The licensee, lessee, or sublessee must act as the manager of the private commons and must retain de facto control of the use of the spectrum by the third-party users. In 2004, the FCC decided to forbear from requiring the leasing parties to provide prior public notice. They also decided to forbear from requiring individual review by the Commission of proposed de facto leasing transfers under certain conditions. Mayo and Wallsten
(2010) summarize the conditions that will prevent forbearance on the part of the FCC:

i. Violations of eligibility and use restrictions,
ii. Foreign ownership,
iii. Transfers by designated entity and entrepreneur licenses,
iv. Harmful to competition, and
v. Any other public interest concerns.

Unless any of the aforementioned conditions are present, the FCC permits immediate approval of the spectrum lease. In the event of one or many of these conditions, the review process is completed within 21 days.

Crocioni (2009) developed a framework that identifies a number of micro factors that can prevent efficient trades in the secondary market from taking place. These factors include high transaction costs, information asymmetries and imperfections, and market power. Transaction costs can be reduced by the regulator by creating a spectrum registry of licensees and introducing rules or undertake policies that facilitate price discovery. An example of the former is the Ofcom’s Spectrum Information Portal, which provides detailed information about spectrum allocation, application details, license details, and license trades. Price discovery will promote more asymmetry in the information that is available to buyers and sellers and reduce the uncertainty around the value of spectrum.

However, price information is not included in the spectrum registries. In this market, both the buyers and the sellers have private information that is not available to the other (Crocioni, 2009). This results in a bilateral monopoly pricing problem. To improve the quantity and quality of information in the market, the regulator can mandate the release of pricing information for spectrum trades (for example, FCC has voluntary price disclosure schemes). Market power of the incumbents can lead to hoarding of the spectrum to control supply of this indispensable input. Crocioni (2009) states that most regulators do not consider this to be an important issue. Cave (2010) proposes a combination of the competition law and spectrum caps as a measure to develop the new secondary
market, create space for new entrants, encourage innovation and counteract the tendency to collude.