

# Understanding affordability of consumer mobile wireless services in Canada

January 2020

## Addendum:

Impact of unlimited data plans on affordability

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# 1. Impact of unlimited data plans on affordability

## Executive summary

This report serves as an addendum to the report titled “Understanding Affordability of Consumer Wireless Services in Canada”, which was written by PwC in December 2019. It intends to review wireless affordability in light of the 2019 launch of unlimited data plans in Canada. Throughout this report, “overages” refers to mobile data overages. As defined by CRTC, this does not include voice, text or other forms of overage.

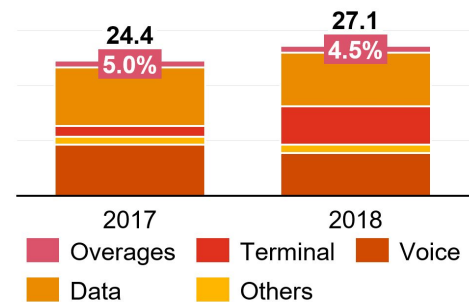
In summary, this report finds that Canadian unlimited data plans are the first ranked amongst the G7 countries, according to PwC’s Unlimited Data Plan Index, which measures plans based on their performance across the key drivers of wireless user experience. Furthermore, this report finds that the introduction of unlimited data plans in Canada are expected to:

- reduce overages by up to 80% by the end of 2020
- incentivize a significant increase in data consumption
- reduce the price paid per GB of data by 50%, between 2018 and 2020
- increase affordability of wireless services by 6% for the average Canadian consumer, by the end of 2020

This report found that in 2017, 5% of Canadian telecom industry wireless revenues were made up of overage fees, which equates to CAD 1.4 billion in total industry revenues. That figure dropped to CAD 1.2 billion in total industry revenues as overage fees declined to 4.5% of telecom revenue in 2018. (Figure 1a) With the introduction of unlimited data plans, that figure is expected to drop at an accelerated rate to 1% of wireless revenues by 2020, cutting roughly 80% of overage fees by the end of fiscal year 2020<sup>1</sup>. This accelerated reduction in overage fees will likely reduce the average revenue per user, and will result in lost telecom industry revenue from overages in the range of CAD 1 billion per year by 2020. (Figure 1b)

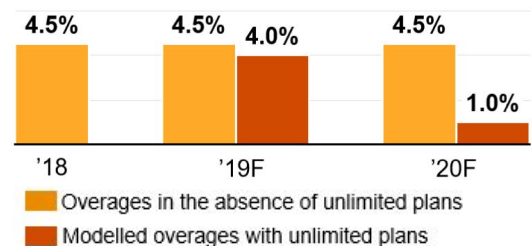
As access to more data becomes available through unlimited data plans, Canadian wireless data consumption is expected to accelerate. This was true for the US, where a rapid increase in wireless data consumption occurred after the full re-introduction of unlimited data plans in 2017.

**Figure 1a: % of telecom revenues from overages vs. other components (CAD billions, %, 2017-18)**



Source: Communication Monitoring Report 2019 - Retail Mobile Sector, CRTC, Government of Canada (Open dataset), F10.1

**Figure 1b: Overage fees as a % of wireless revenues (% of Mobile ARPU, 2018-2020F)**



Source: Communication Monitoring Report 2019 - Retail Mobile Sector, CRTC, Government of Canada (Open dataset), F10.16, PwC forecast for 2019 and 2020 post-launch

A similar trend is already visible in Canada within the first quarter of launch of unlimited plans. For example, Rogers’ Q3 2019 Management’s Discussion and Analysis report states that users who switched to unlimited data plans consumed 50% more data than their tiered plan counterparts. According to TD’s and Scotiabank’s Equity Research Papers from January 8th, 2020, Rogers’ new unlimited data users are consuming 7-8 GB of data a month. However, early switchers are likely to be among the highest data users, and therefore this data increase is expected to moderate over time as more users adopt unlimited plans.

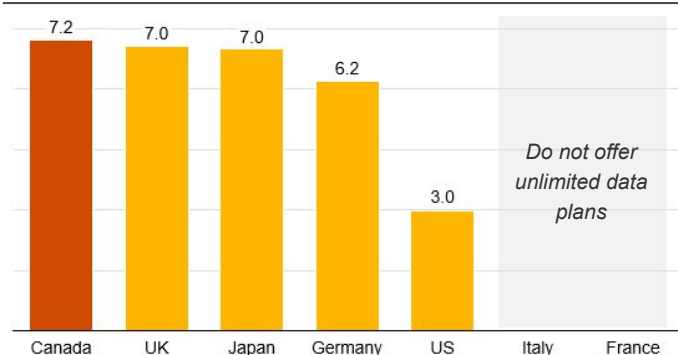
<sup>1</sup> Forecasts throughout the addendum are based on PwC’s assessment of publicly shared information from Canadian telecom providers (Rogers, Bell and TELUS) and other analyst / journalist assessments from reputed sources

Based on the US example, and initial Canadian trends, unlimited plans represent a significant increase in value for money for the average Canadian consumer. By 2020<sup>1</sup>, price paid per GB of data is estimated to decline by 50% compared to 2018 levels, and by 38% compared to 2019 levels. This estimate is driven by forecast increases in data consumption, and reduced overage fees.

Additionally, PwC's Unlimited Data Plan Index shows that Canadian consumers are getting access to the first ranked unlimited data plans amongst the G7 countries. The index is composed of the four key dimensions of wireless user experience - speed, price per GB, access and latency - Canada performs consistently well across these key dimensions, and performs particularly well on speed. (Figure 2)

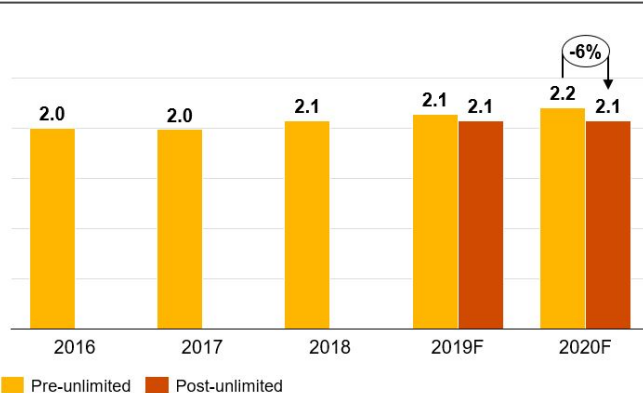
Mobile Average Revenue per User (ARPU) is an industry standard measure to estimate the revenues earned by telecom operators, per mobile user served. It is closely related to the average wireless expenditure by each subscriber, and was used as a measure of affordability in this report. PwC forecasts that through the introduction of unlimited data plans Mobile ARPU for Canadian telcos will be flat, as some consumers are likely to trade up to unlimited data plans, while other consumers move from higher priced tiered plans to ones with unlimited data. This Mobile ARPU as a percentage of disposable income is forecast to drop by 6% in 2020, when compared to the pre-unlimited plans forecast for 2020. This highlights that the introduction of unlimited data plans will increase value through increased data consumption and a declining price per GB of data, as well as increase affordability for the average Canadian consumer. (Figure 3) Notably, younger Canadians under the age of 30 are expected to receive the most benefit from unlimited data plans, as they consume some of the highest volumes of data across age groups.

**Figure 2: PwC's Unlimited Data Plan Index - Canada vs. G7 (index out of 10, 2019)**



Source: PwC's Unlimited Data Plan Index based on speed, access, latency and price paid per GB. See Appendix 2 for details

**Figure 3: Mobile ARPU as a % of adjusted disposable income per capita (% , 2016-2020F)**

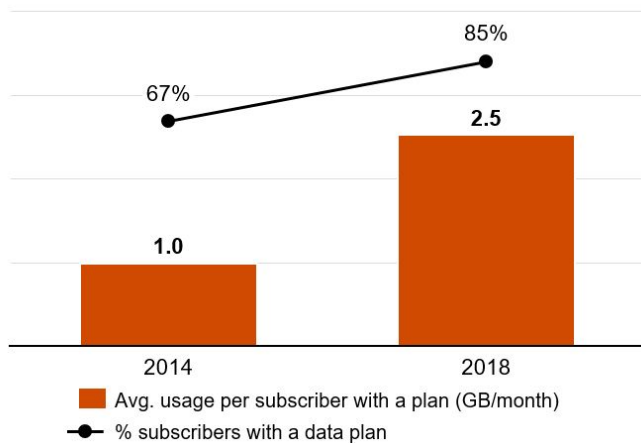


Source: Statistics Canada. Table 11-10-0223-01, Table 11-10-0192-01, Table 36-10-0587-01, Appendix G. User Guide for the Survey of Household Spending 2017, Communication Monitoring Report 2019 - Retail Mobile Sector, CRTC, Government of Canada (Open dataset), F10.1

## 1.1 Introduction of unlimited data plans in Canada

From 2014 to 2018, Canadian consumers showed a steady increase in their consumption of mobile data. In 2014, the average wireless subscriber with a data plan used just under 1 GB per month, which is 60% less than the 2.5 GB per month used in 2018. Additionally, more consumers are subscribing to data plans than before. Last year, 85% of wireless subscribers had a data plan, which is 21% higher than four years ago. (Figure 4)

**Figure 4: % of subscribers with a data plan and their avg. data usage (% of subscribers, GB of data per month, 2017)**



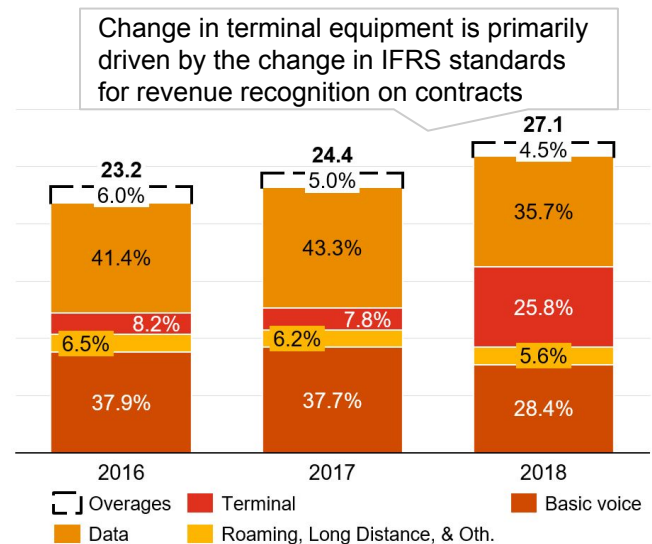
Source: Communication Monitoring Report 2019 - Retail Mobile Sector, CRTC, Government of Canada (Open dataset), F10.6 and F10.15

This increased wireless data consumption was correlated with a change in consumer usage patterns such as shopping, games, videos and social media becoming 'on-the-go', rather than 'on-WiFi'. This resulted in data overages, as many Canadians were unable to manage their data consumption with their new usage patterns.

Canadian consumers collectively paid CAD 1.4 billion in overage fees in 2016, making up 6% of mobile revenues for Canadian telecom operators. Over the years, all telecom players had started providing notifications to consumers who were likely to exceed their data cap, making data management relatively easier. Despite that, consumers paid CAD 1.2 billion in overages in 2018. (Figure 5)

As the size of data buckets offered by telecom companies in Canada grew due to competitive intensity, the market evolved to unlimited data plans and Canadian telecom companies began to offer these plans in 2019. Rogers released its Infinite Data Plan in Q2 of 2019, followed by TELUS and Bell who released their Peace of Mind and Unlimited plans immediately after.

**Figure 5: Breakdown of telecom wireless revenues (CAD billions, % of revenues, 2016-18)<sup>2,3</sup>**



Source: Communication Monitoring Report 2019 - Retail Mobile Sector, CRTC, Government of Canada (Open dataset), F10.1

These unlimited data plans have a limited allotment of high-speed data like traditional tiered plans. However, once the limit is achieved, data speeds are throttled to reduced speeds, rather than overages being applied or data access being denied. When on the reduced speed, consumers are allowed to browse as much as they want. The reduced speed still allows consumers to use communication tools like social messenger applications and access email. Unlimited data plans in Canada range between CAD 75 and CAD 125 across Rogers, Bell and TELUS.<sup>4</sup>

<sup>2</sup> "Overages" throughout the document are based on "Mobile Data Overage" published by CRTC annually

<sup>3</sup> Terminal equipment change is due to new IFRS standards for revenue recognition on contracts

<sup>4</sup> These are all 'Bring Your Own Device' plans. Rogers, Bell and TELUS also offer similar plans that include a device subsidy at a higher price. While the CAD 75 plan is cheaper and more popular as at January 2020, the CAD 125 plan offers higher value for money in terms of price paid per GB included in the plan price



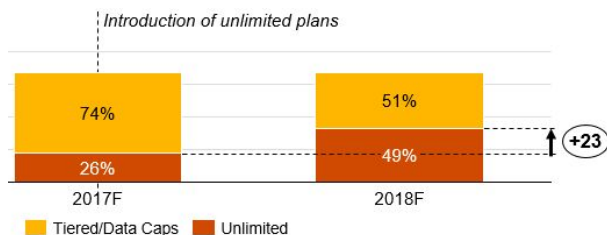
## 1.2 International comparison of unlimited data plans

With the exception of Italy and France, consumers across the G7 (including Canada) now have access to unlimited data plans.

The US first launched unlimited plans in 2009 with 'Verizon Unlimited'. Competitive forces, underestimation of adoption, and infrastructure issues led to the plans placing negative pressures on operators' bottom lines. In 2010, Verizon withdrew its unlimited data plans and its competitors followed suit. Some consumers had locked themselves into yearly contracts, which are now known as 'grandfathered unlimited plans'. US telcos made efforts to shift consumers from grandfathered plans by re-introducing unlimited plans in 2014-15 in a limited capacity. However, in 2017, T-Mobile forced the full re-introduction of unlimited data plans in the US through its "un-carrier" strategy.

Between 2017 and 2018, the US saw 23% of wireless subscribers switching to unlimited plans, and telecom companies began noticing an instant rise in the data consumed by those that had switched. (Figure 6)

**Figure 6: Forecasted wireless consumers by data plan type - US (% , 2017-2018)**

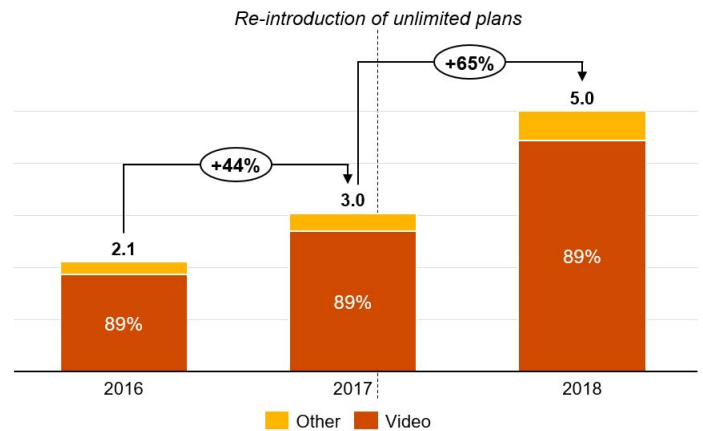


Source: CISCO VNI Forecast 2017-2022 – Impact of US unlimited

Between 2016-17, the US saw a 44% increase in data consumption. However, in 2017-18, after the reintroduction of unlimited plans, the US saw a 65% increase in overall data consumption, with the average consumer using 5 GB a month. (Figure 7) Notably, a large proportion of data consumed in the US (about 89%) is used for video.

It is likely Canadian consumers will see a similar increase in consumption. Rogers' Q3 2019 Report outlines the results of the first quarter of unlimited data plans in Canada, where unlimited users increased their data consumption by 50% when compared to their tiered data plan counterparts. As a result, Rogers expects an elimination of 80% of overage fees by the end of 2020. Further, TD's and Scotiabank's Equity Research shows that Rogers' new unlimited data users are consuming 7-8 GB of data a month. Early switchers are likely to be among the highest data users, and this increase in data consumption

**Figure 7: Actual mobile data use by category - US (GB / month / subscriber, 2016-2018)**



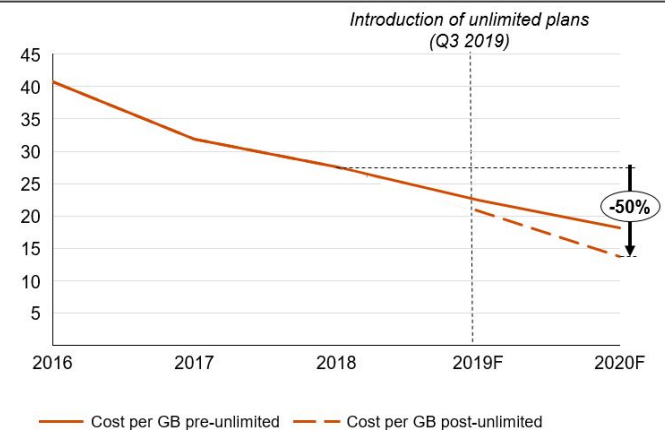
Source: PwC Wireless Consumption Report 2015 & 2019 on data spent per activity, CWIA Annual Results Survey 2019, CTIA "Americans' Wireless Data Usage Continues to Skyrocket" May, 2017

is expected to moderate over time to levels experienced in the US, as adoption of unlimited plans goes beyond early adopters.

Based on the Canadian experience to date and assuming Canadian adoption will be similar to that in the US, unlimited data plans are likely to increase data consumption, and reduce the price per GB. (Figure 8)

Notably, the majority of increased data consumptions is likely to be for video, (Figure 9a) with YouTube and Netflix being the most heavily used sources of video data in Canada. (Figure 9b)

**Figure 8: Mobile ARPU per GB pre- and post-unlimited plans (CAD per GB, 2016-2020F)<sup>5,6</sup>**

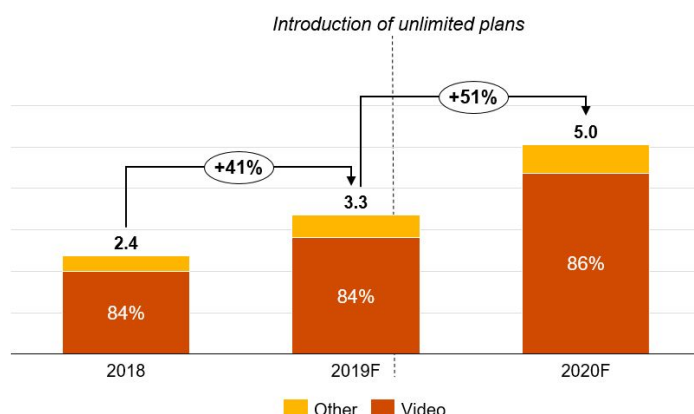


Source: CMR 2018 Retail Mobile Sector (Govt. of Canada Open Database) F10.12, F10.15, PwC forecast based on increase in data usage by unlimited data users and uptake in unlimited plans

<sup>5</sup> This metric was measured by dividing the National Mobile ARPU by the Average Data Usage per Subscriber, both numbers published by CRTC as part of their CMR report from 2019

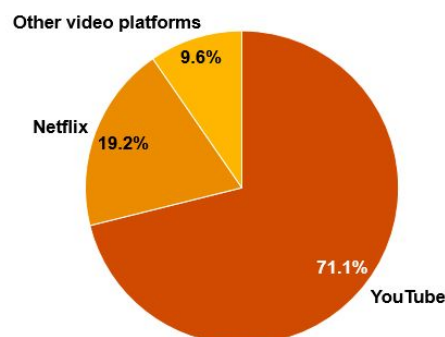
<sup>6</sup> ARPU has been used in the addendum instead of ITU entry-level basket price and household expenditure on wireless used in the main report. This is because ITU's entry-level basket does not represent the impact unlimited data plans, and unlimited data plans affect only a percentage of total consumer base that adopt them, and so can not be accurately forecasted from household expenditure.

**Figure 9a: Mobile data use by category – Canada<sup>7</sup>  
(GB / month / subscriber, 2018-2020F)**



Source: PwC Wireless Consumption Report 2015 & 2019 on data spent per activity, CRTC Mobile Retail Telecommunications 2018 Database, F10.6, Ericsson "Mobile Data Traffic Outlook" 2019

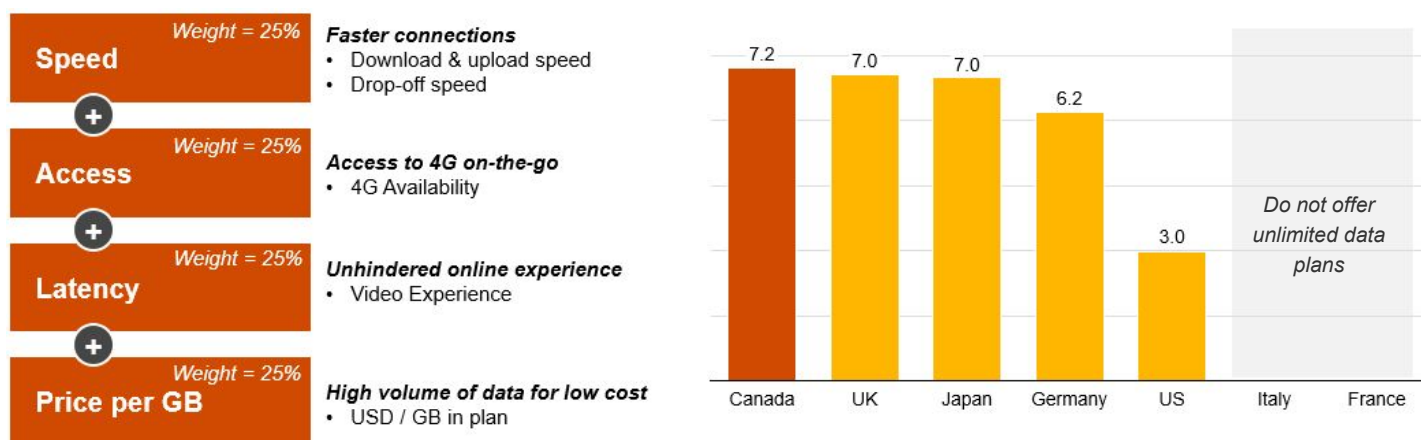
**Figure 9b: Composition of mobile video data consumed (% , 2018)**



Source: PwC Research and Analysis

In order to compare the quality of wireless services received by Canadian consumers, with those received by their counterparts in the G7, PwC developed the Unlimited Data Plan Index. This index, ranging from 1 (poorest) to 10 (best), evaluated wireless services in the six countries (excluding Italy and France) on the four key dimensions that define mobile experience - speed (download, upload and drop-off speeds), access to 4G, latency (video latency and experience)<sup>8</sup> and price paid per GB of data included. The index equally weighs all four factors, and found Canada to be the first ranked of the developed economies compared. Canadian unlimited plans performed particularly well on upload and download speeds. (Figure 10)

**Figure 10: PwC's Unlimited Data Plan Index developed for this report (Index value out of 10, 2019)**

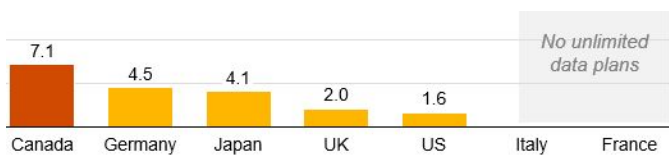


Source: PwC's Unlimited Data Plan Index based on speed, access, latency and price paid per GB. See Appendix 2 for details

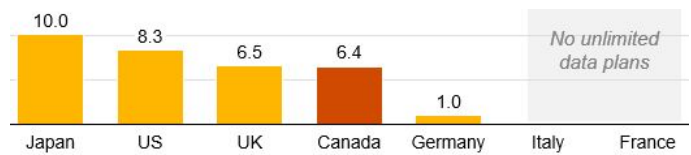
<sup>7</sup> Canadian data consumption in a year from launch of unlimited data plans expected to mimic the US data consumption in the same period, and reach 5GB per month per subscriber

<sup>8</sup> Latency is defined by video streaming experience, the top use of mobile data. A good video streaming experience requires low latency, while high latency has a significant negative impact on video streaming experience. Latency for this report is derived from an ITU-based methodology using video loading time, stall rate and quality. The score is measured on a scale of 0-100, 0 being poor, and 100 being excellent.

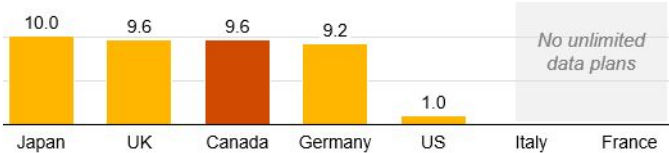
**Figure 11a: PwC's Unlimited Data Plan Index by component - Speed**



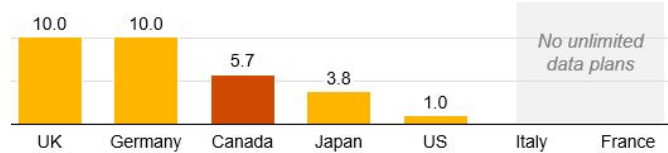
**Figure 11b: PwC's Unlimited Data Plan Index by component - Access**



**Figure 11c: PwC's Unlimited Data Plan Index by component - Latency**



**Figure 11d: PwC's Unlimited Data Plan Index by component - Price per GB**

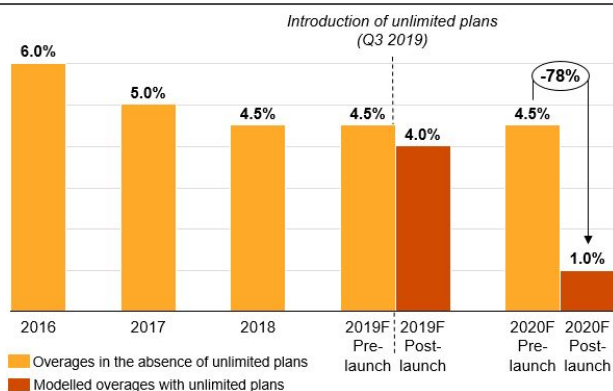


Source: Individual wireless providers annual reports 2017-2019 and official product/ services pages incl. Rogers, Bell, TELUS, Verizon, AT&T, T-Mobile, Sprint, Vodafone, o2, EE, Telekom, NTT DoCoMo, Softbank Wireless, and au.

### 1.3 Impact of unlimited data plans on affordability and their cost to telcos

Unlimited data plans will increase affordability by allowing for increased data consumption, eliminating overage and reducing the price paid per GB by wireless subscribers. Notably, as a percentage of telecom revenues, overages are expected to decline from 4.5% in 2018 to 1% by 2020. (Figure 12)

**Figure 12: Overage fees as a % of wireless revenues (% of Mobile ARPU, 2016-2020F)**

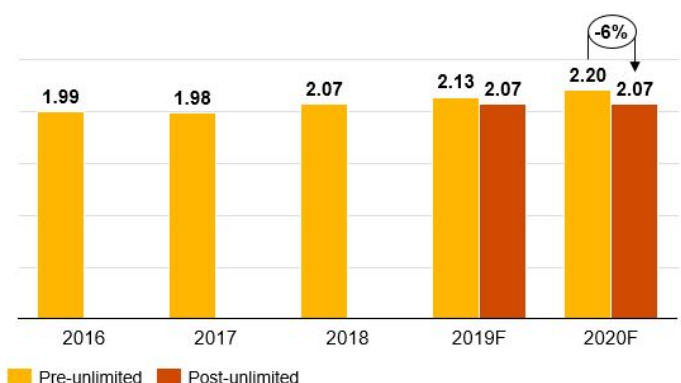


Source: Communication Monitoring Report 2019 - Retail Mobile Sector, CRTC, Government of Canada (Open dataset), F10.16, PwC forecast for 2019 and 2020 post-launch

Given Mobile ARPU's close correlation with average wireless expenditure per user, the report uses Mobile ARPU as a percentage of adjusted disposable income to indicate impact on affordability. As unlimited plans are adopted, Mobile ARPU as a percentage of adjusted

disposable income is expected to decrease by 6% in 2020, compared to the forecasted percentage pre-launch of unlimited plans (Figure 13), increasing wireless affordability for the average Canadian. Notably, given the high volume of data consumed by younger Canadians (<30 years old) relative to other age groups, it is likely that they will benefit the most from unlimited data plans, both through access to significantly higher volumes of data which they will be consuming at a significantly lower price per GB, and through the elimination of overages.<sup>10</sup>

**Figure 13: Mobile ARPU as a % of adjusted disposable income per capita (% , 2016-2020F)<sup>9,11</sup>**



Source: Statistics Canada. Table 11-10-0223-01, Table 11-10-0192-01, Table 36-10-0587-01, Appendix G. User Guide for the Survey of Household Spending 2017, Communication Monitoring Report 2019 - Retail Mobile Sector, CRTC, Government of Canada (Open dataset), F10.1

<sup>9</sup> PwC's forecast is based on the elimination of overage fees, switching of plans (upgrades and downgrades) and associated flattening of ARPUs, along with an increasing adjusted disposable income, which collectively results in a 6% decrease in ARPU as a percentage of income in 2020, vs. the forecast in the absence of unlimited data plans.

<sup>10</sup> Younger Canadians consume significantly more data when compared to their older counterparts, as is indicated by a Financial Post article that mentions: 50% of Canadians between the ages of 18 and 34 use their smartphones for at least 2 hours a day, compared to the national average of ~28%.

<sup>11</sup> This graph uses National "mobile" ARPU to estimate price paid per GB, and not overall industry ARPU for relevance



## 1.4 Looking forward on the impact of unlimited data

With the introduction of unlimited data plans, the average Canadian consumer is expected to consume twice as much data (Figure 9a), pay 50% less per GB of data consumed (Figure 8), and pay approximately 80% less in overages (Figure 12) compared to the 2018 levels. Further, unlimited data plans will increase affordability for the average consumer through a likely reduction in the Mobile ARPU as a percentage of adjusted disposable income, which is forecast to be 6% lower in 2020, compared to the forecasted percentage pre-launch of unlimited plans. This is a significant increase in value and affordability for consumers.

This increase in value will lead to a reduction in revenue for the Canadian telecom industry due to overage elimination, which is unlikely to be completely offset by the upgrade to unlimited plans by some consumers (as per Rogers' quarterly report, 60% of consumers upgraded to unlimited plans and 40% downgraded from higher priced tiered plans). This is because unlimited data plans represent a significant transfer of value from Canadian telecom companies to wireless consumers.








A close-up, slightly blurred photograph of a group of people, likely students or young professionals, gathered together and looking at their smartphones. The focus is on the hands and phones in the foreground, with the faces of the individuals in the background being out of focus. One person in the foreground is wearing a silver metal-link watch. The overall atmosphere suggests a collaborative or educational setting where technology is being used.

# Appendix





## 1. Unlimited data plans

Prices of unlimited data plans, along with other attributes, have been taken directly from the providers' websites.

### 1A. Canada




Carrier	Plan Price (USD)	Data Cap	Download Speed (Mbps)	Upload Speed (Mbps)	Drop-off Speed	4G Availability	Latency (1-100) <sup>8</sup>
 ROGERS	\$58-96	10-50GB	41.7	9.5	512 kbps	87.9%	64.3
 Bell	\$58-96	10-50GB	51.9	8.9	512 kbps	88.6%	68.6
 TELUS	\$58-96	10-50GB	57.0	9.8	512 kbps	90.1%	69.8
 Freedom mobile	\$39-77	7-25GB	N/A	N/A	256 kbps	N/A	N/A
 SaskTel	\$69-96	15-50GB	N/A	N/A	512 kbps – 2Mbps	N/A	N/A

### 1B. United States of America

Carrier	Plan Price (USD)	Data Cap	Download Speed (Mbps)	Upload Speed (Mbps)	Drop-off Speed	4G Availability	Latency (1-100) <sup>8</sup>
 Sprint	\$60-80	500MB-100GB	19.2	2.4	2.1 Mbps	89.5%	47.5
 T-Mobile	\$70-80	3-20GB	23.6	7.3	2.1 Mbps	94.2%	51.7
 AT&T	\$75-85	50-100GB	22.5	4.9	2.1 Mbps	89.6%	46.3
 verizon	\$70-90	10-75GB	22.9	6.9	2.1 Mbps	94.8%	56.1

The US implemented soft-cap unlimited plans where speeds reduce after the cap only when the network is experiencing congestion due to usage levels.

### 1C. Australia




Carrier	Plan Price (USD)	Data Cap	Download Speed (Mbps)	Upload Speed (Mbps)	Drop-off Speed	4G Availability	Latency (1-100) <sup>8</sup>
 Telstra	\$47	40GB	44.5	10.2	1 Mbps	91.1%	70.4
 Vodafone	\$41	100GB	37.2	8.9	1 Mbps	93.1%	70.1
 OPTUS	\$41	30GB	41.6	8.4	1 Mbps	93.2%	70.2

Optus recently relaunched their unlimited data plan after previously experiencing higher than expected costs in sustaining the plans. Vodafone's new unlimited data plan provides 100 GB of 4G speeds without unlimited talk & text, transitioning to a data focused model.

<sup>8</sup> Latency is defined by video streaming experience, the top use of mobile data. A good video streaming experience requires low latency, while high latency has a significant negative impact on video streaming experience. Latency for this report is derived from an ITU-based methodology using video loading time, stall rate and quality. The score is measured on a scale of 0-100, 0 being poor, and 100 being excellent.




## 1. Unlimited data plans (cont'd.)

### 1D. United Kingdom

Carrier	Plan Price (USD)	Data Cap	Download Speed (Mbps)	Upload Speed (Mbps)	Drop-off Speed	4G Availability	Latency (1-100) <sup>8</sup>
	\$44	20GB	31.5	8.2	384 kbps	91.2%	68.4
	\$33	100GB	15.1	5	384 kbps	85.7%	64.6
	N/A	N/A	22	6.7	384 kbps	84.2%	67.7




O2 is currently testing 100 GB data caps, understanding that this provides consumers more data than required.

### 1E. Germany

Carrier	Plan Price (USD)	Data Cap	Download Speed (Mbps)	Upload Speed (Mbps)	Drop-off Speed	4G Availability	Latency (1-100) <sup>8</sup>
	\$71	N/A	33.1	11.1	N/A	85.9%	72.6
	\$71	N/A	18.4	6.6	N/A	72.3%	68.7
	\$94	N/A	21.8	6.3	N/A	81.4%	62.9

German unlimited data plans are considered truly unlimited on 2G+ and 3G speeds only, which cannot be compared to 4G networks.

### 1F. Japan

Carrier	Plan Price (USD)	Data Cap	Download Speed (Mbps)	Upload Speed (Mbps)	Drop-off Speed	4G Availability	Latency (1-100) <sup>8</sup>
	N/A	N/A	27.4	8.1	N/A	96.2%	63.4
	\$34	7GB	32.2	8.9	128 kbps	94.6%	71.1
	\$55	20GB	33.6	6.6	128 kbps	96.8%	67.2

Japan launched unlimited data plans numerous times, first in 1999 when DoCoMo launched their i-mode plans. Those plans were ultimately pulled back in 2017 due to infrastructure concerns and costs becoming too high. New plans since 2017 have seen numerous revisions with Softbank and au removing smaller data cap plans.

<sup>8</sup> Latency is defined by video streaming experience, the top use of mobile data. A good video streaming experience requires low latency, while high latency has a significant negative impact on video streaming experience. Latency for this report is derived from an ITU-based methodology using video loading time, stall rate and quality. The score is measured on a scale of 0-100, 0 being poor, and 100 being excellent.



## 2. Unlimited Data Plan Index: calculation

2A. The collection of data displayed below was taken from OpenSignal industry analysis as well as individual providers' official websites:

Value	Download Speed (Mbps)	Upload Speed (Mbps)	Drop-off (kbps)	4G Availability (%)	Latency (1-100) <sup>8</sup>	USD / GB
Canada	46.8	9.2	512.0	88.3	66.5	1.9
US	22.7	5.9	2100.0	92.2	51.2	3.3
UK	23.3	6.6	384.0	88.5	66.5	0.7
Germany	20.1	6.5	20100.0	76.9	65.8	N/A
Japan	32.9	7.8	128.0	95.7	67.2	2.5

The values shown represent the simple average for the unlimited data plans (one single-user unlimited plan per provider, which offers lowest price per GB of high-speed data included in the plan) offered by the 2-3 of the largest providers per country. This selection criteria was chosen to ensure selection of the most comparable plans across jurisdictions, depending on data availability. Further, latency has been measured based on video latency and experience, as explained in the footnote.

2B. The index was created by assigning a weighting from 10 (best) to 1 (poorest), with the remaining values distributed according to their size between 1 and 10:

Index	Download Speed	Upload Speed	Drop-off	4G Availability	Latency	USD / GB
Canada	10.0	10.0	1.2	6.4	9.6	5.7
US	1.9	1.0	1.9	8.3	1.0	1.0
UK	2.1	2.9	1.1	6.5	9.6	10.0
Germany	1.0	2.5	10.0	1.0	9.2	10.0
Japan	5.3	6.0	1.0	10.0	10.0	3.8

2C. The index was then applied with an equal weighting% for each category as demonstrated below:

Category Index	Speed	Access	Latency	Price per GB	Total	Rank
Canada	7.1	6.4	9.6	5.7	7.2	1
US	1.6	8.3	1.0	1.0	3.0	5
UK	2.0	6.5	9.6	10.0	7.0	2
Germany	4.5	1.0	9.2	10.0	6.2	4
Japan	4.1	10.0	10.0	3.8	7.0	3

Speed was determined by taking an equally weighted average of the upload, download and drop-off speed indices. Access was taken as the availability of 4G. Latency was determined based on video experience, due to video making up majority of the overall data consumption, and hence defining the overall user experience.

<sup>8</sup> Latency is defined by video streaming experience, the top use of mobile data. A good video streaming experience requires low latency, while high latency has a significant negative impact on video streaming experience. Latency for this report is derived from an ITU-based methodology using video loading time, stall rate and quality. The score is measured on a scale of 0-100, 0 being poor, and 100 being excellent.



### 3. Forecasting methodology

The breakdown of industry revenues into key components (voice, data, overages etc.) and number of subscribers for 2013-18, published by CRTC, was used as the starting point for estimating the impact of unlimited plans on affordability. CRTC's overage survey data was used to estimate the percentage of mobile wireless users who paid overages in the previous years. This data, in combination with industry revenues and number of subscribers, was used to estimate the proportion of an average overage-payer's bill that was composed of overage fees. All forecasts of these metrics in the "Pre-Unlimited" scenario were based on the CAGR for 2013-18, used as the year-on-year growth rate going forward until 2020.

Post-unlimited forecasts relied on the above, along with incorporating guidance from the US. In cases indicated within the report (e.g. future data consumption and composition), PwC's analysis assumed that Canada's data consumption would converge with that in the US as limitations on data consumption are lifted with unlimited data plans. Sources like Cellular Telecommunications Industry Association (CTIA), Cellular Wireless Industry Association (CWIA) and CISCO's Virtual Networking Index (VNI) were used to source US data including, but not limited to uptake of unlimited data plans, data consumption by unlimited plan users vs. tiered plan users, average data consumption, etc.

The Mobile ARPU was based on historical Canadian experience, and was substantiated with publicly released forecasts / estimates by Rogers, TELUS and Bell, which provided details into the expected and actual impact immediately following the unlimited data plans' launch.

Collectively, the Mobile ARPU and the average data consumption across those with unlimited data plans and those with tiered data plans was used to estimate the price paid per GB of data consumed on average.

Finally, to forecast the data consumption breakdown, PwC's Wireless Consumption Report 2015 & 2019 on data spent per activity was used for the US and Canada. Using the US as a proxy to forecast Canadian data consumption, a comprehensive breakdown of video vs. other uses was achieved.

# 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 January 2020 and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date that would affect our findings.

**Data limitations:** PwC has relied on information sourced from Statistics Canada, Canadian Radio-television and Telecommunication Commission, telecom operators' websites and annual reports, Office of communication UK, OECD, Cellular Telecommunications Industry Association (CTIA), Cellular Wireless Industry Association (CWIA), CISCO's Virtual Networking Index (VNI) and OpenSignal, among others. PwC has relied on the completeness, accuracy and fair presentation of all information and data obtained from participating businesses and other 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 PwC, 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 descriptions. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.



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