Understanding affordability of consumer mobile wireless services in Canada

December 2019
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</table>
Executive summary

In recent years, retail mobile wireless services have become the largest and fastest growing component of telecommunications services in Canada. Between 2010 and 2017, Canadian households’ expenditure on wireless devices and services (“wireless”) increased at a Compounded Annual Growth Rate (“CAGR”) of 7.7%. In the same period, adjusted disposable household income increased for all income quantiles at an annual average growth rate of between 1.6% and 2.4%. In consideration of the rising concerns on wireless affordability, PricewaterhouseCoopers LLP (“PwC”, “our”, or “we”) conducted a study that examines the affordability of wireless services for Canadian households.

To provide a holistic view of wireless affordability in Canada, this report examined a number of aspects related to the overall affordability of consumer wireless in Canada, including:

1. The changing pattern of household expenditures, as wireless data use is enabling a different delivery of products and services – including the substitution of select historic spend categories by wireless.

2. The assessment of wireless affordability in Canada, as measured by recognized affordability metrics.

3. The affordability of wireless services for Canadians in proportion to their income, relative to other jurisdictions.

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1 Statistics Canada Table 11-10-0223-01: Average Canadian household expenditure for ‘cell phone and pager services’ and ‘purchase of telephones and equipment’ expenditure.
2 Statistics Canada Table 36-10-0587-01: Annual household income after taxes and transfers (cash and in-kind).
3 An income quintile is a measure of neighbourhood socioeconomic status that divides the population into five income groups (from lowest income to highest income) so that approximately 20% of the population is in each group.
Study framework

The Organization for Economic Co-operation and Development ("OECD") defines affordability in terms of the relative burden of paying for communication services with a given income for a given set of benefits derived from access. Drawing on this definition of affordability, the study examined wireless affordability by evaluating the interplay between three factors on which affordability depends: income, price (especially entry-level prices) and utility (consumer benefit) derived from access.

Specifically, we assessed whether wireless in Canada satisfies the two widely used affordability thresholds ("Target thresholds"):

- **Target threshold 1:** The expenditure on wireless does not impose an unreasonable burden on the average household, i.e., it does not require the household to cut back expenditures on necessities.4

- **Target threshold 2:** The cost of 1 GB of data does not exceed 2.0% of the monthly average income.6

While Threshold 1 provides an overarching framework to assess the expenditure of the average Canadian household, Threshold 2 offers a clear quantitative benchmark for assessing the expenditure on wireless within Canada and against international peers.

Within the context of our study framework, this report analysed the following factors:

- **Expenditure trends**
  - Household income trends based on gross income, disposable income and adjusted disposable income, by income quintile
  - Household communication and wireless expenditure trends by income quintile
  - Changing patterns of household expenditure, as wireless data use enables different delivery of products and services, and substitution of select traditional product and service categories

- **Data consumption trends**
  - Consumption of wireless services in terms of volume gauged through average data consumption per subscriber and further indicated by smartphone penetration
  - Wireless data consumption trends by data usage category (i.e. communication, video, social media etc.)

- **Affordability of wireless in Canada**
  - Minimum required expenditure for entry-level wireless plans and the actual expenditure made by Canadians
  - Affordability estimates in relation to the two selected target thresholds

- **International comparison**
  - High-level comparison of Canada’s wireless affordability against three comparable jurisdictions

The study uses ‘Adjusted Disposable Household Income’ as the primary household income metric when evaluating affordability in Canada, as, in our view, it more accurately reflects true purchasing power than metrics like gross income. According to the OECD’s Better Life Index, adjusted disposable income is the amount of money that a household earns each year after taxes and transfers (cash and in-kind)7. It most closely represents the money available to a household for spending on goods or services. Given Canada’s progressive income distribution system, this metric primarily informs our analysis, particularly at an income quintile level.

We note that not all the international jurisdictions selected for this study publish data on this metric, and given different income redistribution systems, the number is often not comparable even for those that do report it. To maintain consistency of comparison across jurisdictions, we relied on disposable income, while recognizing its drawbacks as a measure of income.8

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5 In this study, the non-discretionary or necessities expenditure is defined to include expenditures on food, transport, shelter (including utilities), health care and education.
6 Threshold defined by the Alliance for Affordable Internet, an organization that brings together businesses, governments, and civil society actors from across the globe to deliver the policies needed to reduce the cost to connect and make universal, affordable internet access a reality for all.
8 Disposable Household Income is the income of a household (wages and salaries, self-employed income, income from unincorporated enterprises, social benefits, etc.), after taking into account net interest and dividends received and the payment of taxes and social contributions. Adjusted Disposable Household Income is household net adjusted disposable income, and is the amount of money that a household earns, or gains, each year after taxes and transfers (cash and in-kind). It most closely represents the money available to a household for spending on goods or services.
Canadian household wireless affordability

Wireless comprises call, text and data services through wireless devices. Wireless technology advancements are enabling the delivery of many traditional products and services through wireless devices (smartphones). In other words, the expansion of wireless capabilities is reducing consumer expenditures on various other products and services, which we term as ‘wireless-driven substitution’.

We examined the increasing utility of wireless and its net impact on households’ total consumption of goods and services. Specifically, we found that:

- Wireless expenditure has reduced the household expenditure on a wide range of products including landline, postal, photo, audio, video, and printed reading material.

- Wireless has been instrumental in the growth of a number of new businesses that have directly or indirectly improved access, reduced search costs and enhanced choices for the Canadian consumer. These include ride-hailing services like Uber and Lyft, and alternative accommodation services like AirBnB.

During 2010-2017, Statistics Canada’s average household wireless expenditure increased at a CAGR of 7.7%. The primary driver behind this trend is the increase in smartphone penetration, which climbed from approximately 24.0% to 78.0% in the same period, amounting to a CAGR of 18.3%. Furthermore, the growth in the household wireless expenditure has accompanied the substitution of expenditure on other products and services. To quantitatively estimate the net impact on Canadian households, we assessed trends in the cumulative expenditure on wireless, and products and services in which substitution is enabled by wireless technology, including landline, postal, photo, audio, video and printed reading material:

Figure 1: Expenditure across categories 2010-2017: Absolute and as a % of income

Cumulatively, an average Canadian household’s absolute expenditure on wireless and wireless-substituted categories slightly declined from 2010 to 2017 at a CAGR of 0.1%. The cumulative expenditure as a share of adjusted household disposable income declined at a CAGR of 2.2%. This trend was observed across all income quintiles and age groups. Notably, younger Canadians (under 30 years) spent the most on wireless and the least on landline services, with the greatest levels of substitution. The oldest Canadians (over 65 years) spent the least on wireless and the most on landline services.

In Canada, the average revenue per user (“ARPU”) from wireless services grew by a CAGR of 2.3% during 2014-2017, while at same time, the average Canadian consumers’ wireless data consumption increased by a CAGR of 38.0%. This resulted in the average Canadian’s wireless plan spend per gigabyte of data consumed decreasing by a CAGR of 25.9% during 2014-2017. Notably, the majority of data use and growth during this period is attributable to video and social media usage. These trends indicate that value for money from the wireless expenditure increased.

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Footnote: CRTC’s Communications Monitoring Report 2018 Retail Mobile Sector (Govt. of Canada Open Database) Table F6.16 Mobile device penetration.
As can be seen in Table 1 below, as a share of adjusted disposable income, in 2017, wireless expenditure for the lowest quintile of Canadian households as a proportion of income was approximately 1.5 times that of the wireless expenditure of the highest quintile. Furthermore, as a share of adjusted disposable income, in 2017, the total communication expenditure (landline, wireless, home internet, postal) of the lowest quintile was approximately 1.8 times that of the highest quintile. We note that over the last five years, both ratios were relatively stable. We further note that the CRTC’s Communications Monitoring Report 2019 reported that the lowest quintile’s total communication expenditure was five times that of the highest quintile. The two key differences in the CRTC’s assessment and the analysis in this report are:

i. CRTC uses gross income estimates from Statistics Canada’s Survey of Household Spending, whereas this report uses adjusted disposable income estimates from the National Gross Domestic Product by Income and by Expenditure Accounts Survey; and

ii. CRTC includes television distribution and excludes device costs, on-line services, postal, courier and other communication services when defining communications, as compared to the metric in this report. Both reports include landline services, cell phone and pager services and internet access services.

Table 1: Expenditure as a share of adjusted disposable income (2017): Communication and wireless

<table>
<thead>
<tr>
<th></th>
<th>Lowest quintile</th>
<th>Second quintile</th>
<th>Third quintile</th>
<th>Fourth quintile</th>
<th>Highest quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless expenditure</td>
<td>1.7%</td>
<td>1.4%</td>
<td>1.5%</td>
<td>1.4%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Communication</td>
<td>3.5%</td>
<td>2.8%</td>
<td>2.8%</td>
<td>2.5%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

Further, we assessed wireless affordability in Canada against the target thresholds:

**Target threshold 1: Impact on non-discretionary expenditure**

Across all income quintiles, the total expenditure and its components (non-discretionary, wireless and discretionary expenditures) increased. Furthermore, for all quintiles, the recreational expenditure increased faster than the total expenditure, increasing the share of the discretionary expenditure for all income quintiles. Therefore, in accordance with target threshold 1, it is evident that wireless expenditure did not impose an unreasonable burden on the average Canadian households’ non-discretionary expenditure across income quintiles from 2010 to 2017 to the extent that it did not require the average household to cut back on the non-discretionary expenditure. Beyond not requiring the average household to cut back on the non-discretionary expenditure, the majority (more than 62.0% from 2014-2017) of Canadians opted for more expensive wireless plans from Rogers, Bell and TELUS, despite having the option of less expensive flanker brands like Fido, Koodo, etc., that are almost 15.0% less expensive (excluding device costs) on average. Highlighting that wireless prices did not require the average Canadian to cut back on non-discretionary expenditures, as they have suitably less expensive alternatives.

**Target threshold 2: Alliance for Affordable Internet (A4AI) telecom affordability metric**

The A4AI target threshold requires 1GB of data to cost less than 2.0% of monthly average income. The International Telecommunication Union (“ITU”)’s estimated price of a 2GB data-only plan in Canada in 2018 was CAD 34.01. For all income quintiles, the A4AI target threshold was met in 2018, i.e. the price for a 2GB data-only plan equated to less than 2.0% of adjusted disposable income. Notably, for the lowest income quintile, a 2GB plan’s cost was 1.4% of adjusted disposable income. Cable UK’s estimated price for a 1GB data-only plan in 2018 for Canada was CAD 15.9\(^{10}\), also confirming that the A4AI target threshold was sufficiently met across all income quintiles in 2018.

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\(^{10}\) Cable UK: Worldwide mobile data pricing: The cost of 1GB of mobile data in 230 countries, Dataset, 2018
International comparison

For the purposes of this study, we selected three countries – the United States ("US"), Australia and the United Kingdom ("UK") – for a high-level relative wireless affordability comparison against Canada. For the purpose of this report, our comparison was limited to calculating the percentage of income spent on wireless in each of the countries. It showed that in 2016, an average Canadian household spent 1.6% of its disposable income on wireless, which is less than what an average US or Australian household did. UK households, however, on average spent less, at 1.3% of their disposable income on wireless. By household income quintile, wireless was more affordable in the UK compared to Canada for all income quintiles. Compared to Australia, wireless was more affordable in Canada for all income quintiles except the lowest income quintile.11

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11 For the US data by quintiles was not available.
1. Study background, framework and definitions

1.1 Study background

Wireless services have become the largest and fastest growing component of telecommunications services in Canada. Recognizing the importance of wireless, in 2016, the Canadian Radio television and Telecommunications Commission ("CRTC") adopted a universal service objective that acknowledges Canadians’ increasing reliance on wireless services. In 2017, the Governor in Council expressed concerns about the choice of innovative and affordable wireless services available to Canadians, particularly those with low household incomes. The CRTC’s Communications Monitoring Report ("CMR") 2019, supported this view, noting that the share of the communication expenditure of total income was about five times larger for the lowest-income quintile (3.2%) compared to the highest income quintile (0.9%). Following the comments from 2017, the Governor in Council issued a second Policy Direction in 2019 requiring the CRTC to ensure the Canadian Telecommunication Policy objectives promote competition, affordability, consumer interests and innovation.

In consideration of the rising concerns of wireless affordability in Canada, PricewaterhouseCoopers LLP ("PwC", "our", or "we") conducted a study that examines the affordability of wireless for Canadian households.

This study focuses on assessing three elements of Canadian wireless affordability:

1. The changing pattern of the household expenditure, as wireless data use is enabling different delivery of products and services – including substitution of select historic spend categories by wireless

2. The assessment of wireless affordability in Canada, as measured by recognized affordability metrics

3. The affordability of wireless services for Canadians as a proportion of their income, relative to other jurisdictions

While this is an economic report assessing the affordability of mobile wireless in Canada, it does not attempt to explain the reasons behind Canadian wireless prices or factors that affect the cost of wireless services.

In Sections 2 to 4, we study Canadian wireless affordability. ‘$’ in these sections refers to Canadian dollars. In Section 5, we conduct international comparisons, and ‘$’ in this section refers to 2016 United States Dollars Purchasing Power Parity ("USD PPP").
1.2 Study framework

The Organization for Economic Co-operation and Development ("OECD") defines affordability in terms of the relative burden of paying for communication services, with a given income, for a given set of benefits derived from access. Thus, affordability depends on the following three factors:

- Income
- Price (notably entry-level prices)
- Utility derived from access

According to the International Telecommunication Union ("ITU"), affordability can be measured as a ratio of two elements: (i) the price of the service; and (ii) the economic welfare of the customer. The latter is a consequence of how consumers’ income-expenditure decisions maximize utility.

Affordability analysis of communication services by leading organizations draws on the above OECD and ITU criteria for their affordability definitions, as demonstrated below:

- CRTC’s submission to the Government of Canada Innovation Agenda emphasized that affordability analysis must consider a variety of factors, such as spending decisions on necessary expenditures, (e.g. food, shelter, clothing, etc.) and control over these expenses.\(^\text{17}\)
- UK’s Office of Communication reiterates that, in addition to prices, affordability is affected by household income and the expenditure on other essential services.\(^\text{18}\)
- OECD recommends periodic evaluation of market prices, specifically the average and minimum available prices, as well as international price comparisons.\(^\text{19}\)

Drawing on the above definitions of affordability, this report examines affordability of wireless in Canada through an evaluation of income, prices and the utility derived from access.

First, we selected the following two widely used affordability thresholds to quantitatively assess affordability of Canadian wireless services ("target thresholds"):

- Target threshold 1: The impact on non-discretionary expenditure i.e. at a minimum, wireless is secured at a price that does not impose an unreasonable burden on the average household’s income – meaning that wireless expenditure does not require a household to cut back its expenditure on necessities.
- Target threshold 2: The Alliance for Affordable Internet ("A4AI") telecom affordability metric i.e. 1GB of data should cost less than 2.0% of monthly average income.\(^\text{20}\)

Second, we analyzed a number of aspects related to the overall affordability of wireless within Canada, specifically:

- Expenditure trends
  - Household income trends based on gross income, disposable income and adjusted disposable income, by income quintile
  - Household communication and wireless expenditure trends by income quintile
  - Changing patterns of the household expenditure, as wireless data use enables different delivery of products and services, and substitution of select traditional product and service categories

In developing our study framework, we have made an effort to avoid bias that may arise from the selection of different definitions of household income and communication expenditures. In this regard, we have consistently applied Statistics Canada’s definitions and estimates for all income and expenditure metrics. Below we provide details on Statistics Canada’s definitions for the income and expenditure metrics used in our study.

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\(^\text{17}\) Broadband Policies for Latin America and the Caribbean: A Digital Economy Toolkit, Chapter 6. Affordability, government charges and digital inclusion.

\(^\text{18}\) Measuring the Information Society Report 2018 Volume 1, ITU, Box 4.1 defines affordability.

\(^\text{19}\) CRTTC submission to the Government of Canada’s Innovation Agenda (December 2016): Letter from Jean-Pierre Blais to the Minister ofISED.

\(^\text{20}\) Office of Communication (OfCom), UK, Access and Inclusion in 2016, Outcomes for consumers in vulnerable circumstances.

\(^\text{18}\) Broadband Policies for Latin America and the Caribbean: A Digital Economy Toolkit, Chapter 6. Affordability, government charges and digital inclusion.

\(^\text{20}\) A4AI threshold does not identify a specific income metric in the definition.
1.3 Canadian household income

For the purpose of this study, we considered the following three measures of household income used by Statistics Canada:

**Gross Household Income:** The value of gross income from all sources, before deductions for income tax, superannuation, etc. for all household members.\(^{21}\)

**Disposable Household Income:** The income of a household (wages and salaries, self-employed income, income from unincorporated enterprises, social benefits, etc.), after taking into account net interest and dividends received and the payment of taxes and social contributions.\(^{22}\)

**Adjusted Disposable Household Income:** The amount of money that a household earns, or gains, each year after taxes and transfers (both cash and in-kind).

Statistics Canada follows the statistical framework laid out in the international manual ‘System of National Accounts 2008 (“SNA 2008”)’ published jointly by the United Nations, the European Commission, OECD, the International Monetary Fund and the World Bank Group. Quoting SNA 2008 “the adjusted disposable income of a household can be interpreted as measuring the maximum value of the final consumption of goods or services that it can afford to consume in the current period without having to reduce its cash, dispose of other assets or increase its liabilities for the purpose. Its consumption possibilities are determined not only by the maximum amount it can afford to spend on goods and services (its disposable income) but also by the value of the consumption of goods and services it receives from government units or Non-Profit Institutions Serving Households ("NPISH")s as social transfers in-kind.”\(^{23}\)

Given the comprehensiveness of ‘Adjusted Disposable Household Income’, we used it as the primary measure of household income for the purposes of assessing affordability throughout this study. However, given that some of the selected international peers for this study do not publish data on this measure of household income, we used disposable household income for international comparison, which is adjusted disposable income without in-kind transfers. Appendix 1 provides details on Statistics Canada’s methodology to estimate the above three income metrics.

1.4 Communication expenditures

The communication expenditure is based on Statistics Canada’s Survey of Household Spending (“Statistics Canada SHS”) and includes:

- Landline telephone services
- Cell phone and pager services
- Purchase of telephones and equipment
- Internet access services
- Online services
- Postal, courier and other communication services.

This study estimates the communication expenditure including all six components listed above.

Wireless expenditure is composed of wireless devices and wireless services. These expenditures are estimated using Statistics Canada SHS values for ‘cell phone and pager services’ and ‘purchase of telephones and equipment’ expenditures, respectively.

Statistics Canada SHS estimates the Canadian household expenditure on the ‘purchase of telephones and equipment (telephone devices)’ but does not provide a disaggregation of this expenditure between the purchase of landline and wireless devices. Wireless devices are significantly more expensive than landline devices and spending on landline devices has been declining. In the absence of an alternative and more precise estimate, we have used Statistics Canada SHS’ estimates for the telephone device expenditure to estimate the wireless devices expenditure. We note that the use of this proxy has the potential to overestimate the wireless device expenditure.

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\(^{22}\) OECD Website, Data, Household disposable income definition.

2. Trends in Canadian household income

In 2017, the average Canadian household earned a gross income of $87,200. After paying taxes and receiving transfers (cash and in-kind), the adjusted disposable income for an average Canadian household was 12% higher at $97,677. Adjusted disposable household income was higher than the gross income earned during each of the years in our reviewed period for all income quintiles except the highest quintile (top 20%).

The gross income ratio between the average highest and lowest quintile households in 2017 was 11.9. This compares to a ratio of 11.4 in 2010. For average disposable income, this ratio was 7.1 in 2017 compared to a ratio of 6.5 in 2010. The same ratio for adjusted disposable household income was even lower due to Canada’s progressive income redistribution system, and in particular its universal education and health care system that provides in-kind transfers to all households. The ratio for adjusted disposable income was 4.3 compared to a ratio of 4.1 in 2010.

Table 1: Expenditure as a share of adjusted disposable income (2017): Communication and wireless

<table>
<thead>
<tr>
<th></th>
<th>Lowest quintile Average income ($)</th>
<th>Highest quintile Average income ($)</th>
<th>Ratio: Highest to lowest quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
<td>2017</td>
<td>2010</td>
</tr>
<tr>
<td>Gross income</td>
<td>14,786</td>
<td>17,400</td>
<td>169,199</td>
</tr>
<tr>
<td>Disposable income</td>
<td>21,142</td>
<td>22,563</td>
<td>138,108</td>
</tr>
<tr>
<td>Adjusted disposable income</td>
<td>37,337</td>
<td>41,668</td>
<td>154,403</td>
</tr>
</tbody>
</table>

Source: Statistics Canada Table 11-10-0192-01: Upper income limit, income share and average income by economic family type and income decile; Statistics Canada Table 36-10-0587-01: Distribution of household economic accounts, income, consumption and saving, by characteristic: custom tabulation runs

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24 Statistics Canada Table 11-10-0192-01: Upper income limit, income share and average income by economic family type and income decile.
25 Statistics Canada Table 36-10-0587-01: Distribution of household economic accounts, income, consumption and saving, by characteristic: custom tabulation run.
For all Canadian households, during 2010-2017, adjusted disposable income for all income quantiles increased at an annual average growth rate between 1.6% and 2.4%. During the same period, the average annual inflation rate was 1.6%, which suggests that the average standard of living for all quintiles of Canadian households increased during this time period. The figure below depicts trends in household income over the period 2010 to 2017 for all three measures of household income, for the average Canadian household, and for each income quintile.

**Figure 2: Household income, average and by quintiles, 2010-2017**

**Gross, disposable and adjusted disposable income - Average**  
*Nominal CAD '000, 2010-2017*

**Gross, disposable and adjusted disposable income - Lowest quintile**  
*Nominal CAD '000, 2010-2017*

**Gross, disposable and adjusted disposable income - Second quintile**  
*Nominal CAD '000, 2010-2017*
Gross, disposable and adjusted disposable income - Third quintile
(Nominal CAD '000, 2010-2017)

Gross, disposable and adjusted disposable income - Fourth quintile
(Nominal CAD '000, 2010-2017)

Gross, disposable and adjusted disposable income - Highest quintile
(Nominal CAD '000, 2010-2017)

Source: Statistics Canada Table 11-10-0192-01: Upper income limit, income share and average income by economic family type and income decile; Statistics Canada Table 36-10-0587-01: Distribution of household economic accounts, income, consumption and saving, by characteristic: custom tabulation runs
3. Canadian household communication expenditure trends

As shown in the figure below, between 2010 and 2017, the total communication expenditure grew at a CAGR of 4.7%. While household spending on postal and landline services declined, it was more than compensated for by the rapid growth of household spending on internet access, online services, and cell phone devices and services.

![Figure 3: Communication expenditure by type, 2010-2017](image)

**CAGR (2010-2017).**

<table>
<thead>
<tr>
<th>Service</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postal</td>
<td>-1.3%</td>
</tr>
<tr>
<td>Landline services</td>
<td>-7.2%</td>
</tr>
<tr>
<td>Internet access</td>
<td>7.6%</td>
</tr>
<tr>
<td>Online services</td>
<td>40.9%</td>
</tr>
<tr>
<td>Device</td>
<td>10.7%</td>
</tr>
<tr>
<td>Cell phone services</td>
<td>7.5%</td>
</tr>
<tr>
<td>Communication</td>
<td>4.7%</td>
</tr>
</tbody>
</table>

Source: Statistics Canada. Table 11-10-0223-01: Household spending by household income quintile, Canada, regions and provinces: Custom tabulation run

Between 2010 and 2017, growth in the communication expenditure was consistent across all quintiles at a CAGR that ranged between 4.5% and 5.0%. Furthermore, as shown in the figure below, in 2017, an average Canadian household spent $2,399 on communication services annually with the lowest income quintile spending on average $1,468, compared with $3,374 for a household in the highest income quintile.

![Figure 4: Communication expenditure, average and by quintile, 2010-2017](image)

Source: Statistics Canada. Table 11-10-0223-01: Household spending by household income quintile, Canada, regions and provinces: Custom tabulation run
Communication expenditure 2010-2017 (CAD, by quintile)

<table>
<thead>
<tr>
<th>Year</th>
<th>Average</th>
<th>First Quintile</th>
<th>Second Quintile</th>
<th>Third Quintile</th>
<th>Fourth Quintile</th>
<th>Fifth Quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,742</td>
<td>1,079</td>
<td>1,411</td>
<td>1,739</td>
<td>1,999</td>
<td>2,480</td>
</tr>
<tr>
<td>2011</td>
<td>1,824</td>
<td>1,112</td>
<td>1,528</td>
<td>1,859</td>
<td>2,091</td>
<td>2,529</td>
</tr>
<tr>
<td>2012</td>
<td>1,851</td>
<td>1,148</td>
<td>1,510</td>
<td>1,883</td>
<td>2,126</td>
<td>2,587</td>
</tr>
<tr>
<td>2013</td>
<td>1,997</td>
<td>1,249</td>
<td>1,610</td>
<td>1,984</td>
<td>2,283</td>
<td>2,855</td>
</tr>
<tr>
<td>2014</td>
<td>2,096</td>
<td>1,304</td>
<td>1,713</td>
<td>2,063</td>
<td>2,475</td>
<td>2,927</td>
</tr>
<tr>
<td>2015</td>
<td>2,187</td>
<td>1,317</td>
<td>1,743</td>
<td>2,187</td>
<td>2,568</td>
<td>3,121</td>
</tr>
<tr>
<td>2016</td>
<td>2,246</td>
<td>1,356</td>
<td>1,799</td>
<td>2,316</td>
<td>2,589</td>
<td>3,171</td>
</tr>
<tr>
<td>2017</td>
<td>2,399</td>
<td>1,468</td>
<td>1,929</td>
<td>2,453</td>
<td>2,771</td>
<td>3,374</td>
</tr>
</tbody>
</table>

CAGR (2010-2017)

- Average: 4.7%
- First Quintile: 4.5%
- Second Quintile: 4.6%
- Third Quintile: 5.0%
- Fourth Quintile: 4.8%
- Fifth Quintile: 4.5%

Source: Statistics Canada. Table 11-10-0223-01: Household spending by household income quintile, Canada, regions and provinces: Custom tabulation run

### 3.1 Wireless expenditure

**Wireless services expenditure**

From 2010 to 2017, the average household wireless services expenditure grew at a CAGR of 7.5% and was similar across all income quintiles. In 2017, an average Canadian household spent $1,212 on wireless services, a household in the lowest income spent $644 and a household in the highest income quintile spent $1,857. For all income quintiles, growth in the wireless services expenditure was higher than growth in the total communication expenditure and household income (for all three income metrics) during the same period.

Source: Statistics Canada. Table 11-10-0223-01: Household spending by household income quintile, Canada, regions and provinces: Custom tabulation run

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26 Cell phone and pager services expenditure estimates, Survey of Household Spending, Statistics Canada.
Wireless devices expenditure

In 2017, a Canadian household spent on average $116 on telephone devices, and this expenditure increased between 2010 and 2017, at a CAGR of 11.0%. However, as can be seen from Figure 6, growth in expenditure on wireless devices varied significantly across income quintiles during the 2010-2017 period. For instance, in 2016-2017, growth in the wireless device expenditure was -6.0% for the first quintile, 22.0% for the second quintile, 5.0% for the third quintile, -3.0% for the fourth quintile and 7.0% for the fifth quintile.

As can be seen in Table 4 below, as a share of adjusted disposable income, in 2017, the wireless expenditure for the lowest quintile of Canadian households as a proportion of income was approximately 1.5 times that of the wireless expenditure of the highest quintile. Furthermore, as a share of adjusted disposable income, in 2017, the total communication expenditure (landline, wireless, home internet postal) of the lowest quintile was approximately 1.8 times that of the highest quintile. We note that over the last five years, both ratios were relatively stable. We further note that the CRTC’s Communications Monitoring Report 2019 reported that the lowest quintile’s total communication expenditure was five times that of the highest quintile.

The two key differences in the CRTC’s assessment and the analysis in this report are:

i. CRTC uses gross income estimates from Statistics Canada’s Survey of Household Spending, whereas this report uses adjusted disposable income estimates from the National Gross Domestic Product by Income and by Expenditure Accounts Survey; and

ii. CRTC includes television distribution and excludes device costs, on-line services, postal, courier and other communication services when defining communications, compared to the metric used in this report. Both reports include landline services, cell phone and pager services and internet access services.

Table 4: Expenditure as a share of adjusted disposable income (2017): Communication and wireless

<table>
<thead>
<tr>
<th></th>
<th>Lowest quintile</th>
<th>Second quintile</th>
<th>Third quintile</th>
<th>Fourth quintile</th>
<th>Highest quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless expenditure</td>
<td>1.7%</td>
<td>1.4%</td>
<td>1.5%</td>
<td>1.4%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Communication expenditure</td>
<td>3.5%</td>
<td>2.8%</td>
<td>2.8%</td>
<td>2.5%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

27 Purchase of telephones and equipment expenditure estimates, Survey of household spending, Statistics Canada.
4. Canadian household wireless affordability

4.1 Wireless utility for households

As noted previously, wireless comprises call, text and data services through wireless devices. Technological innovation is enhancing wireless capabilities enabling the supply of many goods and services through wireless devices (smartphones). During 2010-2017, the household wireless expenditure increased at a CAGR of 7.7%, i.e. faster than the growth in communication expenditure, total expenditure and total income. In this section, we assess factors that explain growth in the wireless expenditure, the wireless utility (consumer benefits) and their net impact on households’ final consumption of goods and services.

4.1.1 Wireless utility for households

Expenditure, by definition, is a product of volume and prices. We examine the contribution of volume/usage growth to the growth of wireless expenditures by Canadian households. For volume/usage growth, we used CRTC’s data for smartphone penetration levels, which show an increase in Canadian smartphone penetration from approximately 24.0% in 2010 to 78.0% in 2017, a CAGR of 18.3%. Smartphones have been instrumental in amplifying the utility of wireless.

Figure 7: Smartphone penetration %, contribution to growth in wireless expenditure

<table>
<thead>
<tr>
<th>Smartphone penetration (%) Canadians, 2010-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
</tr>
</tbody>
</table>

Source: Communication Monitoring Report 2018, Retail Mobile Sector, CRTC, Government of Canada (Open Government datasets)

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Smartphone penetration data is not available by the income quintile over time. However, mobile phone penetration data is published by CRTC for the year 2017 by income quintile. In 2017, about 73.1% of the lowest income quintile had access to mobile phones, as opposed to 96.9% for the highest quintile. While mobile phones are not the best predictors of wireless consumption (as compared to smartphones), this data point suggests that this difference across quintiles could be driven by the difference in device ownership. We note that in 2016-2017, the relative growth in mobile penetration was the highest for the lowest income quintile households at a CAGR of 6.4%, while the highest income quintile mobile penetration grew at a CAGR of 0.5%, indicating that the lowest quintile is catching up.

4.1.2 Wireless driven substitution

The ever-increasing scope of wireless devices and services is reducing sales of and expenditures on various other products, which we term as ‘wireless driven substitution’. Below we identify major products for which wireless driven substitution has been prevalent:

**Landline communication:** The growth in the wireless expenditure of 7.7% CAGR during 2010-2017 coincided with a decline of 7.2% in landline services’ expenditure. Statistics Canada SHS notes that, over the years, cellular telephones have replaced landline telephones as the most common telephone type among Canadian households.29 CRTC’s Communication Monitoring Report 2019 notes that “fewer households are subscribing to both services – in 2017, almost a third (36.0%) of Canadian households were mobile-only households, and 9.5% had only a landline”.31 Furthermore, IBISWorld’s 2018 report for Canadian telecommunications sector estimated that more than 60.0% of households with consumers under 35 years of age do not own a landline, opting to use cell phones only, with this trend expected to continue for the next five years”.32

**Postal communication (household expenditure):** In March 2019, worldwide, 188 million emails and 60 million mobile/text messages were sent every minute.33 This has reduced the household expenditure on conventional postal services for personal communication. Further, with digital delivery of government and other non-government services, the household postal expenditure for official communication is also on a decline.

**Photographic goods and services (photo):** Worldwide camera shipments dropped nearly 80% between 2010 and 2017, mostly due to smartphone digital camera technology. This resulted in camera sales decreasing from 121 million in 2010 to 19 million in 2018.34

**Audio, video and printed reading material:** Audio is being substituted as online streaming now accounts for up to 95.0% of the music market. Video is being substituted, with approximately 52.0% of smartphone users in 2017 reporting to watch movies and videos on their devices.35 Finally, printed reading material has been substituted, with time spent reading print newspapers and print magazines declining by approximately 45.0% and 56.0%, respectively between 2011 and 2018.36

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29 CRIC Communications Monitoring Report 2019, Table 1.3 Canadian landline and mobile service subscribers per 100 households, by income quintile, 2013-2017.
31 CRIC Communications Monitoring Report 2019, Page 19, Mobile and landline subscriptions.
33 Visual Capitalist, What Happens in an Internet Minute in 2019?
34 Manufacturing Net, What smartphones have done to the camera industry, 2018.
36 Marketing Charts, Time Spent With Traditional Media Drops As Mobile Internet Use Blossoms, 2018.
**Other wireless driven substitution:** The functionality of wireless devices have improved beyond the products covered above, which is expanding wireless-driven substitution to various other products. Wireless devices have calculators, alarms, digital watches etc., which reduce demand for traditional expenditures.

Due to data limitations, for the purpose of this study, we excluded other wireless driven substitutions from our analysis. Thus, our analysis of wireless-driven substitutions was limited to expenditure trends for the following major products ("wireless-substituted categories"):  

- Landline  
- Postal  
- Photo, audio, video  
- Printed reading material

Cumulatively across the above categories, an average Canadian household's expenditure on wireless and wireless substituted categories slightly declined from 2010 to 2017 at a CAGR of 0.1%.

**Figure 9: Expenditure across categories 2010-2017: Absolute and as a % of income**

![Expenditure chart](chart.png)

*Source: Statistics Canada. Table 11-10-0223-01: Household spending by household income quintile, Canada, regions and provinces: Custom tabulation run*

However, for an average Canadian household, the cumulative expenditure as a share of average adjusted household disposable income declined annually at a rate of 2.2% between 2010 and 2017. Based on these findings, we observe that the net impact of wireless growth in expenditure for an average Canadian household was positive due to simultaneous wireless-driven substitution.
By income quintile

Overall, wireless driven substitution reduced cumulative expenditure on wireless and wireless-substituted categories across all income quintiles.

**Figure 10: Expenditure across categories 2010-2017 (% income), by income quintile**

![Image](image.png)

Source: Statistics Canada. Table 11-10-0223-01: Household spending by household income quintile, Canada, regions and provinces: Custom tabulation run

By age group

For all age groups, wireless driven substitutions reduced the cumulative expenditure on wireless and wireless-substituted categories. Notably, younger Canadians (under 30 years) spent the most on wireless and the least on landline services. The oldest Canadians (over 65 years) spent the least on wireless and the most on landline services. As the Canadian demographic composition shifts towards the younger, more digitally engaged individuals, spending is expected to shift towards wireless and away from landlines.

**Figure 11: Expenditure across categories 2010-2017 (% of income) by income quintile**

![Image](image.png)

Source: Statistics Canada. Table 11-10-0227-01: Household spending by age of reference person: Custom tabulation run
4.1.3 Wireless enabled growth in new business models

Wireless is the foundation for a number of new businesses that have directly or indirectly improved consumer affordability through better access, reduced search costs or enhanced choices. In 2018, the mobile apps with the highest installation and user base growth included ride (Uber-like), dating, shopping, food delivery, travel booking (AirBnB-like), marketplace and classifieds. The traditional service model in these sectors has been disrupted, and new business models have emerged, enabled by wireless networks.

In the Statistics Canada SHS data, expenditure on other (non-traditional) transportation and accommodation categories has been rising capturing, Uber-like and Air-BnB-like services. Wireless networks are the key enabling platform for accelerated growth in these new businesses.

4.2 Entry-level wireless services

According to the ITU, an entry level (low-usage) wireless plan is at a minimum, 70 minutes of voice calls, 20 SMS, and 500 MB of data with a minimum speed of 256 kbit/s. In 2018, the ITU estimated that, in Canada, the price for the lowest cost plan that meets these criteria from the largest operator (in terms of market size), was USD 52.9 including taxes, equivalent to CAD 68.7. This estimation is for a regular plan disregarding special prices, promotions, offers, or discounts. We note that other service providers in Canada with lower market shares are providing more affordable prices for the same plan criteria than that outlined by the ITU. The methodology used by the ITU to estimate prices for wireless services bundles is described in Appendix 3.

Below we quantitatively assess the affordability of ITU's entry level wireless services plan for an average Canadian household in each of the five income quintiles as a percentage of adjusted disposable income:

Source: Low usage mobile broadband bundle. World Telecommunication/ICT Indicators database online, International Telecommunication Union (ITU); Statistics Canada Table 36-10-0587-01: Distribution of household economic accounts, income, consumption and saving, by characteristic.
4.3 Preferences and choice

Canadian households have low-cost wireless plan options that are more affordable than plans offered by the three largest wireless brands ("Top 3"). The latter often have bundled device upgrade options and their price includes device-financing costs. Despite having options for wireless services plans offered by flanker brands that were on average 15.0% cheaper (excluding device costs), more than 60.0% of Canadians opt for more expensive plans offered by the Top 3 brands.

Figure 14: Plan options, price points and % of Canadians across brand type (CAD, 2018)

The IDC’s consumer survey 2018 estimated the market share of the five largest Canadian wireless service providers by income quintile. This survey determined that prices of the five largest wireless service providers were higher than other providers. However, across all income quintiles, the top five providers had greater market shares, suggesting that households can afford their services, as there are appropriate substitutes with lower prices.

Table 5: % of Canadians across wireless service providers, by income quintiles

<table>
<thead>
<tr>
<th>Household Income (HHI)</th>
<th>&lt;35K</th>
<th>35-50K</th>
<th>50-75K</th>
<th>75-100K</th>
<th>100K+</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless service providers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Top five’</td>
<td>70%</td>
<td>74%</td>
<td>77%</td>
<td>78%</td>
<td>83%</td>
<td>76%</td>
</tr>
<tr>
<td>Others</td>
<td>30%</td>
<td>26%</td>
<td>23%</td>
<td>22%</td>
<td>17%</td>
<td>24%</td>
</tr>
</tbody>
</table>

Source: IDC Consumer Survey, 2018

A flanker brand, also referred to as an extension or a secondary brand, is expressed as logos or words, and is used by the primary brand WSP to market and offer varying services and plans to consumers. The primary brand’s network is used to provide services under the flanker brand. Virgin (Bell), Lucky Mobile (Bell), Koodo Mobile (TELUS), and Fido (Rogers) are examples of flanker brands. A primary brand is the brand that is most recognizable by consumers and is directly associated to the parent company that owns and operates the facilities to provide services. (Source: CRTC, Telecom Procedural Letter Addressed to Distribution List, Ottawa, 29 June 2018).

Definition sourced from Statistics Canada, CMR 2018 - Retail Mobile Sector.
4.4 Data consumption

In Canada, the average revenue per user (“ARPU”) from wireless services only grew by a CAGR of 2.3% during 2014-2017. In the same period, the usage and traffic generated by wireless internet services expanded substantially, and Canadian consumers’ wireless data consumption increased by a CAGR of 38.0%. To provide a numeric indication of the growth in consumers’ value-for-money from wireless services, we used an indicator; i.e. ratio of monthly mobile ARPU and average monthly data usage per user (ARPU/GB), based on CRTC estimates. This indicator shows a decline of 25.9% for Canadian consumers between 2014 and 2017. This suggests that the expenditure incurred per unit of consumption declined, and the value for money increased.

Figure 15: Canada: Average revenue per user, data consumption per user and spend per unit data (CAD, GB, 2014-2017)

Average revenue per user, data consumption per user and spend per unit data (CAD, GB, 2014-2017)


4.4.1 Data consumption by categories

PwC’s Global Entertainment & Media Outlook 2019-2023 estimates the use of smartphone data by categories. Video consumption is the most data intensive use of wireless services, which accounted for 83.4% of the growth in total data used between 2014 - 2018. Together, media and entertainment categories (video, music, games, social networking) accounted for 88.9% of data usage growth. Communication and web browsing accounted for 9.0% and 0.9% of data consumption, respectively. The rapid growth in data consumption was primarily driven by growth in video consumption.

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39 Data for ‘Average monthly data usage per user’ was published only from 2014 to 2017.
40 Government of Canada, Open Data, Communications Monitoring Data 2018 for Retail Mobile Sector, published by CRTC (ZIP file).
41 This refers to applications, services and protocols that allow email, chat, voice and video communications. Examples include WhatsApp, Skype, Viber and iMessage.
4.5 Target thresholds for affordability

4.5.1 Target threshold 1: Impact on non-discretionary expenditure

This target threshold requires that wireless is secured at a price that does not impose an unreasonable burden on the average household income, i.e. its cost does not require a household to cut back expenditures on necessities like food, shelter, transportation and health care.

We define non-discretionary or necessities expenditures as expenditures on food, transportation, shelter (includes utilities), health care and education. Between 2010 and 2017, Canadian households’ total spending on necessities increased consistently in absolute terms, suggesting that the average Canadian household did not cut back on necessities. In fact, as a percentage of adjusted disposable income, the average Canadian household increased its expenditure on necessities.

Source: Statistics Canada. Table 11-10-0223-01: Household spending by household income quintile, Canada, regions and provinces: Custom tabulation run
To determine whether an unreasonable burden was imposed on household income due to wireless, we conducted a trend analysis of non-discretionary/necessities expenditure in relation to (i) wireless expenditure; (ii) discretionary expenditure; (iii) total expenditure; and (iv) total income.

Figure 18: Average household expenditure as a % of adjusted disposable income, by type, 2010-2017

As a share of adjusted disposable income, the household total expenditure grew from 70.7% in 2010 to 72.8% in 2017. During this period, the household non-discretionary expenditure grew from 44.3% to 45.3% while the wireless (devices and services) expenditure grew from 0.9% to 1.4%. The household discretionary expenditure increased from 25.4% to 26.1%. Since adjusted disposable income during the same period increased by more than the average inflation rate of 1.6%, the growth in household expenditures as a percentage of adjusted disposable income suggests that there was an overall increase in volume of goods and services consumed by households at all income quintiles.

Figure 19: Household expenditure as a % of adjusted disposable income, by income quintile (2010-2017)
4.5.2 Target threshold 2: A4AI affordability threshold

The A4AI target threshold requires that 1GB of data must cost less than 2.0% of monthly average income. For Canada, the ITU estimated that, in 2017, the cheapest available plan offered by the service provider with the largest market share was USD 26.16 (including tax) or CAD 34.01, for 2GB. The methodology used by ITU to estimate prices for wireless services bundles is described in Appendix 3.

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The Rogers plan used by ITU offers 2GB through a portable router, which can be used as a Wi-Fi on the go to connect through wireless.

For all the income quintiles, the A4AI target threshold was met, i.e. a 2GB data-only plan cost was less than 2% of adjusted disposable income in 2017.\textsuperscript{43} Cable UK’s estimated price for a 1GB data-only plan in Canada was $15.92 in 2018\textsuperscript{44}, less than half the ITU price for 2GB of data. This further confirms that the A4AI target threshold was met for Canadian households across all income quintiles in 2018.

In addition, CRTC, in March 2018, resolved to address affordability of a lower-cost data-only plan in the wireless market. Following which, wireless providers have introduced a variety of such plans. CRTC notes, “Providers such as Virgin, Lucky, Fido, Chatr, Public Mobile and Koodo committed to offering plans ranging from $15 for 250MB to $30 for 1GB on a prepaid and postpaid basis. The plans were made widely available by April 2019.”\textsuperscript{45}

\textsuperscript{43} We note that the A4AI target threshold does not define the income metric referred in its definition.

\textsuperscript{44} Cable UK: Worldwide mobile data pricing: The cost of 1GB of mobile data in 230 countries, Dataset, 2018.

\textsuperscript{45} CRTC, Phone, Mobile, Data-only wireless plans in Canada, Date modified: 2019-12-03.
5. International comparison

In this section, wireless affordability in Canada is compared to a select number of comparable countries. We note that the scope of our study did not include an analysis of the underlying reasons for any differences between Canada and the comparable jurisdictions.

5.1 Peer countries’ selection criteria

For an international comparison, we based our selection criteria on the following four metrics:

- Population density – to compare with countries facing similar challenges in providing universal and affordable wireless services across broad geographies
- GDP per capita (PPP) – to compare with households with a similar level of purchasing power
- GINI coefficient (inequality measure) – to compare with countries with similar levels of middle class concentration

While there is not one country that is perfectly comparable to Canada on all the four metrics, we selected three countries – US, Australia, and UK (‘select international peers’).

Figure 21: Selected comparable country characteristics

<table>
<thead>
<tr>
<th>County</th>
<th>Canada</th>
<th>US</th>
<th>Australia</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>North America</td>
<td>North America</td>
<td>Australasia</td>
<td>Western Europe</td>
</tr>
<tr>
<td>Population density (pop./km²)</td>
<td>4</td>
<td>34</td>
<td>3</td>
<td>274</td>
</tr>
<tr>
<td>GDP per capita (PPP)</td>
<td>$49,051</td>
<td>$62,000</td>
<td>$52,373</td>
<td>$45,705</td>
</tr>
<tr>
<td>GINI coefficient (inequality measure)</td>
<td>34</td>
<td>41.5</td>
<td>34.7</td>
<td>34.1</td>
</tr>
</tbody>
</table>

In this section, all currency values are presented in terms of 2016 USD PPP for comparability. Accordingly, trends for some metrics may be impacted by the trends in exchange rates.
5.2 Relative wireless affordability

This section presents a comparison of the average household wireless expenditure as a proportion of income between the selected international peers. All estimates were sourced from income and expenditure surveys nearly identical to Statistics Canada’s surveys conducted by national statistical offices in their respective countries. Australian Bureau of Statistics conducts detailed expenditure surveys every five years. The latest available data for Australia was from 2016. To maintain consistency, we present this comparison for the year 2016 for all countries. We note that not all the international jurisdictions selected for this study publish data on adjusted disposable income, and given different income redistribution systems, the number is often not comparable even for those that do report it. To maintain consistency of comparison across jurisdictions, we relied on disposable income, which is adjusted disposable income without in-kind transfers.

In 2016, average household wireless expenditure (including services and devices) was:
- Canada: $977
- US: $1,124
- Australia: $808
- UK: $612

In 2016, an average Canadian household spent 1.6% of their disposable income on wireless, lower than the US and Australia. UK households, on average, spent less at about 1.3% of their disposable income.

Figure 22: Wireless expenditure as a % of disposable income, 2016, by select international peers


We further investigated how the affordability of wireless varied between the selected countries by household income quintile. For the US, comparable household disposable income was not available by quintile.

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39 Data for ‘Average monthly data usage per user’ was published only from 2014 to 2017.
40 Government of Canada, Open Data, Communications Monitoring Data 2018 for Retail Mobile Sector, published by CRTC (ZIP file).
41 This refers to applications, services and protocols that allow email, chat, voice and video communications. Examples include WhatsApp, Skype, Viber and iMessage.
By household income quintile, wireless was more affordable in the UK compared to Canada for all income quintiles. Compared to Australia, wireless was more affordable in Canada for all income quintiles except the lowest income quintile.
Appendices
Appendix 1: Household income methodology

We have presented household income in terms of three metrics, which are published by Statistics Canada in public domain. The underlying source and methodology of these metrics is described in further detail below:

**Gross income**

The gross income numbers used in this study are sourced from Statistics Canada’s Canadian Income Survey (CIS) Table 11-10-0192-01. This survey is used by Statistics Canada to publish estimates for Canadian households in the public domain. The CIS data is combined with Labour Force survey data and tax data to publish accurate income estimates in the public domain.

We used average total income (before tax) estimates for economic families, which includes market income from earnings, investment, pension, spousal support, etc. Specifically, this survey asks the following question to respondents:

“What is your best estimate of your total personal income, before taxes and deductions, from all sources during the year ending December 31?”

We note that this survey defines household in terms of economic and non-economic families. Economic family refers to a group of two or more persons who live in the same dwelling and are related to each other by blood, marriage, common-law union, adoption or a foster relationship. A couple may be of opposite or same sex. Income is typically shared between economic families. If individuals in a household are not related to each other, they usually would not share income. Thus, household income estimates are more accurate at economic family level. We note that a household shares expenses if they live in the same dwelling and are not related to each other. The definition of household accordingly changes for Survey of Household Spending.

In this study, we used gross income estimates only for international comparison purposes.

**Disposable and adjusted disposable income**

This study primarily relies on adjusted disposable income estimates for the affordability analysis. The conclusions from international comparison have mainly relied on disposable income when comparable adjusted disposable income estimates were not available for selected international peers.

Statistics Canada publishes these income metrics for household sector in Table 36-10-0587-01. These estimates are derived from macroeconomic account National Gross Domestic Product by Income and by Expenditure Accounts (“IEA”). The Income and Expenditure Accounts record the distribution and use of income by the six main institutional sectors: households, non-profit institutions serving households, general governments, non-financial corporations, financial corporations and non-residents. These accounts articulate revenues to the sector (including current transfers from other sectors, such as employment insurance received) and current expenditures of the sector (including transfers to other sectors, such as income taxes paid to government).

A broad range of survey and administrative data sources are used to compile the GDP and Income and Expenditure Accounts. Some of the more notable sources include: the quarterly survey of financial statements, the monthly survey of employment, payroll and hours, the quarterly retail commodity survey, annual business surveys, banking information, Government Finance Statistics, the Balance of Payments statistics, and the T4 remuneration file from the Canada Revenue Agency. All of these data sources are adjusted to conform to the “2008 System of National Accounts” concepts and definitions and integrated into the “2008 System of National Accounts” macroeconomic accounting framework.

IEA numbers are estimated by taking the most complete and high quality data sources available to establish benchmark annual estimates. This generally entails taking annual business surveys, administrative data files from the Canada Revenue Agency or annual household survey files and integrating them into the “2008 System of National Accounts” framework to establish annual estimates. The annual benchmarks for gross domestic product by the income approach and by the expenditure approach are generated through the construction of annual supply and use tables, which balance the supply of each product in the economy against its use. These tables present the most complete and accurate depiction of Canadian economic activity.
It is not possible to produce typical survey-based quality indicators such as coefficients of variation or survey response rates. Instead, data are analyzed for time series consistency, links to current economic events, and coherence in source data. Since the IEA measures values from two perspectives (incomes and expenditures), the compilation process itself is an important quality control on the data. Differences between values from different sources highlight inconsistencies in the source data leading to coherence adjustments that improve the overall quality of the estimates. In addition, the IEA embed a number of important accounting identities, i.e. economy wide transfers received must equal economy wide transfers paid. Adherence to these identities and the investigation and resolution of imbalances when they arise is another quality feature of the system.

Household disposable income can be interpreted in a narrow sense as the maximum amount that a household or other unit can afford to spend on consumption goods or services during the accounting period without having to finance its expenditures by reducing its cash, by disposing of other financial assets or non-financial assets or by increasing its liabilities. This concept is equivalent to the economic theoretical concept only when the net worth at the beginning of the period is not changed by capital transfers, other changes in the volume of assets or real holding gains or losses recorded during the period.

Household disposable income = Compensation of employees + net mixed income + net property income + net transfers from government, corporations, non-profit institutions, non-residents.\(^{46}\)

Adjusted disposable income adds in-kind transfers (health, education and others) to household disposable income.

Appendix 2: Core communication definition

To arrive at the core communication definition, we reviewed core communication as defined by various reputed organizations. We based our definition on the following four sources:

<table>
<thead>
<tr>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
</table>
| CRTC   | Canadians, in urban areas as well as in rural and remote areas, have access to voice services and broadband Internet access services, on both fixed and mobile wireless networks. Basic telecommunication services are defined to constitute:  
  ● Fixed and mobile wireless broadband internet access services  
  ● Fixed and mobile wireless voice services |
| Office of Communication, UK | Essential communication services mean not being able to live or function without them:  
  ● Safety, and access to emergency services  
  ● Communication and social inclusion  
  ● Access to information, education and entertainment  
  ● Economic livelihood |
| Australian Government | A future Universal Service Guarantee will need to meet the following criteria:  
  ● Broadband services are available to 100% of Australian premises, on request, at the completion of the NBN rollout in 2020  
  ● Voice services are available to 100% of Australian premises on request |

In this study, we have defined core communication as having access to:

- Safety and emergency services: including free helpline services
- Communication: voice and broadband communication that allows individuals to connect with others
- Information: to fulfill basic necessities and core activities such as education, health care and housing searches
- News local and national, entertainment
- Economic livelihood including job searches and applications

Statistics Canada’s communication expenditure components fully capture the definition of core communication:

<table>
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<tr>
<th>Category</th>
<th>Stats Canada Expenditure Categories</th>
<th>PwC’s Rationale for inclusion in core communication definition</th>
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</thead>
</table>
| 1. Landline | ● Landline telephone services | ● Provides access to safety and emergency helpline services in homes  
  ● Enables communication through voice calling |
| 2. Postal | ● Postal, courier and other communication services | ● Enables communication through written letters  
  ● Is acceptable in some job searches as a means for applying and providing necessary documentation to employers  
  ● Is commonly used by public institutions and banks to send regular updates, information and requests |
<table>
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<tr>
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<th>Stats Canada Expenditure Categories</th>
<th>PwC’s Rationale for inclusion in core communication definition</th>
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</table>
| 3. Mobile Wireless | Cell phone services, Device        | • Provides access to safety and emergency helpline services on the move  
• Enables communication through wireless voice and broadband calling  
• Offers access to local news, education and entertainment in transit and areas without Wi-Fi access  
• Allows access to Uber-like and AirBnB-like services, which are quickly becoming a part of the daily life and means for transportation and temporary residence |
| 4. Fixed Broadband | Internet access, On-line services   | • Allows wireless/wireline voice and video communication  
• Offers information and entertainment at home / in the office  
• Enables economic livelihood through online job applications, email, file sharing and video interviewing |
Appendix 3: ITU entry-level wireless basket options - Methodology

ITU publishes price information for different baskets of wireless services acknowledging that a wireless plan has call, text and data components. We compare prices of the following three baskets to examine relative international position of Canada, when service offerings change in a wireless plan.

- **Mobile-cellular basket**: monthly usage of 70 minutes (on-net/off-net to a fixed line) in predetermined ratios, plus 20 SMS messages.
- **Data-only mobile broadband basket**: monthly data usage of a minimum of 1.5GB with a minimum speed of 256 kbit/s irrespective of the device used.
- **Bundled mobile-broadband prices (low usage bundle)**: entry-level low-consumption plan allowing monthly data usage of a minimum of 70 minutes, 20 SMS and 500MB data with minimum speed of 256 kbit/s.

Following are the key assumptions used by ITU in estimating prices for all baskets:

- The most common contract modality (postpaid or prepaid) in the country was selected. Pay-as-you-go offers were used if they were cheaper for a given bundle.
- Prices of the operator with the largest market shares (measured by the number of subscriptions) were selected.
- If prices vary between regions of a country, prices in the largest city or the capital city were selected.
- Given different packages with varying number of calls, SMS and data, prices of the cheapest plan that provides the minimum services offerings listed for the basket, were selected.
- Where monthly recurring charges exist, they were added to the basket. Non recurrent fees were not added.
- Prices for a regular plan were considered. Special/promotional offers, discounts, or plans with special price for a family member, were excluded. Special prices that apply to certain type of phones were excluded.

In addition, the following assumptions were made specific to the basket:

**Mobile-cellular basket**

- Outgoing local call rate is considered when national call rates were different.

**Data-only mobile broadband basket**

- 3G technology or above, was considered.
- Residential single user prices were collected.
- Validity period should have been 30 days or 4 weeks.
- The cheapest option providing 1.5GB was selected. For example, if an operator offers 500MB and 2GB plans, a minimum of three times the price of the 500MB plan or the price of the 2GB plan is selected.
- Data volume should refer to both upload and download volumes.

Bundled mobile-broadband prices (low usage bundle)

All the assumptions specific to the first two baskets were used. The selected plan was necessarily not the one with the data, voice and SMS allowances closest to the consumption set of each bundle but rather the cheapest that includes the minimum allowance set for each service offering. For example, if an operator offers a plan including 35 minutes, 10 SMS and 250MB, and a plan including 1GB and unlimited domestic voice and SMS, either twice the first plan (if the package can be purchased twice per month) or the second plan could be selected for the low-consumption bundle. The cheapest option was chosen.
Appendix 4: Study limitations

Receipt of new data or facts: PwC reserves the right at its discretion to withdraw or make revisions to this report should we receive additional data or be made aware of facts existing at the date of the report that were not known to us when we prepared this report. The findings are as of December, 2019 and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date, which would affect our findings.

Data limitations: PwC has relied on information sourced from Statistics Canada, Canadian Radio-television and Telecommunication Commission, Bureau of Labor Statistics US, Federal Communication Commission US, Australian Bureau of Statistics, Office for National Statistics UK, Office of communication UK, OECD. PwC has relied upon the completeness, accuracy, and fair presentation of all information and data obtained from participating businesses and the various data sources, which were not audited or otherwise verified. The findings in this report are conditional upon such completeness, accuracy, and fair presentation, which have not been verified independently by PwC. Accordingly, we provide no opinion, attestation or other form of assurance with respect to the results of this study.

This report and related analysis must be considered as a whole: Selecting only portions of the analysis or the factors considered by us, without considering all factors and analysis together, could create a misleading view of our findings. The preparation of our analysis is a complex process and is not necessarily susceptible to partial analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.