A STUDY ON THE WIRELESS ENVIRONMENT IN CANADA

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Canadian Wireless Telecommunications Association

WALL COMMUNICATIONS INC.

NOTE

The views expressed in this report are those of Wall Communications Inc. and, as such, they are not intended to and nor do they necessarily reflect the views of the Canadian Wireless Telecommunications Association.

Wall Communications Inc*. is an economics consulting firm specializing in telecommunications, broadcasting, film and television production, new media, copyright and intellectual property and competition policy. The firm provides policy and strategic planning advice, conducts economic research and analysis and prepares evidence for regulatory and other proceedings.*

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EXECUTIVE SUMMARY

In June of 2006, the Canadian Wireless Telecommunications Association (CWTA) contracted Wall Communications Inc. to carry out a Study on the state of the Canadian wireless industry. We were asked to assess various dimensions of the industry, including the financial state of the industry, the state of competitiveness, pricing conditions and other performance parameters.

To accomplish this task, the Study includes an examination and assessment of six key aspects of the Canadian wireless industry:

i) financial performance of the industry since its inception 20 years ago,

ii) current wireless coverage or footprint in Canada,

iii) wireless technology deployment and innovation over the last 20 years,

iv) pricing and usage of wireless services in Canada relative to other jurisdictions, particularly the U.S.

v) wireless penetration rates in Canada relative to other jurisdictions, particularly the U.S., and

vi) the current state of competition in the Canadian wireless services market.

In what follows, we provide brief highlights from each of these sections of the Study.

Financial Performance

Since the launch of wireless services in 1985, the growth in mobile wireless subscribers in Canada has been very rapid. The number of wireless subscribers grew from zero to over 17 million today, or well over half the Canadian population.

The investments and expenditures required to make mobile wireless services available to the vast majority of the Canadian population and meet rapid growth in demand have been enormous. According to our estimates, between $18.6 billion and $20 billion has been invested.

Annual net income for the industry has generally been negative over the last 20 years. Net income was briefly positive during the mid-1990s, but turned negative again during the period when second generation digital network capacity and services were initially deployed (i.e., the late 1990s). Net income only became positive again in 2003 and has remained positive since then. The industry, after 20 years of operation, however, has

yet to reach the point where it has fully recovered cumulative investments and expenditures incurred to date.

Wireless Footprint

With a land area of roughly 10 million square kilometres, Canada is the second largest country in the world in terms of land area (only Russia is larger), with a land area of 17 million square kilometres. Given its massive scale, vast rural and remote areas and relatively limited current population of just over 32 million, Canada's population density is only 3 persons per square kilometre.

Despite the challenging scale of the task, digital mobile wireless network coverage in Canada is currently available to 97% of the Canadian population. In terms of geographic coverage, current digital network coverage is close to 1.3 million square kilometres, representing about 14% of Canada's total land area (including the northern territories). Next generation advanced third generation (3G) services are being rolled out rapidly and are currently are available to about 30% of Canadians. Deployment of 3G has primarily been limited to urban centres to date, consequently, so the land area covered by 3G capable wireless networks is minimal relative to Canada's total land area.

In terms of population coverage, Canada compares favourable with other OECD countries including the U.S. However, relative to Canada, there is broader geographic coverage of digital network facilities in the U.S. when considering all wireless carriers operating in the U.S. Comparable geographic coverage data is not available for other OECD countries, but given the vast scale of Canada, including very low population densities across most of the country, there is no reason to expect Canada to match the geographic coverage of wireless networks in most other OECD countries.

Technology Deployment and Innovation

Wireless infrastructure has progressively been modernized worldwide over three generations of technologies -- analog, digital Personal Communications Services (PCS) and advanced digital or 3G wireless services.

The Canadian market, however, has generally been too small to drive new generation wireless technologies or to set the pace at which they are deployed. Several cases have illustrated the challenges and risks of pursuing unique Canadian approaches such as the AURORA cellular technology and digital cordless CT-2 phone. There has been considerable success, however, with a "smart-follower" approach for services such as broadcasting (radio, television, direct satellite), commercial mobile (trunk mobile, cellular and PCS) and consumer products (Wi-Fi and family radios).

In Canada's case, the much larger U.S. wireless market has largely dictated the nature and timing of the introduction of new wireless technologies. Furthermore, for this same reason, there is a need for Canada to align frequency bands and technology decisions with the U.S. In recognition of this reality, Canada has typically adopted a "smart" or "fast-follow" approach to the American wireless industry. In this way, Canadian wireless carriers can take advantage of lower cost (and perhaps proven) technology, the

availability of a wide range of handsets as well as learn from American experience in the marketing of new mobile wireless products and services.

The U.S. has had two significant head starts relative to Canada in the deployment of wireless services. The first came with the deployment of analog cellular service in 1985 and the second with the deployment of digital PCS in the mid-1990s. The U.S. will once again enjoy a head-start with the deployment of Advanced Wireless Services (AWS) at 1710/2110 MHz and wireless at 700 MHz. In large part, the lead time required by the Canadian regulatory process for granting licenses for new spectrum to support services such as cellular, PCS and now AWS accounts for the delays.

Canadian carriers were quick to implement national intermediate second generation digital network capabilities (i.e., GSM/GPRS and CDMA 1XRTT technologies) and did so in parallel timelines with the U.S. carriers. However, Canadian carriers are somewhat behind in the rollout of 3G capabilities in comparison with the U.S. Since a considerable amount of uncertainty still exists as to the best technologies and network solutions to provide high-speed mobile data services, a "smart-follower" approach may again be beneficial for Canadian consumers.

Wireless Pricing and Usage – Comparisons with Other Jurisdictions

Comparing mobile wireless service prices across carriers as well as countries is a complex task given the numerous rate elements and usage considerations involved. Bearing this caveat in mind, we found that mobile wireless service price data across all 30 OECD countries suggest that Canadian mobile wireless rates have consistently compared favourably. Relative to the U.S, Canadian mobile wireless rates also compare favourably, except in the case of high volume users. However, virtually all OECD countries do not compare favourably with the U.S. in this area.

A recent SeaBoard Group wireless pricing comparison study shows that Canada compares favourably with Germany, Sweden, the U.K. and the U.S. for low call volume users, but not for "average" users. However in our opinion, the "average" user, as defined this study, should more accurately have been labelled a "high" volume user. Consequently, the fact that the U.S. was found to have the lower rates for high volume users compared to Canada was not surprising. Had the SeaBoard Group study been broader in scope, as in the case of existing OECD pricing studies, we expect that Canada would have compared favourably for a true "average" user of wireless services.

In terms of a variety of other pricing and usage statistics, we found that:

- While average revenue per minute (RPM) rates in Canada are higher than those in the U.S, they are nevertheless well below RPM rates in many other OECD countries, including Germany, Italy, the U.K. and Japan.

- In terms of average monthly minutes of use (MOU) levels, which are currently at close to 400 MOU per month per user, Canada lags the U.S. which is currently at close to 800 MOU per month per user. Canada nevertheless ranks well ahead of all other OECD countries in terms of monthly per subscriber MOU levels. Moreover, Canada also ranks very favourably among OECD countries in terms of monthly MOU per capita.

- In terms of average revenue per user (ARPU) levels, Canada also falls somewhat short of the U.S. However, Canada nevertheless ranks third highest among OECD countries in terms of ARPU. In addition, Canada's average ARPU has been increasing over the last five years whereas in many OECD countries, including the U.S., it has been declining.

- In terms of data usage levels, both Canada and the U.S. lag Europe in terms of data revenues as a percentage of total ARPU. However, this is largely due to the fact that Europeans and Asians rely on text messaging as a substitute for voice calling due to the higher cost of calling in those countries.

Overall, therefore, we found that Canadian wireless usage rates and prices generally compare very favourably with those of other OECD countries. Canada, like most other OECD countries, ranks behind the U.S. when it comes to rates for high volume users.

Wireless Penetration

Since the launch of mobile wireless services in the mid 1980s, growth in wireless service subscribers in both Canada and the U.S. has been very impressive. Moreover, the average annual growth rates in the two countries have been identical.

On the other hand, whether measured on a population or household basis, penetration rates have been consistently higher in the U.S. compared to Canada since the launch of mobile services in the two countries. As of 2005, wireless penetration in the U.S. was roughly 70% of the total population versus 52% in Canada, representing a difference or "gap"" of 18 percentage points.

In explaining the difference in Canadian and U.S. penetration rates over the last twenty years we found that relative price changes between to the two countries likely played some role, primarily over the course of the last few years. In addition, we expect that relative incomes levels have also played some role in keeping the U.S. ahead of Canada. However, the majority of the difference appears to be explained by the 18 month introduction of service head start enjoyed by the U.S. From the outset when Canada's mobile industry was launched, U.S. wireless penetration has been greater. With growth rates in subscribers largely being equal over the course of the last 20 years, the gap simply grew in proportion to the relative underlying bases of subscribers in the two countries.

There is some evidence suggesting that wireless penetration rates in the U.S. may have accelerated somewhat relative to Canada in the last few years. This may be a result of recent price reductions in the U.S. relative to Canada (i.e., result from the introduction of "big-minute-bucket" low-price, high-volume rate plans in the U.S.).

The State of Competition in the Canadian Wireless Industry

In assessing the overall current state of competition in the Canadian mobile wireless market, we examined five competition measures: product-related measures, price-

related measures, entry/exit conditions, market share/rivalry, and other measures/considerations.

With respect to each of these factors, we reached the following conclusions:

- While the acquisition of Microcell by Rogers has reduced the number of network based suppliers, Canadian consumers still enjoy a healthy and growing number of alternatives, both in suppliers (at retail) and in mobile services and features.

- Canadian wireless prices generally compare favourably with those of other OECD countries, although some service prices and service fees appear to have moved upward in the past few years. We would also note that there have been some downward pricing adjustments and greater customization opportunities that have allowed customers to lower their bills. As a matter of assessing the state of competition, we believe that pricing behaviour is an area that merits ongoing monitoring but it does not, in and of itself, send up a red flag of concern.

- A very powerful mechanism (i.e. ease of entry) to prevent or discourage non-competitive behaviour is absent from the mobile wireless industry since a new network-based entrant will require spectrum that only the government can make available. While entry can (and has) occurred via Mobile Virtual Network Operators (MVNOs) that has added a valuable competitive element to the Canadian market, and other technologies can (and have) provided additional competitive pressure, we believe that preserving an opportunity for new network-based entry is extremely important to disciplining market behaviour, irrespective of whether a new entrant would ultimately succeed in the market. There are several ways that this might be best accomplished and we expect that this issue will receive considerable attention in future policy discussions.

- The overall market share for the three largest facilities-based service providers (NBSPs) has increased in the last year or two. Recognizing that more is usually better for consumer choice, we would note that the loss of the fourth NBSP has been off-set to some extent by greater competition at the retail level from several new MVNOs. In addition, rivalrous behaviour may not be quite as vigorous today as, for example, the period when Microcell was competing but it still exhibits plenty of aggressive marketing and promotional effort to attract customers from one provider to another.

- Consolidation and growing affiliations between competitors have the potential to reduce the tenacity of competition. While a slackening of competition has not been observed as yet, the need for ongoing monitoring of competitor relations and market concentration continues to warrant attention.

A STUDY ON THE WIRELESS ENVIRONMENT IN CANADA

1. INTRODUCTION

In June of 2006, the Canadian Wireless Telecommunications Association (CWTA) contracted Wall Communications Inc. to carry out a Study on the state of the Canadian wireless industry. We were asked to assess various dimensions of the industry, including the financial state of the industry, the state of competitiveness, pricing conditions and other performance parameters.[1]

This Study begins with a review of the *financial performance and characteristics* of the industry. A specific area of interest to the CWTA was the extent to which the investments and expenditures made by wireless carriers in Canada have been recovered since the mobile wireless service industry was first established some twenty years ago. For this purpose, we examined and assessed available historical revenue, expense, capital expenditure and earnings data for the Canadian mobile wireless industry since its inception.

The Study next reviews the coverage (or *wireless footprint*) of Canadian wireless providers. This section of the report provides estimates of the aggregate footprint of mobile wireless service providers in Canada, including population coverage, geographic or land area coverage, network characteristics and availability in urban versus rural areas. This was undertaken with population and land area coverage data provided to us by the largest Canadian wireless carriers, namely Bell Mobility, Aliant Mobility, TELUS Mobility and Rogers Wireless.

A brief review of the *evolution of technology* in the industry follows. The section is divided into three periods, each one roughly corresponding to the three generations of technology used in the industry. Technological development in Canada is compared with events in the U.S. with additional consideration of the role of regulation in the choice and timing of technologies in each country.

The next section considers *pricing* in the Canadian market. There have been a number of recent studies that focused or touched on the state of wireless service prices in Canada. We review the methodologies of that research and provide our views on how Canada compares with the U.S. and other countries.

Penetration of wireless services has been closely linked (by some observers) to overall industry performance. The next section examines mobile wireless penetration rates in Canada and the U.S. We were specifically asked to examine whether a wireless penetration "gap" exists between Canada and the US. To address this question we analyze historical wireless penetration rates in the two countries and provide explanations of the differences that have developed since wireless services were first launched twenty years ago.

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[1] In addition, Wall Communications was asked to prepare a separate study to examine the issues raised in the recent report published by the federal Telecommunications Policy Review Panel. That Study appears under separate cover.

Finally the *state of competition* in the industry is reviewed. The analysis examines five key areas of competitiveness: product (or non-price) considerations, pricing, entry/exit conditions, and market share and rivalry characteristics. Where appropriate, comparisons with other countries (particularly the U.S.) are employed and trends over time are considered.

2. OVERALL FINANCIAL PICTURE OF THE INDUSTRY

2.1 INTRODUCTION

The CWTA asked Wall Communications to estimate the extent to which the investments and expenditures made by wireless carriers in Canada have been recovered since the mobile wireless service industry was first established some twenty years ago. For this purpose, we examined and assessed available historical revenue, expense, capital expenditure and earnings data for the Canadian mobile wireless industry since its inception.

Before turning to the historical financial analysis, we first provide a brief backgrounder on the industry as well as description of the data used for the analysis.

2.2 BACKGROUND

Mobile wireless services were initially launched in Canada in 1985. At the time, there were effectively two major suppliers of mobile wireless services nationwide: Rogers Cantel (now Rogers Wireless) and the incumbent telephone company owned wireless carriers (i.e., the Mobility Canada companies). During the 1980s and well into the 1990s mobile wireless or cellular services were provided using mainly analog technology or first generation (1G) mobile wireless technology.[2]

In 1995, Rogers and the Mobility Canada companies along with new entrants, Clearnet and Microcell, were licensed by Industry Canada to provide second generation (2G) digital Personal Communications Service (PCS). Digital PCS services were initially launched in 1997, which necessitated the rollout of nationwide 2G digital PCS wireless networks. Shortly thereafter, Mobility Canada companies dissolved their alliance and TELUS Mobility acquired Clearnet in 2000. As well, Rogers acquired Microcell in 2004. Consequently, there are now three major national facilities-based wireless players, including the Bell Mobility, TELUS Mobility and Rogers. In addition, there are a number of other regional players as well, such as MTS Mobility, SaskTel Mobility among others.

Since 2G digital PCS wireless services were first deployed in the late 1990s more advanced digital services have been developed and deployed. All major wireless carriers have upgraded their networks to provide more advanced (higher speed) digital wireless services (generally referred to as 2.5G digital technologies). These include 1xRTT technology in the case of CDMA network operators such as Bell Mobility and TELUS Mobility and GPRS and EDGE technologies in the case of GMS network operators such as Rogers. As well, third generation (3G) technologies, offering much higher data transmission speeds, are currently being deployed by all major carriers, initially in large urban areas. Successive wireless technology advancements have

[2] As discussed in Section 4, digital Time Division Multiple Access (TDMA) technology was also introduced during this period.

resulted in successive waves of wireless network build-outs or upgrades, each at significant cost.

2.3 OVERVIEW OF INDUSTRY DATA AND METHODOLOGY

Our primary source of financial data, including revenues, expenses, earnings and capital expenditures, for the Canadian wireless industry which is used in this analysis is Statistics Canada. While Statistics Canada has long collected and published statistics on the wireline telecommunications industry in Canada, it only began to collect data on the wireless segment of the industry in the mid 1990s. Its first publication providing comprehensive historical data on the Canadian wireless industry was released in 1998.[3] This initial release included financial data and statistical indicators for the industry for the period 1987 to 1996. Data for first two years wireless services were available in Canada, 1985 and 1986, were not released by Statistics Canada for confidentially reasons (and they remain confidential today). Consequently, we do not have access for financial data for those initial two years.

Revenues in those years were likely relative low given that there were only a few thousand subscribers in 1985 and only roughly 42,000 in 1986.[4] On the other hand, capital expenditures in the initial start-up phase of the industry were likely significant. As is shown in the following section, however, it is likely wireless industry capital expenditures incurred in 1985 and 1986 are insignificant relative to cumulative capital expenditures incurred between 1987 to date.

Statistics Canada also issued an historical statistics update for the industry in early 2000, which provided summary financial and statistical information for the Canadian wireless industry for the period 1995 to 1998.[5]

From that point on, Statistics Canada's annual surveys of the telecommunication industry, included in the *Broadcasting and Telecommunications Service Bulletin*, were expanded on a permanent basis to include data on both the wireline and wireless segments of the industry.[6] There were a number of methodological changes to the way in which revenue and expense data for the wireless industry were reported in the annual surveys (starting with 1998) compared to the first two ad hoc surveys of the wireless industry (covering the period 1987 to 1997). However, it appears that while the levels of expenses and revenues changed somewhat as a result these methodological changes,[7] there was no significant affect on historical measures of depreciation expenses, capital expenditures or earnings due to the methodological changes.

It should be noted that Statistics Canada also issues a separate *Quarterly Telecommunications Statistics Service Bulletin* which reports quarterly

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3 Statistics Canada, Communications Service Bulletin, Catalogue no. 56-001-XIB, Vol. 28 No.1, April 1998.

4 Source: CWTA Industry Subscriber Statistics.

5 Statistics Canada, Communications Service Bulletin, Catalogue no. 56-001-XIB, Vol. 29 No.4, March 2000 (revised May 2000).

6 Provided in Statistics Canada, Communications Service Bulletin, Catalogue no. 56-001.

7 According to Statistics Canada, the primary change in methodology involved a shift in reporting revenues from a net to gross revenue basis.

telecommunications statistics for the wireline and wireless segments of the industry.[8] This service bulletin is issued on a timelier basis (e.g., the most recent edition released in May of this year provides data for the 4th quarter of 2005). However, to do so, Statistics Canada relies on data collected from major rather than all players in the industry. This approach necessitates the inclusion of under-coverage adjustments to account for likely measurement errors. In effect, therefore, the *Quarterly Telecommunications Statistics Service Bulletin* is less comprehensive and likely somewhat less accurate compared to data provided in Statistics Canada's *Broadcasting and Telecommunications Service Bulletin*.

Consequently, for the purpose of constructing a historical time series of financial data for the wireless sector of the Canadian telecommunications industry, we have relied on data reported in Statistics Canada's annual telecommunications industries survey contained in the *Broadcasting and Telecommunications Service Bulletin.* In fact, Statistics Canada provided us with updated data from this publication for the period 1998 to 2004.

However, to extend the historical data period one additional year, we have also relied on the financial data for 2005 reported in Statistics Canada's *Quarterly Telecommunications Statistics Service Bulletin.* The financial data for 2005 may not be strictly consistent with previous years, although we would expect any discrepancies to be minimal.

Where apparent discrepancies do exist between the Canadian wireless industry data provided by Statistics Canada's *Broadcasting and Telecommunications* and *Quarterly Telecommunications Statistics Service Bulletins* which are relevant to this report, they are noted below.

Note that all data used to generate the figures discussed in the following section are provided in the Appendix.

2.4 HISTORICAL FINANCIAL TRENDS

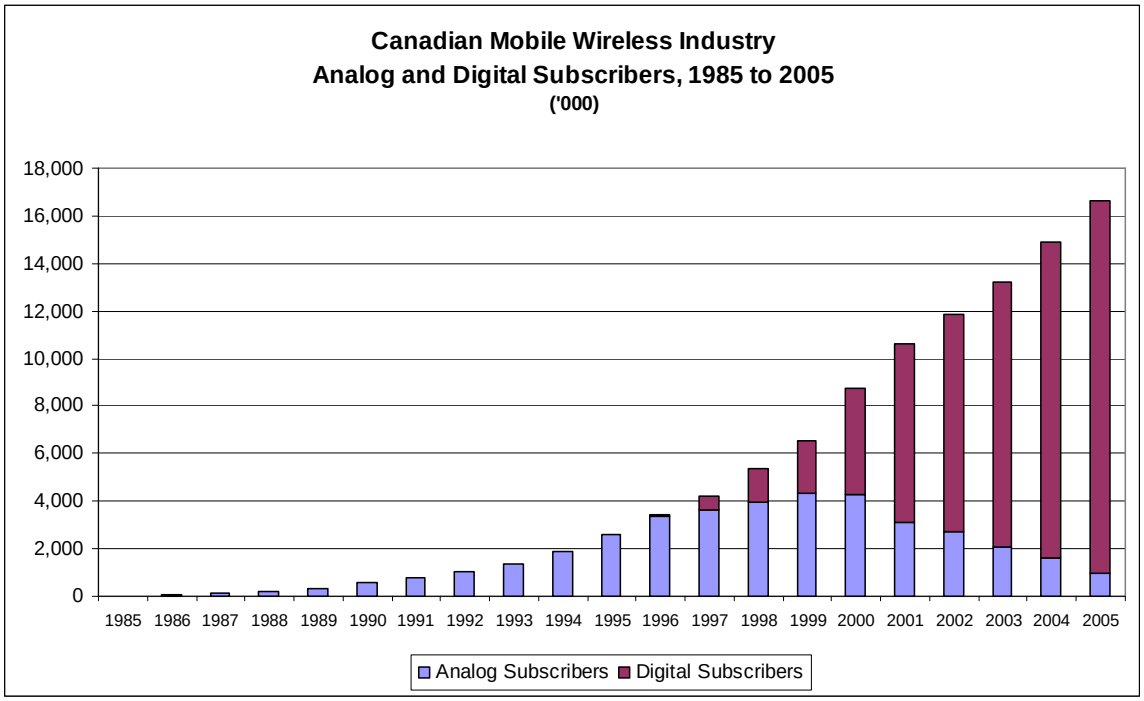
Subscriber Growth

Since the launch of wireless services in 1985, the growth in mobile wireless subscribers in Canada has been rapid. The number of wireless subscribers grew from zero to over 16.5 million in 20 years (i.e., as of year-end 2005). Over the last ten years alone, the average annual rate of growth in subscribers was 20%. As the base of subscribers has grown, the year-over-year growth in subscribers has however generally declined.

Figure 2.1 below provides an overview off subscriber growth over this period, separating analog and digital subscribers. Digital PCS wireless services were launched in 1997 and more advanced digital technology based services (2.5 and 3G) have been launched more recently. As of 2005, digital mobile wireless subscribers accounted for close to 95% of all subscribers.

[8] Statistics Canada, Broadcasting and Telecommunications Service Bulletin, Catalogue no. 56-002 (which includes an annual issue on Telecommunications Industries).

Figure 2.1



Source: Statistics Canada, CWTA and Wall Communications

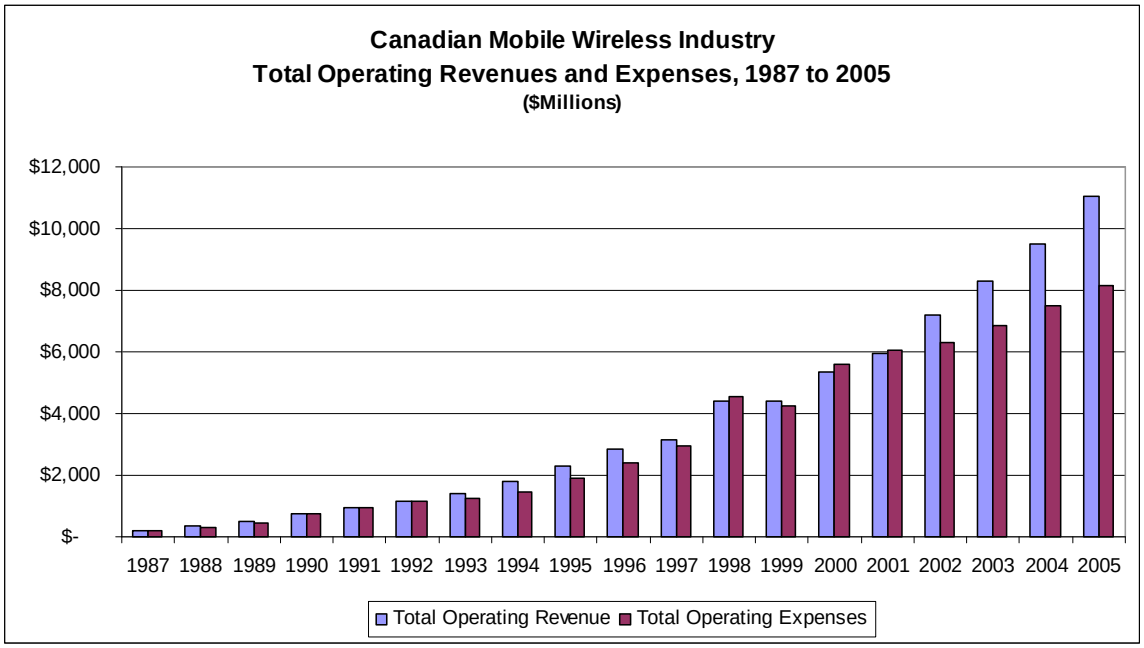
Revenues and Expenses

Rapid growth in mobile wireless subscribers has translated into rapid growth total operating revenues for the Canadian mobile wireless industry. As of 2005, total operating revenues for the industry reached just over $11 billion. Over the last 10 years, total operating revenues have grown at an average annual rate of 17%. This is somewhat lower than the growth in subscribers which indicates that the average revenue per subscriber (ARPU) has declined, on average, over the same period.

At the same time, total operating expenses (including depreciation) have also grown rapidly. As of 2005, total operating expenses reached $8.2 billion. Over the last ten years, total operating expenses have grown at an average annual rate of 16%, just below the growth rate in revenues.

As Figure 2.2 indicates, in most years total operating revenues have exceeded expenses, the exceptions being in the initial start-up years and during the launch of 2G digital PCS services. The decline in revenues and expenses in 1999 relative to 1998 is likely due, in part, to methodological changes introduced by Statistics Canada at that time. More recently, revenues have increasingly exceeded expenses and, consequently, net operating revenues have grown considerably as a result.

Figure 2.2



Source: Statistics Canada and Wall Communications

Earnings

Since 1985, wireless industry net operating revenues (i.e., earnings before interest and taxes or EBIT) have generally been low or even negative in many years. However, as of 2002, industry net operating revenues finally turned positive and have begun to grow steadily. As of 2005, net operating revenue reached $2.9 billion. On a cumulative basis for the period 1987 to 2005,[9] net operating revenues reached $8.6 billion, the vast majority of which was generated since 2002.

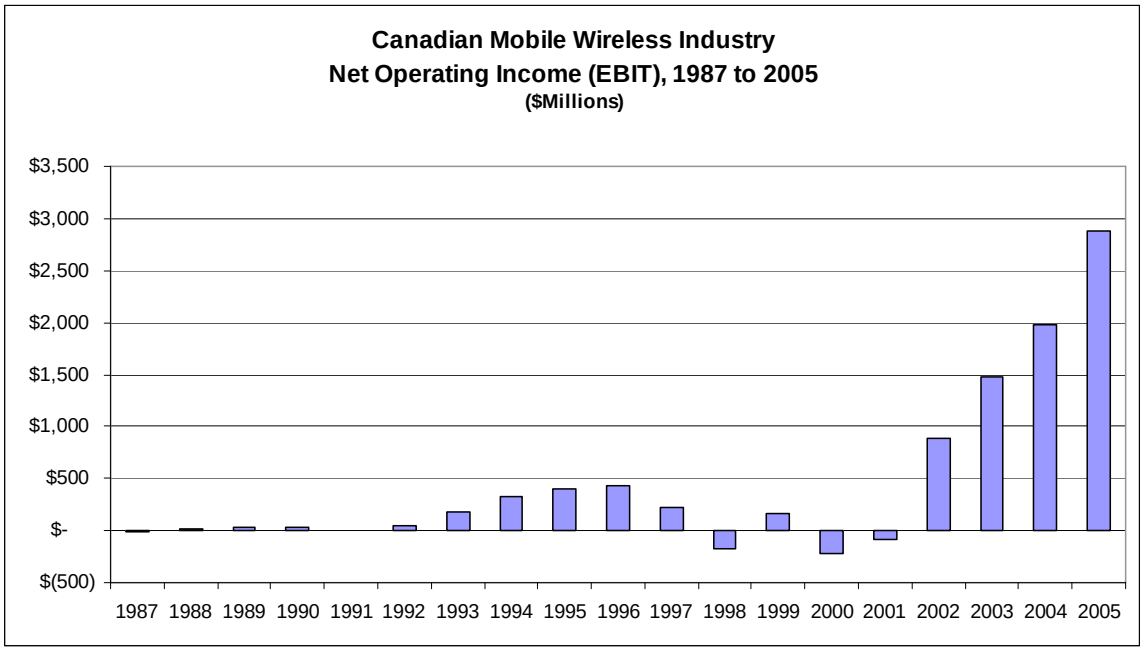
Figure 2.3 below provides annual wireless industry net operating incomes (or EBIT) for the period 1987 to 2005.

A similar pattern also emerges when we look at wireless industry net income (i.e., earnings after depreciation, interest and taxes). In this case, however, net income for the most part has been negative over the last 20 years. Net income was briefly positive during the mid-1990s, but turned negative again during the period when digital PCS network capacity and services were initially deployed (i.e., the late 1990s). Net income became positive once again in 2003 and has subsequently grown to roughly $2.3 billion as of 2005. On a cumulative basis over the period 1987 to 2005, net income is just over $1 billion. However, up until 2005, cumulative net income had been consistently negative in all preceding years (dropping to a low of -$3.8 billion in 2001 and 2002).

[9] Note that all reported cumulative totals are based on current or book dollars for the period 1987 to 2005. The cumulative total does not include 1985 and 1985 and, therefore, slightly understates the cumulative totals relative to the initial launch date of the industry.

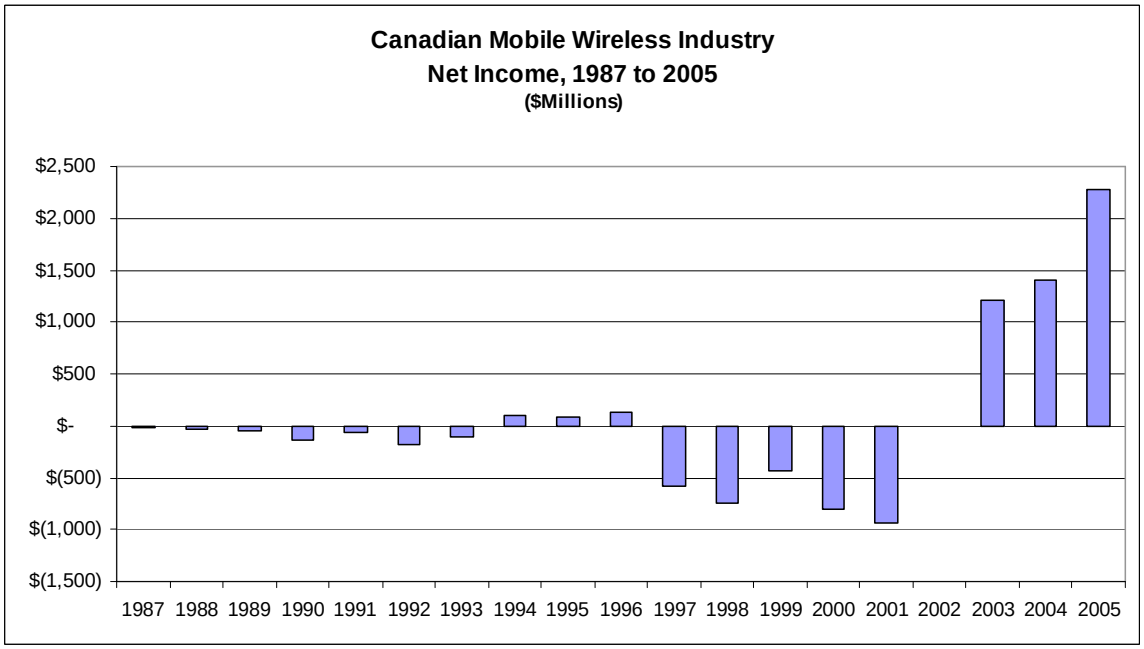
Figure 2.4 below provides annual wireless industry net income for the period 1987 to 2005.

Figure 2.3



Source: Statistics Canada and Wall Communications

Figure 2.4



Source: Statistics Canada and Wall Communications

Capital Expenditures

Canadian wireless industry capital expenditures grew quickly during the first five years wireless services were made available in Canada, before tapering off somewhat in the early 1990s. During that time, industry capital expenditures ranged from a low of $160 million in 1987 to $627 million in 1990 (in book dollars). With the launch of digital PCS services in the late 1990s and subsequent upgrades to more advanced digital technologies, capital expenditures increased to over $1 billion per year from 1996 to date, and exceeded $2 billion in 2000.

We note, however, that capital expenditure data reported in Statistics Canada's *Broadcasting and Telecommunications* and *Quarterly Telecommunications Statistics Service Bulletins* can vary considerably in some years during the period 2000 to 2004. Based on capital expenditure data provided by the major wireless carriers, it appears that in some years Statistics Canada's capital expenditure estimates reported in the *Broadcasting and Telecommunications Service Bulletin* may be underestimated (especially so in 2001).[10] On balance, it appears that Statistics Canada's capital expenditure estimates may be understated by at least $750 million. We have not, however, attempted to adjust Statistics Canada's data in this regard, but simply note this apparent measurement error as a caveat when considering annual and cumulative capital expenditure estimates for the industry.

As well, as noted earlier, we do not have estimates of industry capital expenditures for 1985 and 1986, which also implies that our estimate of the cumulative capital expenditures for the Canadian wireless industry since its inception are further understated. In the latter case, the magnitude of the understatement is likely not large -- i.e., no more than $300 million to $400 million -- given that available industry capital expenditures in the 1987 to 1898 period increased rapidly and averaged roughly $275 million per year.

Figure 2.5 below provides an overview of annual capital expenditures in the industry covering the period 1987 to 2005. In sum, cumulative capital expenditures over this period reached $18.6 billion as of 2005. However, for the reasons noted above, it is likely that cumulative capital expenditures could be closer to $20 billion to account for capital expenditures incurred in 1985 and 1986 and apparent measurement discrepancies in Statistic Canada's recent *Broadcasting and Telecommunications Service Bulletins*.

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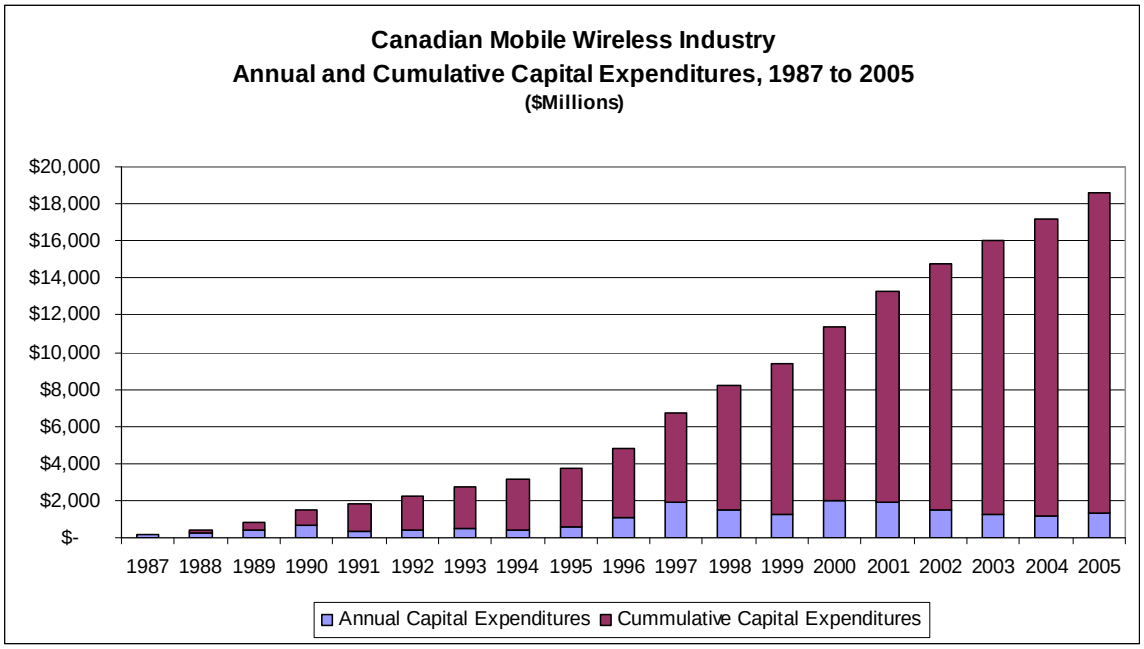
[10] While discrepancies in capital expenditure estimates do not appear to be large in most years, there is one exception. In 2001, the difference between Statistics Canada's capital expenditure estimates reported in the *Broadcasting and Telecommunications* (which we rely on) and *Quarterly Telecommunications Statistics* Service Bulletins is in the order of $750 million. The estimate in the latter publication appears to more closely correspond to the capital expenditure data reported the major wireless carriers. However, without being able to adjust other financial data as well (e.g., depreciation and interest), we simply rely on the data provided by Statistics Canada that is reported in the *Broadcasting and Telecommunications Service Bulletin.*

Figure 2.5



Source: Statistics Canada and Wall Communications

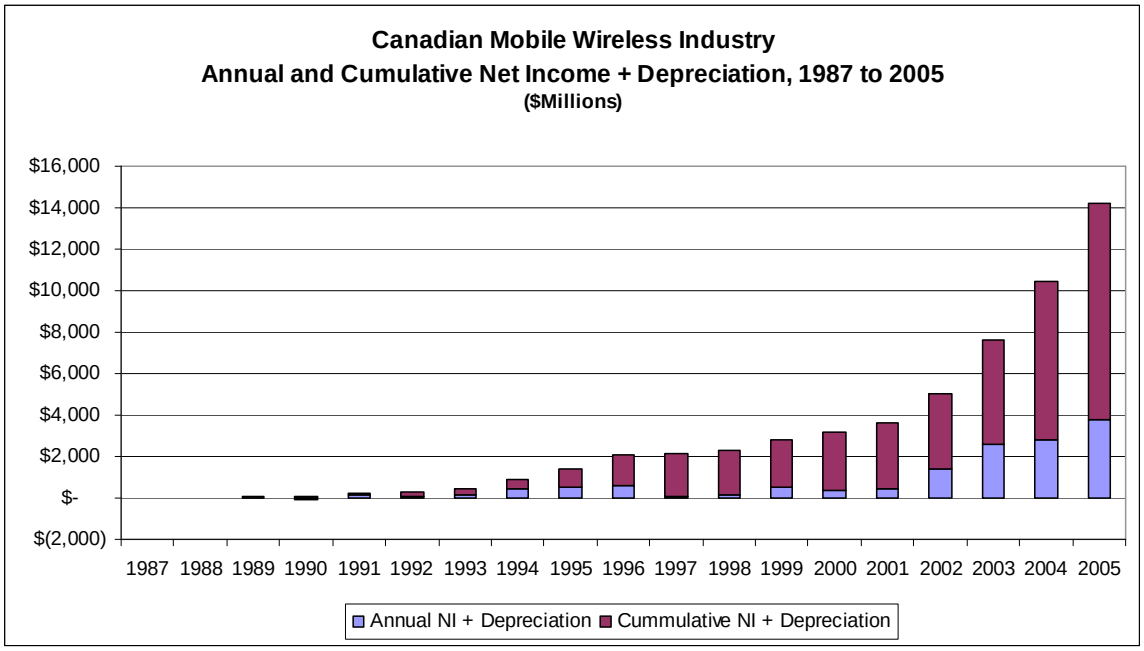
Cash Flow and Capital Recovery

In order to assess the Canadian wireless industry's ability to recover capital investment and other operating expenditures we first consider historical trends in net income plus deprecation expense over the period 1987 to 2005 (i.e., internal cash flows that can be used to fund capital investments). As Figure 2.6 below shows, the cumulative net income plus depreciation approached $1 billion in 1994 and then reached $2 billion two years later in 1996. Since that time, cumulative net income plus depreciation accelerated rapidly, rising to over $14 billion as of 2005.

Nevertheless, cumulative capital expenditures over the same period (i.e., of at least $18.6 billion) exceeded cumulative net income plus depreciation by over $4 billion as of 2005. However, the gap between to two is quickly shrinking. Considering cumulative industry-wide cash flow (i.e., measured as cumulative net income plus depreciation less capital expenditures) over the period 1987 to 2005, we see that the industry turned the corner in terms of cumulative cash flow in 2002 (see Figure 2.7 below). At that time, cumulative cash flow had dropped to almost -$10 billion. However, as of 2005, cumulative cash flow had improved considerably and was roughly -$4 billion.

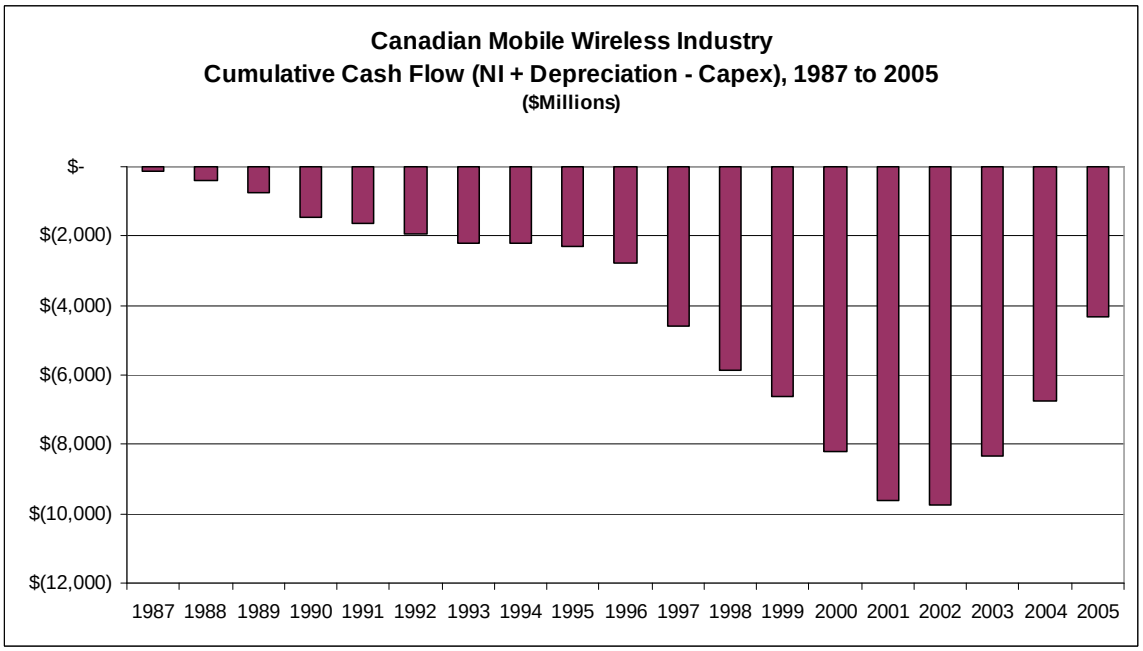
Therefore, while the industry has yet to fully recover its capital investments and expenditures, it appears that it should be able to reach this goal within the two years or so assuming earnings continue to improve consistent with recent earnings performance.

Figure 2.6



Source: Statistics Canada and Wall Communications

Figure 2.7



Source: Statistics Canada and Wall Communications

2.5 CONCLUSION

There are over 17 million mobile wireless subscribers in Canada today, representing roughly 53% of the Canadian population. The investments and expenditures required to make mobile wireless services available to the vast majority of the Canadian population and meet rapid growth in demand for wireless services over the last 20 years have been enormous: according to our estimates, at least $18.6 billion (and likely closer to $20 billion if capital expenditures for 1985 and 1986 are included and apparent capital expenditure underestimates were corrected). Our findings indicate that the industry, after 20 years of operation, has yet to reach the point where it has fully recovered cumulative investments and expenditures incurred to date. However, based on recent financial performance trends, it appears that the industry is now only a few years or so away from achieving this goal.

3. WIRELESS FOOTPRINT

3.1 INTRODUCTION

In this section of the report, we provide estimates of the aggregate footprint of mobile wireless service providers in Canada, including population coverage, geographic or land area coverage, network characteristics and availability in urban versus rural areas. To do so, we have relied on the population and land area coverage data provide to us by the major Canadian wireless carriers, namely Bell Mobility, Aliant Mobility, TELUS Mobility and Rogers Wireless.

Where possible, we have also provided additional demographic parameters of coverage areas, such as population densities and private dwelling densities as well as measures of investment per capita as it relates to geographic coverage. In addition, we have provided comparative information for the U.S. and other countries.

3.2 BACKGROUND

With a land area of roughly 10 million square kilometres, Canada is the second largest country in the world in terms of geographic area. Only Russia is larger, with a land area of 17 million square kilometres. The U.S. is the third largest country and is very close in scale to Canada, with a land area of 9.6 million square kilometres.[11]

Given its massive scale and relatively limited current population of just over 32 million, Canada's population density is only 3 persons per square kilometre. Not surprisingly, given that population in the U.S. is almost ten times higher than that of Canada, population density in the U.S. is also roughly ten times greater, at roughly 31 persons per square kilometre. By way of further contrast, other countries with large geographic land areas such as China and India have even higher population densities of 136 and 329, respectively. On the other hand, Australia, like Canada, also has a population density of 3 persons per square kilometre.[12]

In terms of population distribution by province within Canada, Ontario accounts for the largest share of Canada's population at close to 40% of the total (as shown in Table 3.1 below). Québec is the next largest province, accounting for roughly 24% of the total population. Alberta and BC jointly account for a similar share. The Atlantic Provinces, Manitoba and Saskatchewan combined account for about 14% of the total population. The three northern territories account for only a very small fraction of the country's population.

Population densities vary considerably by province. While not shown in Table 3.1, PEI has the highest population density at roughly 24 persons per square kilometre as of year-end 2005. It is followed by Nova Scotia at 17 persons per square kilometre.

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[11] Land area statistics are drawn from WorldAtlas.com, http://worldatlas.com/aatlas/populations/ctyareal.htm.

[12] Ibid.

However, the average for the four Atlantic Provinces combined is roughly 4 persons per square kilometre. Otherwise, Ontario has the next highest population density at roughly 12 persons per square kilometre. Québec, Alberta and BC follow at roughly 5 persons per square kilometre. The remaining provinces are lower still and, of course, the population density is negligible in the vast area covered by the northern territories.

Table 3.1
Canadian Population Count and Density
Year-end 2005

Geographic Area	Estimated Population Year-end 2005	Population Distribution %	Land Area km^2	Population Density $persons/km^2$
Atlantic Provinces	2,340,665	*7.2%*	539,102	4.3
Quebec	7,623,870	*23.5%*	1,540,680	4.9
Ontario	12,599,364	*38.9%*	1,068,582	11.8
Manitoba	1,178,348	*3.6%*	650,087	1.8
Saskatchewan	990,930	*3.1%*	651,900	1.5
Alberta	3,306,359	*10.2%*	661,185	5.0
British Columbia	4,279,462	*13.2%*	948,596	4.5
Territories	103,921	*0.3%*	3,916,007	0.0
Canada	**32,422,919**		**9,976,139**	**3.3**

Source: Statistics Canada and Hammond Atlas of Canada and the World.

In contrast, there are only ten U.S. states with population densities of 12 persons per square kilometre or less. Most U.S. states have far higher population densities. In fact there are ten states with population densities of over 100 persons per square kilometre, including New Jersey which has the highest state population density in the U.S. at roughly 450 persons per square kilometre.

According to Canada's 2001 Census data,[13] 80% of Canadians live in urban areas with the balance living in rural areas.[14] The percentage of Canadian living in urban areas has been steadily increasing over time. In 1986, for instance, when wireless services had just been launched a year earlier, the percentage of Canadians living in urban areas was 76%.[15] It is likely therefore that the 2006 Census results will once again show a slight increase in the percentage of the total population living in urban areas today.

The distribution of urban and rural populations varies considerably by province, as shown in Table 3.2 below. In the larger provinces -- Ontario, Quebec, BC and Alberta -- urban population accounts for 80% or more of the total provincial population. In other

[13] The 2001 Census provides the most comprehensive data on Canadian population statistics, although population projections are also available. Canadian 2006 Census data is not yet available.

[14] Note that an "urban" area is defined as an area with a minimum population concentration of 1,000 persons and a population density of at least 400 persons per square kilometre. Urban population includes all population living in the urban cores, secondary urban cores and urban fringes of census metropolitan areas (CMAs) and census agglomerations (CAs), as well as the population living in urban areas outside CMAs and CAs. All territory outside urban areas is classified as "rural".

[15] Statistics Canada: http://www40.statcan.ca/l01/cst01/demo62a.htm?sdi=urban%20rural.

cases, the rural population can account for close 50% of the population (as in the case of the Atlantic Provinces as well as the northern territories.

Table 3.2
Canadian Population: Urban versus Rural
2001 Census Data

Geographic Area	Urban	Rural
Atlantic Provinces	54%	46%
Québec	80%	20%
Ontario	85%	15%
Manitoba	72%	28%
Saskatchewan	64%	36%
Alberta	81%	19%
British Columbia	85%	15%
Territories	51%	49%
Canada	**80%**	**20%**

Source: Statistics Canada

There are close to 30 larger urban centres in Canada -- i.e., Census Metropolitan Areas or CMAs as defined by Statistics Canada. The five largest include: Toronto, Montreal, Vancouver, Ottawa/Gatineau and Calgary. Population densities in these CMAs were 793, 847, 690, 200 and 187 persons per square kilometre, respectively, in 2001.[16] The average across all CMAs is 244 persons per square kilometre. A listing of population densities for all CMAs is provided in Table 3.A1 in the Appendix.

The total population of all CMAs in Canada in 2001 was roughly 19.2 million representing roughly two-thirds of the total Canadian population. The remaining urban population is located in smaller urban centres or Census Agglomerations (CAs). The total land area of all CMAs amounts to roughly 1.0% of the total land area of Canada. The total land area of all CMAs and CAs combined amounts to roughly 3.5% of the total land area of Canada.[17]

In comparison, population in densities in major U.S. cities are generally higher. The five largest cities by population in the U.S. are New York, Los Angeles, Chicago, Houston and Philadelphia. The population density in New York exceeds 10,000 persons per square kilometre, and the population densities in Los Angeles, Chicago and Philadelphia fall between 3,000 and 5,000 persons per square kilometre. It should be noted, however, that these very high population densities are measured over relatively small urban land areas compared to CMAs as defined by Statistics Canada. For instance, the City of Montréal sub-division of the Montreal CMA had a population density of roughly 5,600 persons per square kilometre in 2001 and the City of Toronto sub-division of the Toronto CMA had a population density of roughly 3,000 persons per square kilometre that same year.

[16] http://www12.statcan.ca/english/census01/products/standard/popdwell/Table-CMA-N.cfm.

[17] Although it should be noted that land areas for some CMAs or CAs used in Statistics Canada's population density calculates may not be accurate, consequently, Census related land area estimates can differ from actual geographic land area data.

On the other hand, Houston has a very large land area and, as a result, its population density is only 31 persons per square kilometre.[18] Consequently, it is not necessarily the case that U.S. cities or urban areas have higher population densities than Canadian urban areas, but rather that there are more cities in the U.S. and, therefore, higher population densities per square kilometre on average at the state and national levels.

There were roughly 12.5 million private dwellings in Canada at the time the 2001 Census was conducted. Private dwellings are very close in number to Canadian households, although it is possible that some private dwellings are unoccupied. Table 3.3 provides a summary of the number of private dwellings in Canada, broken down by province and region, and it also provides the average number of persons per private dwelling and private dwelling density per square kilometre.

Table 3.3
Canadian Private Dwelling Count and Density
2001 Census Data

Geographic Area	Private Dwellings 20001	Dwelling Distribution %	Avg. Persons per Dwelling	Dwelling Density dwellings/km^2
Atlantic Provinces	1,000,990	*8.0%*	2.3	2.0
Quebec	3,230,196	*25.7%*	2.2	2.4
Ontario	4,556,240	*36.3%*	2.5	5.0
Manitoba	477,085	*3.8%*	2.3	0.9
Saskatchewan	431,628	*3.4%*	2.3	0.7
Alberta	1,171,841	*9.3%*	2.5	1.8
British Columbia	1,643,969	*13.1%*	2.4	1.8
Territories	36,639	*0.3%*	2.1	0.0
Canada	**12,548,588**		**2.4**	**1.4**

Source: Statistics Canada

The majority of Canadian private dwellings are found in Ontario and Quebec (i.e., over 60% combined). The average number of persons per dwelling does not vary greatly by province or region. For the country as a whole, the average is 2.4 persons per private dwelling.

Like population density, private dwelling density varies considerably across the country. The highest density is found in Ontario at 5 private dwellings per square kilometre. The two lowest densities are found in Manitoba and Saskatchewan at just under one private dwelling per square kilometre in each province. Private dwelling density is near negligible in the northern territories.

3.3 WIRELESS NETWORK COVERAGE

For the purpose of this study, we asked CWTA member wireless carriers for information on their current mobile wireless network coverage. The information was requested on

[18] U.S. statistics drawn from U.S. Census Bureau, State & County Quick Facts: http://quickfacts.census.gov/qfd/.

the basis of population coverage as well as land area coverage (measured in square kilometres) and included a breakdown of coverage by area (urban and rural) as well as by technology (analog, 2G digital and advanced 2.5G - 3G digital).

We received coverage information in this respect from Bell Mobility (including Aliant Mobility), TELUS Mobility, SaskTel Mobility, TBay Tel Mobility and Rogers Wireless. Not all of the requested information could be made available, and we note that we had to rely on public sources for information on MTS Mobility's network coverage.

Population Coverage

Table 3.4 provides a summary of current population coverage by province or region and is further split out by analog (1G) and digital (2G and 2.5G) technologies. In the latter case, digital coverage includes 2.5G technologies such as 1xRTT for CDMA carriers and GPRS/EDGE for GSM-based carriers. Not all carriers have the same coverage within each province or region. What we have reported in Table 3.4, therefore, is the network coverage for the wireless carrier with the greatest reach.

Table 3.4
Wireless Network Coverage in Canada
Percent of Population

Geographic Area	Analog	Digital
Atlantic Provinces	91%	96%
Québec	94%	94%
Ontario	98%	98%
Manitoba	97%	97%
Saskatchewan	95%	95%
Alberta	100%	100%
BC	98%	98%
Territories	52%	57%
Canada	**96%**	**97%**

Source: CWTA Member Companies; compiled by Wall Communications.

Overall, wireless coverage of both analog and digital mobile wireless services are similar at 96% and 97% of Canada's total population, respectively. Analog coverage is generally equal to or at most slightly lower than existing digital coverage. Relative to digital technologies, the expansion of older analog technology reach is no longer a priority. In fact, analog service is scheduled be phased-out no later than 2008.

Overall coverage is also lower in certain regions (such as the Atlantic Provinces in the case of analog coverage and the northern territories) where the ratios of rural to urban population are higher than average.

Coverage of urban populations in all provinces and regions is virtually 100% for both analog and 2G as well as more advanced 2.5G digital services. This does not imply that coverage is equally extensive for all three major carriers. In some urban areas, 2.5G services may only be available from one or two of the major wireless carriers.

More advanced 3G wireless services have been deployed on a limited basis to date. Network upgrades to provide 3G services are currently being rolled out first in larger urban areas. The major wireless carriers generally intend to complete rollout of 3G services across their existing wireless footprint within the next two to three years, if not earlier.

Currently, roughly 30% of the population, the vast majority of which is located in urban areas, have access to 3G wireless service from at least one wireless service provider.

Geographic Coverage

Both analog and digital geographic coverage, measured in square kilometres, is relatively limited given the concentration of Canada's urban centres and population in the southern parts of the country. Table 3.5 provides a summary of current estimates of geographic land area covered by at least one wireless carrier's network.

Table 3.5
Wireless Network Coverage in Canada
Geographic Land Area

Geographic Area	Analog Coverage		Digital Coverage	
	(%)	*km²*	*(%)*	*km²*
Atlantic Provinces	21%	114,875	23%	121,518
Québec	7%	105,900	7%	104,300
Ontario	14%	147,000	14%	151,900
Manitoba	20%	130,017	20%	130,017
Saskatchewan	46%	301,108	34%	224,672
Alberta	63%	414,204	63%	414,204
BC	11%	106,954	11%	106,954
Territories	0%	6,000	0%	6,000
Canada (exc North.)	24%	1,320,058	23%	1,253,565
Canada	**15%**	**1,326,058**	**14%**	**1,259,565**

Source: CWTA Member Companies; compiled by Wall Communications.

Geographic coverage varies considerably by province and region. The highest coverage rates are in Alberta and Saskatchewan at 63% and 46% respectively in the case of analog coverage and, somewhat lower in the case of digital coverage in the latter case. Lower geographic coverage ratios of 14% to 23% exist in the provinces of Manitoba and Ontario as well as the Atlantic Provinces (although it should be noted that coverage in PEI is 100%).[19] Coverage in BC and Quebec is much lower still while geographic wireless coverage in the northern territories is negligible.

[19] Note that estimates for Manitoba have been guesstimated given that MTS Mobility did not provide land area network coverage and nor were such estimates available from public sources.

In total, estimated analog network coverage is roughly 1.326 million square kilometres and digital coverage is slightly lower at 1.260 million square kilometres. In the former case, coverage amounts to roughly 15% of Canada's total land area and 14% in the latter case.[20]

Not all CWTA member mobile wireless carriers were able to provide estimates of urban geographic land area coverage. Based on the available information, therefore, it was not possible to develop estimates of the urban land area network coverage by province or, for that matter, nationally. However, we note that a very high percentage of urban land area is covered by one or more wireless networks, as suggested by the urban population coverage estimates of virtually 100%. As noted earlier, all urban areas in Canada (CMAs and CAs combined) account for about 350,000 square kilometres or 3.5% of Canada's total land area. We would expect that the vast majority of urban land area is covered by one or more wireless networks including both analog and digital technologies.

While the percentage of the Canadian population with access to 3G services is currently relatively large (at about 30%) and growing, the geographic footprint for 3G services, when measured as a percent of Canada's total land area, remains negligible at this time.

Foreign Comparisons

In terms of population coverage, Canada compares favourably with other countries. The OECD average for mobile wireless population coverage was just over 98% in 2003 (see Table 3.A2 in the Appendix to this section). Canada's wireless population coverage at the time was 96% and is now 97%. Given the geographic dispersion of population in a country the size of Canada relative to other OECD countries, it is not surprising to find that Canada is marginally below average.

Geographic land area wireless coverage for across OECD countries is not available. However, we note Canada's existing wireless network geographic coverage of 1.3 million square kilometres represents a land area that is 2.4 times larger than France, 3.7 times larger than Germany and 5.4 times larger than the U.K.

In the case of the U.S., wireless network population coverage was estimated to be 99% in 2003.[21] According to the Federal Communications Commission (FCC), 285 million people or 99.8% of the total U.S. population live in counties where wireless operators offer digital mobile telephone service, using CDMA, TDMA/GSM, or iDEN, or some combination of the three.[22] This estimate includes respective 2G and 2.5G generation technologies, but not necessarily 3G technologies.

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20 This estimate is based on Statistics Canada's 2001 Census related land area estimates. Actual geographic land area coverage is slightly higher which would reduce the above noted estimate to between 12% and 13%.

21 See OECD estimates in Table 3.A2 in the Appendix.

22 FCC 10th Annual Commercial Mobile Radio Service Report, 30 September 2006, paragraph 117. Note also that the population coverage of the major U.S. wireless service is many times larger than the population of Canada -- e.g., Cingular Wireless reports that its network covers 270 million Americans throughout the U.S., Verizon Wireless 255 million Americans, and Sprint Nextel 190 million Americans.

Furthermore, the FCC estimates that these counties make up 89% of the total land area of the United States.[23] Consequently, geographic wireless coverage is far more extensive in the U.S. relative to Canada. Geographic coverage in the U.S. by technology is provided in Table 3.6 below.

Table 3.6
U.S. Mobile Wireless Network Coverage, 2005
(Population counts based on 2000 U.S. Census Data)

Technology	Population in Counties	Percent of Total Population	Land Area Covered km^2	Percent of Total U.S. Land Area
CDMA	279,966,795	98%	7,815,423	84%
TDMA / GSM	277,837,880	97%	6,334,135	68%
iDEN	262,564,508	92%	4,422,814	47%
Total Digital	284,904,797	100%	8,317,402	89%

Source: FCC, 10th Annual CMRS Report.

It should be noted, however, that the FCC's approach to estimating service coverage by carrier, by county somewhat overstates the population with access to wireless service since it does not take into account gaps in coverage within individual counties. In the case of geographic land area coverage, the FCC's approach likely significantly overstates the true combined land area coverage of wireless carriers in the U.S. since, once again, coverage gaps within individual counties are not taken into account.

Cumulative capital investment in the U.S. mobile wireless industry reached US$199 billion as of year-end 2005. This includes US$25 billion in capital investment in 2005 alone. With roughly 208 million subscribers in the U.S. as of year-end 2005, this represents a cumulative investment of roughly US$960 per subscriber or measured on a per capita basis, about US$670 per capita.[24]

As noted, in Section 2 of this report, cumulative capital investment in mobile wireless in Canada as of year-end 2005 is at least CDN$18.6 billion and more likely closer to CDN$20 billion. With just under 17 million subscribers in Canada as of year-end 2005, this represents a per subscriber cumulative investment of close to CDN$1,100 to CDN$1,175. On a per capita basis, this amounts to between CDN$575 and CDN$620.

Comparing Canadian and U.S. cumulative capital investment figures for the last 20 years is difficult given the many historical fluctuations in Canadian to U.S dollar exchange rates. However, it appears that cumulative capital investment per subscriber

[23] Note that the FCC's approach to estimating service coverage by carrier and by county overstates the geographic land area with wireless service since it does not take into account gaps in coverage within individual counties.

[24] CTIA, Wireless Quick Facts, April 2006.

is somewhat higher in Canada compared to the U.S, whereas per capita cumulative capital investment appears to be lower in Canada than in the U.S.[25]

3.4 CONCLUSION

Digital mobile wireless network coverage in Canada is currently available to 97% of the Canadian population. In terms of geographic coverage, current digital network coverage is close to 1.3 million square kilometres, representing about 14% of Canada's total land area (including the northern territories). Analog coverage is slightly higher at 15% of Canada's total land area. Next generation 3G services are being rolled out rapidly and are currently are available to about 30% of Canadians. Deployment of 3G has primarily been limited to urban centres to date and consequently the land area covered by 3G capable wireless networks is minimal relative to Canada's total land area.

In terms of population coverage, Canada compares favourable with other OECD countries including the U.S. However, relative to Canada, there is broader geographic coverage of digital network facilities in the U.S. according to FCC estimates of U.S. wireless land area coverage. Comparable geographic coverage data is not available for other OECD countries, but given the vast scale of Canada, including very low population densities across most of the country, there is no reason to expect Canada to match the geographic coverage of wireless networks in most other OECD countries.

[25] Based on historical Canadian-US dollar exchange rates, for the period 1987 to 2005, we estimate that cumulative capital expenditures in Canada amounted to roughly US$790 to 845 per subscriber and US$415 to 445 per capita. These are, however, crude estimates at best. It should be noted that the higher cumulative capital expenditures in the U.S. may be due to the larger number of wireless carriers in the U.S.

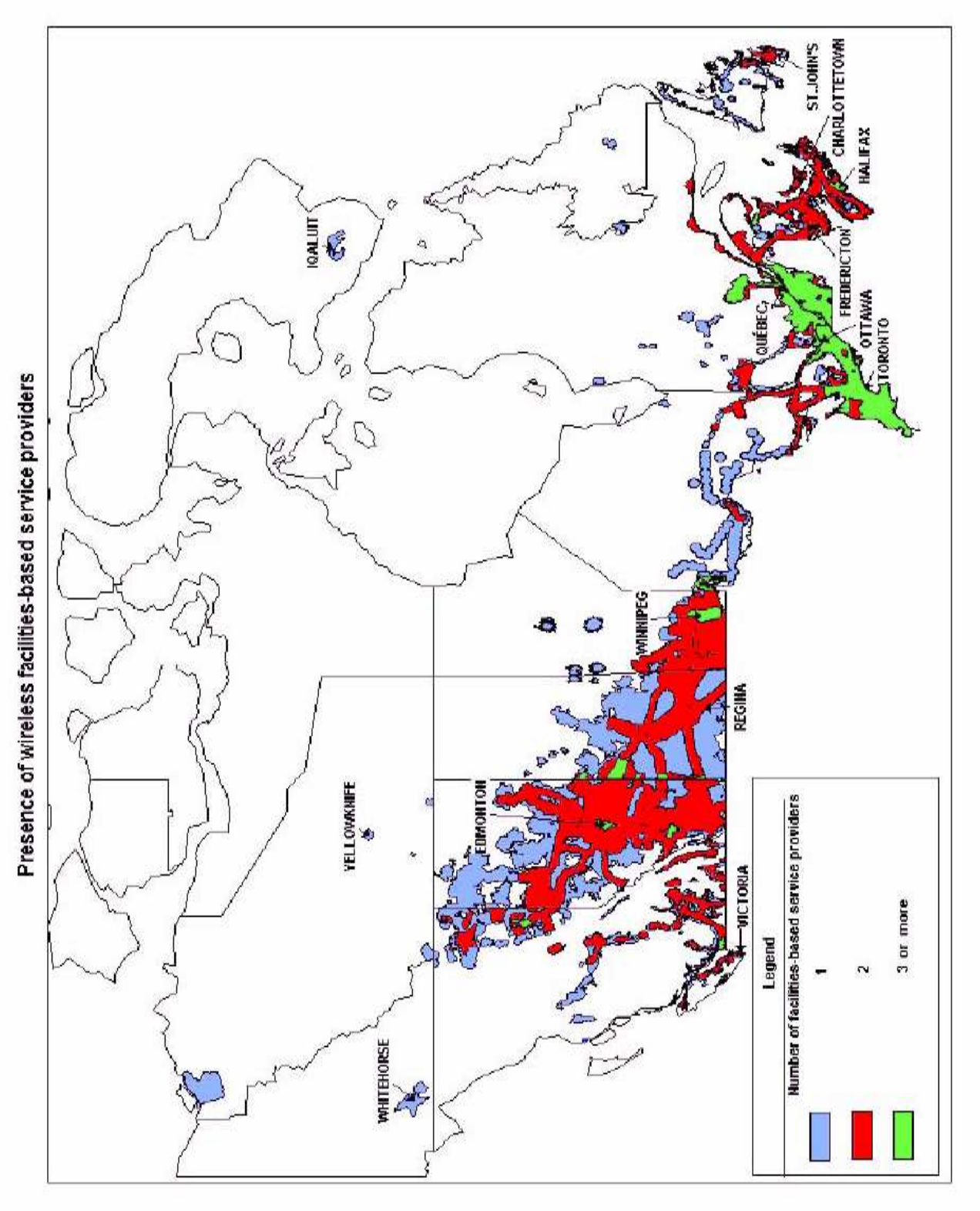
3.5 DATA APPENDIX

Table 3.A1
Canadian CMA Population Counts and Densities
2001 Census Data

Province	CMA	Population, 2001	Land area, km^2	Population density per km^2, 2001
Newfoundland & Labrador	St. John's	172,918	805	215
Nova Scotia	Halifax	359,183	5,496	65
New Brunswick	Saint John	122,678	3,360	37
Québec	Montréal	3,426,350	4,047	847
	Québec	682,757	3,154	216
	Ottawa - Hull (Part of Que.)	257,568	2,044	126
	Chicoutimi - Jonquière	154,938	1,754	88
	Sherbrooke	153,811	1,108	139
	Trois-Rivières	137,507	880	156
Ontario	Toronto	4,682,897	5,903	793
	Hamilton	662,401	1,372	483
	Ottawa - Hull (Part of Ont.)	806,096	3,274	246
	London	432,451	2,333	185
	Kitchener	414,284	827	501
	St. Catharines - Niagara	377,009	1,406	268
	Windsor	307,877	1,023	301
	Oshawa	296,298	903	328
	Greater Sudbury	155,601	3,536	44
	Kingston	146,838	1,907	77
	Thunder Bay	121,986	2,548	48
Manitoba	Winnipeg	671,274	4,151	162
Saskatchewan	Saskatoon	225,927	5,192	44
	Regina	192,800	3,408	57
Alberta	Calgary	951,395	5,083	187
	Edmonton	937,845	9,419	100
British Columbia	Vancouver	1,986,965	2,879	690
	Victoria	311,902	695	449
	Abbotsford	147,370	626	235
Total		**19,296,926**	**79,133**	**244**

Source: Statistics Canada

Figure 3.A1
Geographic Coverage of Facilities-Based Wireless Service Providers



Source: CRTC July 2006 Monitoring Report

Table 3.A2
OECD Countries - Percentage of population coverage of mobile networks

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Australia	85	91	91	94	94	95	97	98	98
Austria	87	90	93	97	97	99	98	98	98
Belgium	..	..	95	96	98	99	99	99	99
Canada[1]	..	..	93	93	93	94	96	96	96
Czech Republic	88	92	95	96	97	98	98	99	99
Denmark	100	100	100	100	100	100	100	100	100
Finland	100	100	100	100	100	100	100	100	100
France	98	98	94	97	98	99	99	99	99
Germany	99	99	99	99	99	99	99	99	99
Greece	95	95	95	95	96	98	99	100	100
Hungary	89	97	97	98	98	98	98	98	99
Iceland	..	..	99	99	99	99	99	99	99
Ireland	95	95	96	96	96	98	99	99	99
Italy	95	95	97	98	100	100	100	100	100
Japan	..	..	98	98	98	98	99	99	99
Korea	95	95	97	98	99	99	99	99	99
Luxembourg	..	..	99	98	98	98	99	99	99
Mexico	..	..	80	81	82	86	90	91	92
Netherlands	97	80	98	98	98	100	100	100	100
New Zealand	95	95	95	95	95	95	97	97	97
Norway	98	98	98	98	98	98	98	98	98
Poland	..	..	75	91	93	95	98	99	99
Portugal	..	..	98	98	99	99	99	99	99
Slovak Republic	..	..	95	96	98	98	98	97	99
Spain	98	99	99	99	99	99	99	99	99
Sweden	..	..	96	96	96	96	96	96	96
Switzerland	95	98	98	98	98	98	99	99	100
Turkey	..	46	61	61	61	64	88	89	95
United Kingdom	..	..	98	98	98	98	98	98	98
United States[2]	95	95	95	95	95	95	97	99	99
OECD average	94.7	92.5	91.0	95.2	95.7	96.4	97.8	98.0	98.4

1. Data for Canada are Rogers Communications Canadian coverage for 1997-1999 and Bell Canada for 2000. This would tend slightly understate the combined coverage of all systems in these years. Canadian data for 2001-2003 are CWTA estimates for the entire industry.
2. Data for the United States show the proportion of population living in counties with mobile network coverage.

Source: OECD 2005 Communications Outlook

4. TECHNOLOGICAL INNOVATION

4.1 INTRODUCTION

In this section of the report, we provide a descriptive history of the evolution of wireless technology in Canada with a specific emphasis on innovation. New services and features are described as they accompanied new standards and technologies, including new advanced digital technologies. The rollout of these technologies in Canada is compared to that of the U.S. in terms of timing and coverage.

This section is divided into three main areas that roughly correspond to the three technology phases experienced by the Canadian wireless industry:

- first generation of analog cellular mobile networks and services: 1985-1995;
- second generation of digital personal communication services (PCS) and networks: 1995-2000; and
- emerging third generation advanced digital PCS services and networks: 2000 to date.

In the context of the historical overview, we also briefly consider the pros and cons of a "smart-follower" versus a "first to market" approach in new wireless technologies. Examples of Canadian wireless innovations are described and assessed in the context of market and regulatory backgrounds.

Before turning to a discussion of each of these periods, we provide some background on the initial launch of mobile wireless services and Canada's position vis-à-vis the U.S. in terms of rolling out wireless services.

4.2 BACKGROUND

The Launch of Cellular Mobile Services

Cellular began in the early 1980s as a public mobile telephone service in various regions of the world, including in the United States and Canada. The U.S. Bell System was the first to demonstrate the technical feasibility and promising benefits of a wide-area cellular mobile system. As a result, the U.S. Federal Communication Commission (FCC) and the Canadian Department of Communications (now Industry Canada) and other regulators allocated new frequency bands for cellular mobile. A total of 50 MHz was set-aside in the 800 MHz band in North America for cellular services.

In Europe and Asia, several technologies and frequency bands were used to implement analog cellular networks. Even in Canada, as a pre-cursor to the 800 MHz cellular service, a cellular system known as AURORA was implemented in the 400 MHz band in Alberta.

The U.S. and Canada proceeded to license cellular service by adopting a common analog technology i.e. AMPS (Advanced Mobile Phone System), along with individual regulatory/policy frameworks intended to foster competition. The first generation AMPS networks were expected to provide phone service of high quality, full interconnection to local exchange telephone service (PSTN), continuity of mobile calls (automatic hand-off between cells) and roaming between networks, efficient frequency re-use and many network features (available with electronic switching).

In Western Europe, some countries implemented analog cellular service using different technologies which ruled-out the interoperability of services between countries and kept costs of technology and handsets high. This also contributed to low initial subscription rates.

A fast-follow approach with the United States

Cellular networks were to provide wide-area mobile telephony service using a standard air-interface to support a multitude of handsets, voice quality approaching traditional phone service, ubiquitous coverage over high populated areas and full interconnection to the PSTN. In much the same way that the Canadian PSTN has evolved as part of the integrated North American telephone system and beyond, Canadian cellular networks have followed a similar path.

Even before the launch of cellular service in Canada, it was apparent that the Canadian wireless market was likely too small to support unique technology, services and frequency plans for public networks and consumer products. Several examples serve to illustrate the challenges and risks of pursuing unique Canadian approaches, including the AURORA cellular technology, digital cordless phone CT-2 and digital audio broadcasting. There has been considerable success, however, with a “smart-follower” approach for services such as broadcasting (radio, television, direct satellite), commercial mobile (trunked mobile, ESMR, cellular and PCS) and consumer products (Wi-Fi and family radios).

In general, Industry Canada and the Canadian wireless industry have promoted common equipment standards and frequency allocations world-wide. Where a common global approach has not been achievable, Canada has generally aligned itself with the U.S. market. In addition, Canada has generally followed American spectrum allocation decisions and licensing processes by delays of one to two years in order to align and benefit from the scale and scope of the large North American market. Consequently, Canada has adopted a “fast-follow” approach to the U.S. for licensing processes, network implementations and applications of most public services and consumer products. This includes the adoption of common frequency plans, technology standards and service offerings.

4.3 THREE PERIODS OF WIRELESS TECHNOLOGY EVOLUTION

Over the past two decades, the mobile wireless industry has experienced three distinct wireless technology generations. This evolution has been driven by the rapid acceptance of mobile communications, the increasing range of service features and consumer experience and the convergence of voice, data and media.

First Generation Networks – 1985 - 1995

Background

The provisioning of mobile as a comprehensive public service emerged in the early 1980s with the establishment of analog cellular networks. After many years of spectrum planning and technology development, regulatory frameworks were established to oversee the licensing of cellular mobiles.

At the outset, cellular mobile networks were based on common analog standards (AMPS). Early mobile telephone networks, however, were constrained by limitations such as coverage, service quality, and spectrum efficiency. Over time, new cellular networks[26] provided a solution for wide-area coverage with automatic hand-off of calls from cell-to-cell, improved voice quality, handling of high peak traffic hours and a more efficient frequency re-use. Capacity was expanded as subscribers and traffic grew by adding frequencies, converting large size cells into clusters of smaller cells (cell splitting) and sectorization of cells to increase the spectrum re-use and the traffic capacity by several folds. Although analog cellular service provided a significant improvement over conventional mobile telephone networks, it did not rival the high quality and reliability of fixed telephone service.

The United States

In 1982, the FCC granted two commercial cellular licenses for AMPS service for some 150 large metropolitan areas which later expanded to 306 metropolitan and 428 rural areas. 25 MHz licenses were granted to the regional wireline carriers and 25 MHz licenses were granted to non-wireline carriers through the use of a lottery licensing process. The policy framework prescribed the AMPS standard to promote universal mobile service and to facilitate interconnection to PSTN as well as promoting voluntary cellular roaming between carriers.

By 1986, one or two cellular carriers had established some cellular coverage in the 90 largest markets.[27] At the time, six network manufacturers provided equipment to some 40 operators.

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[26] The International Telecommunications Union (ITU) initiated work to develop a digital technical standard for a global International Mobile Telecommunications Service (IMTS)-later known as Future Public Land Mobile Telephone Service (FPLMTS), which resulted in service and network protocol for a third generation digital mobile networks known as International Mobile Telecommunications (IMT). Canada has been an active participant in influencing the digital standard which was adopted in 2000 as IMT-2000.

[27] William C.Y. Lee, *Mobile cellular Telecommunications Systems*, 1991

The first cellular terminals were only available for automobiles and as large, heavy portable phones at price of over $2000. By the late 1980s, the price of handsets was below $200 with pocket size units helping to increase the demand for cellular service. The take-up rate for cellular phone services far exceeded all forecasts.[28] The service coverage gradually extended beyond the 150 large market centers to small communities and contiguous population areas along primary to some secondary highways. However, due to the partitioning of the two cellular licenses over a large number of market areas and different operators, the availability of contiguous services and automatic roaming service in the United States was problematic and affected the quality of the cellular service.

Cellular phone service was initially targeted for business communications purposes. With the availability of small terminals at lower cost and longer battery life, the consumer demand for personal use of cell phone greatly increased. Purchase prices for cellular telephones ranged from approximately $100 to $500.[29] Cellular Digital Packet Data (CDPD) was introduced for limited data transmission of 19.2 Kbps over analog AMPS networks. To increase traffic capacity and spectrum re-use, large cells were split into clusters of small cells and were further divided in sectors.

In the late 1980s, spectrum became congested in large markets due to high traffic and limited AMPS network capacity. Instead of opening new spectrum, the FCC permitted the introduction of other network technologies. This led some carriers to overlay a first digital network using Time Division Multiple Access (TDMA IS-54) to complement AMPS. First generation TDMA networks were rolled-out in large cities to alleviate the congestion and to offer a premium service. Network traffic capacity increased as much as six-fold and quality of service improved with TDMA technology.

Dual-mode handsets at 800 MHz provided digital service in cities and analog service in areas only served by AMPS. Also, a new combination push-to-talk wide-area digital dispatch and mobile telephone service (ESMR) emerged in the early 1990s using iDEN technology. This service was developed primarily for group calling communication needs of industrial, business and public safety users.

By 1995, prior to the pending opening of PCS spectrum at 1900 MHz, the U.S. wireless industry was well established with 34 million subscribers and a penetration rate of 13% of the total population. Service coverage had steadily expanded to smaller communities and along primary highways and the service quality had gradually improved to serve the business and the consumers markets. Half of the new subscribers opted for handheld cellular phones instead of automobile installs.

Canada

In 1982, the Department of Communications allocated 40 MHz (later expanded to 50 MHz) in the 800 MHz band to cellular mobile and established a licensing policy framework. Licensing was carried out in 1984 for two service operators to offer analog cellular mobile using AMPS networks. A cellular license for 20 MHz was granted to each

[28] See the section of this report on wireless penetration.

[29] FCC, First Annual CMRS Competitive Report.

of the provincial, territorial and local telephone carriers and a national license for 20 MHz was granted to a non-wireline carrier.

This established a duopoly market structure for analog mobile services. Obligations were imposed requiring the roll-out of cellular phone service in 23 metropolitan centers across Canada. A head-start of 6 months was afforded to the non-wireline carrier in order to facilitate PSTN interconnection arrangements. Due to the common marketing of the cellular service by the wireline carriers, Canada had virtually two national cellular networks providing roaming for the users.

Cellular services began in mid 1985 in a few large cities in Ontario, Quebec and B.C. By 1986, 9 out of the 23 metropolitan markets were in operation and coverage was expanded to other cities and along high traffic highway corridors. Also, during this time, roaming arrangements were established with U.S. carriers. By 1991, 75% of the Canadian population was served by essentially two cellular providers.

In 1990, Industry Canada released an additional total of 10 MHz partitioned to 5 MHz to each of the wireless carriers as swing spectrum to implement an overlay digital TDMA networks to enhance the analog AMPS infrastructure. Both digital technology and an improved design of cellular coverage with smaller cells (cell splitting and sectorizing) provided an effective boost in spectrum capacity for growth while improving the service quality.

Dual-mode TDMA/AMPS handsets provided premium service in large market areas. In 1992, one cellular carrier began to overlay a TDMA IS-54 network in large cities across Canada in collaboration with a U.S. carrier affiliate, to achieve the first digital network in North America. A second TDMA network began to be built later in certain markets while awaiting second generation (2G) PCS technology. TDMA networks provided enhanced voice quality, improved security, leading edge network features and premium services.

Also, two separate mobile data networks were developed by the cellular operators in the early 1990s to provide some mobile data communications such as for e-mail and point-of-sale transactions. A limited implementation of CDPD technology was overlaid on the AMPS network in certain cities to provide low data speed service.

As cellular phone service and handsets became more affordable over time, there was a general acceptance of cellular service by consumers. The AMPS and TDMA networks continued to expand their service coverage in the early 1990s to smaller cities and along primary and some secondary highways. By 1995, more than 80% of the population was served by the two cellular mobile operators and cellular expansion was progressing into rural and northern communities. At that time, Canada had roughly 2.6 million cellular subscribers representing a penetration rate of close to 9% of the population.

Some Comparative Observations

During the 1980s, two cellular networks were built in major cities across North America. The industry was in start-up mode at the time. Both coverage and subscriber levels expanded exponentially. However, given that the U.S. had a head start of roughly a

year and a half, Canada tended to lag behind the U.S. in terms of number of subscribers relative to total population.[30]

The granting of national licenses in Canada was instrumental in promoting contiguous service across the country with full interoperability, automatic roaming, common quality of service and billings. In the U.S. the fragmentation of networks over many regional licenses, resulted in discontinuity of service, substantial levels of manual roaming (use of credit cards/operator), more call drops and high roaming charges.

Over 80 % of the Canadian population generally had access to two cellular providers by 1995. The service was being expanded to Canadian rural and northern communities. Cellular coverage in certain populated areas in the U.S. was reported to be patchy, although serving a large rural geography and many highways was especially challenging. Canadian and U.S. carriers reached roaming arrangements with each other and other countries.

U.S. cellular carriers used six main network equipment suppliers where Canada had two suppliers with a strong R&D presence. This helped drive innovation in new service applications, network design and up-grade through collaboration between the wireless carriers and manufacturers of wireless network equipment and handsets.

Second Generation Networks – 1996 - 2000

Background

The new spectrum designated by the ITU in 1992 in the 1900 MHz band for advanced mobile service provided the impetus for the U.S. and Canada to license new spectrum for digital PCS networks in the 1984-1995 timelines. Western European countries had already issued a series of licenses at 1800 MHz for 2G GSM networks in the early 1990s.

By the mid 1990s, telecommunications markets worldwide were being liberalized and opened to competition. Wireless service was already subject to competition in Canada and the U.S., and the service had steadily shifted from a business to a consumer commodity, characterized by rapid growth, new applications and more convenient handsets.

North American PCS carriers were given full flexibility to implement digital technologies and services of their choice. The 2G network technologies chosen for the 1900 MHz PCS band included TDMA (IS-136), CDMA IS-95 and GSM.[31] Both the TDMA and CDMA technology provided for the upgrade of the first generation AMPS/TDMA (IS-54) technology in the 800 MHz cellular band. These advanced digital networks provided

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[30] See the Section 6 of this report on wireless penetration for a discussion of the reasons for this difference.

[31] Time Division Multiple Access (TDMA) divides each frequency channel available to the network into time slots to allow multiple calls; Code Division Multiple Access (CDMA) uses a spread spectrum technology in which multiple calls are assigned different codes to simultaneously occupy the same frequency channel; and, General Mobile for Mobile Communications (GSM) is a TDMA-based technology.

improved voice and supported richer service features and low speed data for web browsers, short messaging service (SMS) and other applications[32]. Several manufacturers produced dual and tri-bands handsets for operators with analog and digital networks to, allow customers to move between digital and analog serving areas with ease.

The United States

In 1994, a new era in wireless communications began with the U.S. with the auctioning of PCS spectrum at 1900 MHz and the availability of 2G PCS technologies for new personal communications. At the time, provisions were made to promote competition, such as a cap to limit spectrum holdings, choice of technology and service offerings. The new 1900 MHz spectrum in addition to the 800 MHz cellular resulted in the development of six national cellular/PCS carriers with at least one regional carrier in each market in the United States.

Between 1995 and 2000, substantial investments were made to build out new digital networks using TDMA, CDMA and GSM technologies. Also, a wider range of handsets, new service features, service packages for different user groups were launched which accelerated growth in subscriptions. PCS technologies had the effect of hastening the conversion of cellular networks from analog to digital technology. By 2000, there were two national CDMA networks, one TDMA, one GSM, and one iDEN and one TDMA/GSM network in the U.S.

According to the FCC, roughly 91% of the U.S. population had access to 3 or more different operators offering mobile telephone service in the counties which they lived[33]. A number of operators had improved their coverage through mergers, acquisitions and license swaps. At the end of 2000, digital customers made up 62% of the total users. As well, at the time, all major operators had begun to offering mobile data services, including wireless web, SMS and e-mail.

Canada

In late 1995, four national PCS spectrum licenses were granted for 80 MHz in the 1900 MHz band. Licenses were granted to the two cellular incumbents and to two new carriers. The established regulatory framework included provisions to foster competition and promote service availability across all regions of the country through measures such as a spectrum cap to support new entrants, PCS roll-out requirements, arrangements for roaming and resale of analog service.

Substantial investments were made between 1995 and 2000 to build four PCS networks in Canada. Carriers had to choose network technologies which aligned with carriers in the U.S. and overseas. In this respect, Canadian carriers followed the U.S. wireless

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[32] In 1991, several European companies began rolling out GSM services. Within 2 years, GSM covered most major European service areas.

[33] For example in 2000, there were roughly 1,800 counties with 3 or more operators representing a population of 259 million or 91% of the total population and 40 % of the U.S. land mass. Note that the FCC's approach to estimating service coverage by carrier and by county somewhat overstates the population and geographical area with actual services.

industry which allowed them to secure cost effective network technologies together with a wide range of handsets, and enabled roaming capabilities with American carriers and others. Ultimately, Canadian carriers deployed TDMA IS-136, CDMA IS-95 and GSM 1900 technologies.[34]

Between 1996 and 1998, Canadian carriers launched PCS services in a number of large market areas. Also, dual-mode and dual-band handsets were introduced to permit the evolving PCS coverage to be supplemented by AMPS service. iDEN/ESMR[35] service was also gradually deployed beginning n the 1980s in a number of cities and along highway corridors.

Canada effectively started its PCS service a full two years behind the U.S. Nevertheless, by the end of 2000, 93% of the Canadian population had cellular/PCS coverage from at least two operators (or four operators when considering including analog roaming) and 50 % of the population had access to four digital operators. One national digital network operator provided coverage to 83% of the population.[36]

With the launch of 2G networks in Canada, new services were introduced such as SMS, e-mail and web browsing. Significant marketing innovation evolved with the decreasing prices for handsets and new service plans, such as pre-paid and no contract plans and by-the-second billing and rates based on time of day and weekend pricing.

Some Comparative Observations

The launch of 2G PCS networks marked the start of a period of tremendous change in the wireless industry in terms of capital investment, marketing innovation, handset evolution, subscriber growth and increased competition. By the mid to late 1990s, four PCS networks and one ESMR network were being built out across Canada and seven PCS networks and an ESMR network were being built out across the U.S. Advanced digital technologies were providing improved service quality, richer network features, modest data applications and new smaller and more convenient handsets.[37]

The decision to grant national licenses and provide for access to roaming and resale for new entrants, promoted contiguous service across Canada with full interoperability, automatic roaming, common quality of service and billing. Resale of analog cellular provided national mobile service during the early phase of the construction of PCS networks.

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34 As a condition of licence, Canadian carriers are required to spend at least 2% of their revenues on R&D as well as invest in lawful access capabilities for circuit-switched services. See http://strategis.ic.gc.ca/epic/internet/insmt-gst.nsf/vwapj/pcspolicy_dec16_e_final.pdf/$FILE/pcspolicy_dec16_e_final.pdf.

35 ESMR - an integrated phone, dispatch on group calling, alphanumeric, paging, messaging services on one handset.

36 Wall Communications Inc., *A Competitive Assessment of the Canadian Wireless Industry – prepared for Industry Canada*, November, 2001.

37 European countries also experienced rapid subscriber growth with a common infrastructure using GSM technology; Telecommunications Policy Review Panel, Final Report, 2006: Figure 1-7, Mobile Wireless Penetration, 1996-2004.

The U.S. auctioned PCS spectrum in many market areas, making it difficult for carriers to aggregate spectrum for full national coverage. Eventually, six U.S. carriers expanded to national coverage status through a series of acquisitions, mergers and of license swaps.

By the end of 2000, 93% of the Canadian population had cellular/PCS coverage by two operators (plus ESMR) and 50% of the population had access to four digital operators whereas in the U.S., 91% of the population had access to three or more different operators.

Collaboration between a larger number of wireless carriers and manufacturers of networks and handsets, accelerated with the implementation of 2G PCS networks. Heavy capital investments and significant R&D were carried out. Four PCS networks were built in Canada and seven in the U.S. using 2G digital technologies. The existing AMPS networks continued to operate in most regions of North America with users being given access with dual-mode, dual-band handsets.

Deployment of Third Generation Networks – 2001 - 2005

Background

In 2000, demand for faster mobile data communications, global compatibility and multimedia services, precipitated the approval of an International Mobile Telecommunication (IMT-2000) standard or the 3G mobile networks[38]. The U.S. and Canada proceeded to auction unassigned PCS spectrum at 1900 MHz so as to provide spectrum for growth, to complete national coverage and to implement 3G networks. Moreover, the 2000 World Radio Conference designated additional spectrum for IMT-2000 in a number of bands.[39]

Many mobile operators outlined plans to migrate from 2G to 3G networks, although most planned to deploy intermediate advanced digital technologies along the way. The term 2.5G became a common to describe such intermediate technologies as networks were upgraded to incorporate full 3G capabilities.[40]

The U.S. and Canada, which had deployed a mix of 2G network technologies, adopted two general migration paths to implement 3G network capabilities -- i.e., moving to CDMA-2000 or W-CDMA.[41] Carriers using CDMA IS-95 generally elected to implement

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38 IMT-2000s standards (3G networks in NA or UMTS in Europe) provide for theoretical bearer transmission capacities of up to 144 Kbps for high-speed mobile, 384 Kbps for pedestrians and 2.0 Mbps or more for fixed locations. Experience has shown that network achieve much more reduce rates based on economics and technical realities.

39 The ITU designated spectrum in 700 MHz, 1.7 GHz and 2.5 GHz bands for IMT-2000. The U.S. has recently auctioned a total of 90 MHz in the 1710/2110 MHz bands for Advanced Wireless Services (AWS) which includes mobile services such as 3G and beyond. Canada can be expected to auction similar spectrum in 2007-2008.

40 The intermediate phase has been often described as the 2.5G as it falls short of the full data access speed defined for IMT-2000 using WCDMA and CDMA2000.

41 Although the two 3G technologies achieve the same speeds, they handle transmission in different ways. This underlying technology is transparent to the users as all 3G connections at the network side are interoperable. A WCDMA phone, for example could use a camera to videoconference with a user using similar equipped CDMA2000 phone,

CDMA-2000 by overlaying CDMA-1XRTT (double voice capacity and data transfer speed of up to 144kbps), and then by move to 3G in deploying CDMA 1xEV-DO to potentially boost the network speeds to 2.0 Mbps or more. Carriers with TDMA IS136 and GSM 1900 generally elected to implement W-CDMA (UMTS), with eventual addition of HSDPA. Carriers would then migrate from intermediate 2.5G networks to 3G with broadband technologies such as EV-DO or HSPDA. This would be done gradually as data application demand justifies the roll-out.

Since 2000, there has been significant consolidation in the wireless industry after U.S. and Canadian regulators removed spectrum cap limits. The Canadian wireless industry went through a period of industry restructuring from 4 to 3 national carriers, while the U.S. went from a 6 to 4 national carriers.

Worldwide, wireless service continued to grow very rapidly. Indeed, the number of mobile phones overtook the number of fixed lines in 2002.[42] By the end of 2002, the world had almost completed the transition to digital cellular. Analog cellular accounted for as little as 3% of the total number of subscribers. It is expected that most analog cellular service in North America will be phased out by 2008.

Wireless data, however, is a main driver behind the implementation of 3G technologies with higher speeds. To date, mobile data service revenues in North America account for a limited share (e.g. 10% or less) of overall revenues. In comparison, mobile data services are more prominent in Europe and Japan. The modest growth of mobile data in North America has influenced the conservative pace of broadband 3G implementation.

The United States

Between 2001 and 2005, the U.S. wireless industry focused, in part, on building 3G network capabilities, developing mobile data applications and seeking new markets and sources of revenue. Significant effort went into introducing smart handsets with a wide range of features and applications.

In 2002, the U.S. wireless carriers began implementing 2.5G technologies with CDMA 1XRTT and GMS/GPRS to achieve average speeds of 50-70 Kbps. By early 2003, carriers were offerings services over these new digital networks in at least portion of U.S. counties comprising 93% of the population. Then, in 2003-2004, carriers operating 1XRTT networks began deploying broadband CDMA 1xEV-DO in certain large cities for typical download speeds of 400-700 Kbps.

Also, GSM/GPRS carriers deployed EDGE as an improvement to GPRS for operating speeds of up to 180 Kbps. In 2004-2005, a few carriers launched broadband WCDMA in selective cities with plans to upgrade with HSDPA technology[43]. In 2006, the first

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as connections are made at network levels. Also see http://files.ctia.org/pdf/Davey_CTIA_EVDO.v2.pdf/

[42] ITU paper, *The Regulatory Environment for Future Mobile Multimedia Services*, June 2006. http://www.itu.int/osg/spu/ni/multimobile/papers/ITU_MMSissuespaper_60606.pdf

[43] WCDMA networks to support up to 2 Mbps rate although user in real network can initially expect up to 384kbps services. Japan is working on a WCDMA upgrade to deliver 3 Mbps and with HSDPA upgrade, sometimes referred as a 3.5G technology, to deliver in

deployment of HSPDA occurred with average download speeds of between 500 and 700 Kbps. Carriers are expected to continue implementing UMTS and HSDPA in large urban centers as justify by market demands.

The adoption of IMT-2000 standards led to the development of a wide range of handsets with air interfaces to operate on migrating 3G technology, such as, GPRS, CDMA 1XRTT and EDGE and later W-CDMA/HSDPA and CDMA2000 1X EV-DO.[44] Also, some advanced handsets have several access technologies such as, GSM/GPRS/EDGE/W-CDMA or CDMA-IS-95/ 1XRTT/ 1xEV-DO with 3 or 4 bands. A wide range of handsets have incorporated a number of features or capabilities such as color screen, camera phone, text messaging, internet access, gaming, e-mail, music download, video clip and position location.

Canada

Between 2001 and 2005, Canadian wireless carriers also began building 2.G and 3G network capabilities and developing mobile data applications, introducing new feature-rich handsets and opening new markets.

Industry changes took place with the merger of a national carrier with a regional carrier and the acquisition of new PCS spectrum which enabled the continuation of a 4 carrier industry structure - i.e., including one non-wireline carrier, two wireline carriers and a new PCS entrant. A resale and roaming agreement between two wireless carriers provided the sharing of PCS and 3G network facilities in certain areas across Canada. In 2004, further consolidation of the industry took place which resulted in moving from 4 to 3 national carriers.

By 2001, the Canadian wireless carriers had chosen their new technologies and began implementing 2.5G network capabilities in a number of major cities using CDMA 1XRTT and GMS/GPRS technologies capable of average speeds of 50-70 kbps. In early 2002, one 2.5 G digital network was already reaching 85% of the population and further expansion by all carriers continued in the 2002-2003 timelines. As broadband data applications were believed to be the future mobile growth area, the carriers began implementing higher speed technologies such as EDGE and 1xEV-DO facilities in selected large cities in 2005.

By the end of 2005, about 97% of the Canadian population had digital and analog mobile services and approximately 93% of population was provided with 2.5G digital services by at least one network. An increasing number of large Canadian cities have access to high speed broadband mobile services. However, certain areas of Canada, particularly remote rural and northern areas, continue to be served only by analog cellular networks. Roaming and sharing arrangements have had an impact on delaying the expansion of 3G networks, especially in rural and northern communities.

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theory a peak data download of up to 14.4 Mbps. Networks are likely to operate services at lower speeds according to economics and customer demands.

[44] ITU, *The regulatory Environment for Future Mobile Multimedia Service*, June 2006. As an example of the relative rates of adoption of 3G handset technologies, in 2004, the U.S. had roughly 48M handsets capable of accessing CDMA20001x networks for a 16% penetration (number of handsets per 100 inhabitants). Korea and Japan, having a head start, had penetration rates of 51% and 21 %, respectively, of 3G handsets. Canada had a CDMA2000 1x handset penetration of 23%.

The migration toward 3G technology has expedited the replacement of PCS and cellular networks. Analog networks are now planned to be phased-out by no later than 2008.

The advanced capabilities of 2.5G networks and new handsets features have supported a number of new data applications which are receiving acceptance such as text and e-mail messaging, mobile internet applications (e.g., e-commerce and web access) and multi-media messaging (e.g. photos, graphics, video and audio clips and multi-media service e.g. radio and TV services).

Canadian operators have implemented several inter-carrier arrangements to advance wireless services to users, such as, for text messaging, multi-media messaging and Wi-Fi roaming. Important mobile-location applications are being introduced which will support enhanced 911 public safety and promising commercial services.[45] The Canadian wireless industry is about to implement wireless number portability to give mobile users the ability to keep their original phone numbers if they wish to move to wireless carrier or wireline carrier services.

Some Comparative Observations

The emergence of advanced digital wireless technologies, 2.5G and 3G, and advanced handsets features provided a renewal period for the wireless industry in terms of migration of networks to higher data speeds with the promise of new applications and revenues.

In addition to the initial granting of national PCS licenses in 1995, Industry Canada decided to grant regional licenses for the remaining PCS spectrum in 2001. This new spectrum facilitated traffic growth and regional carriers (occasioned by industry consolidation) to obtain national spectrum license. Similarly, U.S. carriers expanded their service to national coverage through new spectrum, carrier acquisition, merger and spectrum swaps (there are now four national carriers in the U.S.). Also, a major resale arrangement between two Canadian carriers facilitated the extension of national services into small communities and rural areas.

By the end of 2005, 97% of the Canadian population had digital and analog wireless coverage by at least one service provider. About 93% of the Canadian population had at least one digital 2.5G service provider and close to 90% of the population had three digital providers. An increasing number of large Canadian cities are obtaining access to higher-speed broadband 3G services. At the same time, 97% of the U.S. total population lived in counties with 3 or more service providers and have digital service coverage in part or in whole. Some coverage in rural areas of the U.S. continues to be solely analog.

Canadian carriers were quick to implement national 2.5G network capabilities (i.e., GSM/GPRS and CDMA 1XRTT technologies) and did so in parallel timelines with the

[45] Canadian wireless carriers have implemented Phase One wireless E9-1-1 service in many provinces. Phase One of E911 provides emergency operators with a wireless caller's phone number and the location of the cellular site carrying the call. For an example of available coverage see http://www.TELUSmobility.com/about/public_affairs/e911.shtml.

U.S. carriers. However, Canadian carriers are slightly behind in the rollout of 3G capabilities in comparisons with the U.S.

The deployment of higher speed 3G technology depends to a large extent on the demand for advanced mobile data applications.[46] In other words, a much larger market may provide a better market test of such technologies. For Canada, with a more limited demand than the U.S., consumers may ultimately be best served by following the lead of its neighbour to the south.

Some analysts are of the view that there is a weak business case to accelerate the roll-out 3G broadband network, given the low demand for mobile data services. Existing data traffic, in their views, barely support 2.5 G networks operating CDMA-1XRTT and GPRS/EDGE. As well, it appears that in some respects European operators may well have deployed 3G services somewhat prematurely and in doing so have not properly addressed customer needs. As the FCC has observed:

> *Even though commercial 3G services are now widely available in Western Europe, analysts and experts continue to stress that consumer use of new services may be limited in the near term due to problems such as download speeds that are much slower than theoretical speeds, patchy coverage (especially inside buildings), and lack of "killer applications" that could drive demand for 3G services.*[47]

On the other hand, it should be noted that Canadian operators were among the first to implement several inter-carrier arrangements to better serve wireless users for such services as text messaging, multi-media messaging and Wi-Fi roaming.

It is our view that Canadian operators will advance their networks and services as the market dictates. By necessity, this will generally mean lagging the U.S. market for a period of time. The U.S. will likely be first to market with most technological changes and/or services – again consistent with market forces as their larger market demand can draw out the necessary resources to trial and implement new technologies.

While Canada has enjoyed some notable successes (as described above) it seems unrealistic to expect Canada to lead the charge, at least as in terms of implementing capital intensive new technologies. Moreover, Industry Canada readily acknowledges that it is prudent to follow the U.S lead in terms of releasing spectrum and harmonizing technical standards.

4.4 CONCLUSION

Wireless infrastructure has progressively been modernized worldwide over three generations of technologies, each requiring substantial capital investments. However, the Canadian market is generally too small to drive new generation wireless technologies or set the pace at which they are deployed. Several cases have illustrated

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46 Backbone Magazine, July/August 2006, reports that according to IDC Canada non-voice service including music download, accounted for $672 M in revenue in 2005 and predict a growth to $1.1 billion in 2006 and $2.43 billion in 2009.

47 FCC, 10th Annual CMRS Report, September 2005, paragraph 193.

the challenges and risks of pursuing unique Canadian approaches such as the AURORA cellular technology and digital cordless phone CT-2, among others.

In Canada's case, the much larger U.S. wireless market has largely dictated the nature and timing of the introduction of new wireless technologies. Furthermore, for this same reason, there is a need for Canada to align frequency bands and technology decisions with the U.S. In recognition of this reality, Canada has adopted a "smart" or "fast-follow" approach to the American wireless industry. In this way, Canadian wireless carriers can take advantage of lower cost (and perhaps proven) technology, the availability of a wide range of handsets as well as learn from American experience in the marketing of new mobile wireless products and services.

The U.S. has had two significant head starts relative to Canada in the deployment of wireless services. The first came with the deployment of analog cellular service in 1985 and the second with the deployment of digital PCS in the mid-1990s. The U.S. will once again enjoy a head-start with the deployment of Advanced Wireless Services (AWS) at 1710/2110 MHz and wireless at 700 MHz. The lead time required by the Canadian regulatory process for granting licenses for new spectrum to support services such as cellular, PCS and now AWS account for the delays.

Canadian carriers were quick to implement national 2.5G network capabilities (i.e., GSM/GPRS and CDMA 1XRTT technologies) and did so in parallel timelines with the U.S. carriers. Canadian carriers are slightly behind in the rollout of 3G capabilities in comparisons with the U.S.; however, given the limited demand for high-speed mobile data services to date, this may prove to be a case where the smart-follower approach provides the greatest benefit to Canadian consumers.

5. WIRELESS PRICING

5.1 INTRODUCTION

Mobile wireless service prices comprise numerous rate elements including up-front handset and set-up costs, base monthly recurring charges, local, roaming and long distance per minute charges or overage charges (subject to time of day variations), optional feature charges (such as voice mail and call display) and data charges (text or multimedia messaging and Internet access), among others. As well, there are pre-paid and post-paid pricing options available, along with a variety of promotional offers to attract new customers and retain existing customers. Consequently, comparing overall service prices between services providers within a market can be difficult and, moreover, comparing prices across countries can be even far more difficult still. In the latter case, adjustments for currency differences also come into play.

More generally, in comparing wireless service rates across countries there are inherent problems with standardizing products and product baskets as well as selecting a meaningful exchange rate formula. As a result, the results of such comparisons should be viewed with caution.

At times, Canadian wireless rates have been touted as being among the lowest in the world. More recently, they have been criticized for being higher than those in the U.S. A recent study conducted by the SeaBoard Group (SeaBoard), for instance, suggests that an "average" wireless subscriber in Canada pays 60% more than in the U.S. and 19% more than in Europe.[48] In this section of the report, we examine and assess international wireless service price comparisons and, more specifically, critique SeaBoard's recent wireless price comparison analysis.

In addition, we also examine and compare Canadian usage and average revenue per user (ARPU) for voice and data services levels with other jurisdictions, specifically including the U.S., as well as average revenue per minute (RPM), the customer acquisition costs and the impact of handset subsidies.

5.2 MOBILE WIRELESS PRICING

Background

As noted, there are numerous rate elements to take into account when comparing mobile wireless service prices across countries. The results of any such comparisons depend crucially on the design of the wireless service basket or baskets constructed for the purpose. Indeed, typically more than one basket is constructed to properly capture airtime usage volume level requirements for low, medium and high volume users. Furthermore, even for a specific user category service basket rates can vary widely by

[48] Seaboard Group, *Lessons for Canada; Wireless pricing – A Cross-National Survey: US, Canada and Europe*, July 2005.

wireless service provider within a country let alone across countries. Consequently, the choice of service provider also influences the outcome of international rate comparisons.

Also, the conversion rate to translate local currencies into a common currency is also critical. Typically US$ exchange rates or US$ purchasing power parity or PPP translators are used, but each can provide very different conclusions.

We would also note that quality levels should be taken into account when comparing prices to ensure that apples are being compared to apples. Unfortunately, we are unaware of any international comparative studies that take account of quality dimensions such as call drop rates, congestion, speech clarity or even coverage measures. International price comparisons without standardizing for quality of service differences can be misleading.

Canadian Mobile Wireless Service Rate Comparisons

Before considering the results of international mobile rate comparisons, it is useful to review the results of comparing rates among existing Canadian wireless service providers.

Merrill Lynch, for one, provides regular comparisons of wireless rates in Canada. In a recent publication, Merrill Lynch provided a comparison of wireless rates among Canada's major wireless carriers -- i.e., Bell Mobility, Rogers Wireless and TELUS Mobility -- as well as several Mobile Virtual Network Operators (MVNOs) or resellers -- i.e., Primus, Virgin Mobile, Sears, President's Choice and Videotron.[49]

In the analysis, Merrill Lynch considered rates currently available to a light user and a heavy user. The light user profile includes 150 minutes of local airtime per month (divided by time of day, weekday versus weekend), along with a variety of features including voice mail, text messaging (50 outgoing messages per month) and long distance (15 minutes per month). The heavy user profile includes 900 minutes of local airtime per month, voice mail, 50 outgoing text messages and 90 minutes of long distance. The analysis also takes into consideration up-front costs such as connection fees and the cost of an entry-level handset.

In the case of the light user profile, Merrill Lynch compared rates across nine separate post-paid rate plans. One time up-front costs were found to vary from zero to $66 and one time promotional offers were found to range in value from zero to $80. Monthly recurring charges were estimated to fall between $36 and $47. The lowest monthly rate was found to be roughly 24% below the highest rate.[50]

Considering seven alternative pre-paid plans for the same light user profile, Merrill Lynch reported that one time up-front costs were generally higher (i.e., ranging from $69 to $114) and promotional offers were somewhat lower (i.e., ranging from zero to $50). Average overall monthly charges were estimated to range from $28 to $50. Under the

[49] Merrill Lynch, *Telecom Pricing in Canada*, 25 August 2006.

[50] Ibid. Table 2, page 8.

pre-paid pricing options available, the lowest cost plan was roughly 44% less than the highest cost option.[51]

Lastly, in the case of the heavy user profile, only post-paid plans were compared since pre-paid plans in this case were not competitive. Eight alternative offers were considered. Once again, up front costs were found to vary from zero to $66 while the value of promotional offers ranged from zero to $60. Monthly recurring charges were estimated to fall between $48 and $81. In this case, the lowest monthly rate was roughly 41% below the highest rate.[52]

Among other things, Merrill Lynch's wireless price comparisons demonstrate that for a fixed basket of wireless service elements, aggregate monthly recurring charges can vary widely from one wireless service provider to another. This is explained by the fact that each of the wireless service plans considered is customized to meet specific customer usage requirements, not necessarily the requirements of the user profile assumed for price comparison purposes. As well, for each of the three price comparisons conducted by Merrill Lynch, a different wireless service provider was found to be offering the lowest available monthly rate. Whereas one wireless service provider could be offering the lowest available rate for one user profile, it could just as easily be offering the highest rate for another. Consumers, of course, would normally sort through available offers to determine the plan that best meets their own specific usage requirements.

Therefore, it is not surprising to see a considerable degree of variability in the rates for a defined basket of usage requirements. Similarly, it is not surprising to see wide swings in the estimated overall price levels for defined baskets of wireless service elements across countries.

OECD Wireless Service Price Comparisons

The OECD produces extensive comparisons of international mobile wireless service rates in its biannual Communications Outlook. It compares prices for mobile wireless services tailored to the needs of three alternative users -- i.e., a low, medium and high volume user. The OECD's wireless price comparisons cover all 30 OECD countries. The overall price for the set of services in each basket is estimated using published rates for what is determined to be the lowest cost wireless service provider in each OECD country. However, in this respect, rates for only the two largest wireless service providers are taken into account. This approach, therefore, may not reflect generally available prices across a given country or, for that matter, the lowest available price in any given OECD country.[53]

To provide an overview of recent OECD mobile price comparison results, we briefly review the results of price comparisons reported in the OECD's 2001, 2003 and 2005 Communications Outlooks.

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51 Ibid. Table 4, page 10.

52 Ibid. Table 2, page 8.

53 Note that Teligen Ltd. designs the mobile wireless service baskets in conjunction with the OECD and collects the necessary price data to conduct price comparisons across OECD countries. For more information see www.teligen.com.

The OECD's 2001 Communications Outlook provides mobile wireless price comparisons across OECD member countries for two user profiles or service baskets. The first is a "low" volume consumer user basket, assumed to include 50 minutes a month of airtime. The second is a "high" volume business user basket, assumed to include 300 minute a month of airtime. Additional assumptions are made regarding the mix of calls -- i.e., local, national, international and mobile to mobile. The latter category is necessary since in most OECD countries calling party pays (CPP) rating applies, under which wireless only pay for outgoing calls. Incoming calls are charged to the calling party. In contrast, in Canada and the U.S., wireless subscribers typically are charged for both pay for both incoming and outgoing calls. Further assumptions are made with respect to the distribution of monthly calls by time of day and day of week.[54]

In comparing prices across countries, rates offered by a number of wireless service providers in each country were considered. The lowest rates found were used in the in the price comparisons.

It should also be noted that the OECD analysis compares OECD mobile wireless prices across countries by translating local currency prices into US$ using two separate approaches: (i) international currency exchange rates and (ii) US$ purchasing power parity (PPP) translators.[55] We note that PPP translators are generally considered as superior for the purpose of product and services price comparisons across countries; however, both approaches are commonly used for such purposes. The OECD's mobile wireless price comparison results differ, in some cases significantly, when a US$ exchange rather than PPP translators are used.

The PPP-based price comparisons results reported in the 2001 Communications Outlook indicate that for the low volume mobile wireless user basket, Canadian rates were slightly higher than the OECD average and almost 30% higher than in the U.S. On the other hand, for the high volume mobile wireless user, Canadian prices were 25% lower than the OECD average, and 15% higher than in the U.S.[56] Therefore, at the time, Canadian wireless rates were close to or below the OCED average, but higher than rates in the U.S. for both user profiles considered.

The OECD's 2003 Communications Outlook provides more detailed mobile wireless price comparisons. In this case, mobile wireless service baskets were constructed for three alternative user profiles or baskets. "Low" volume users were assumed to make 25 calls per month, "medium" volume users 75 calls per month and "high" volume users 150 calls per month. Call volumes were spread over calls to fixed networks, other mobiles on the same network and other mobiles on other mobile networks. As well, a number of monthly short message service (SMS) or text messages were included for

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54 The OECD develops service baskets for mobile wireless and other services for price comparison purposes with Teligen. For further details see, Teligen, OECD Telecommunications Basket definitions as of June 2000, 20 June 2000.

55 PPP translators calculated as the ratio of country-specific prices for an established basket of consumer goods and services. The choice of the specific goods and services included in the basket can significantly impact measured relative price countries and, therefore, the PPP translators between countries. One can well imagine that a basket of goods and services purchased by a typical consumer in different OECD countries (such as Korea, Greece and Canada) could vary significantly.

56 OECD 2001 Communications Outlook, pages 185-186.

each of the three baskets. The baskets were rated by country using prices in effect in August 2002.[57]

The results provided in the 2003 Communications Outlook indicate that PPP-based Canadian mobile wireless rates were consistently and significantly below the OECD average. For low volume users, Canadian rates were the sixth lowest across all 30 OECD countries, although they were 10% higher than U.S rates. For medium volume users, Canadian rates were the second lowest among OECD countries. Only rates in Finland were cheaper. Canadian rates for medium volume users were 13% cheaper than U.S rates. For high volume users, Canadian rates were again the second lowest among all 30 OECD countries. For this basket, only rates in the U.S were lower than those in Canada, by roughly 20%. Consequently, in this case, Canadian wireless rates compared favourably to those in other OECD countries, as well as rates in the U.S.

In the OECD's most recent Communications Outlook, released in 2005, a similar cross-OECD country mobile wireless service price comparison was conducted for low, medium and high volume users based on rates in effect in August 2004. In this analysis, PPP-based Canadian rates for the low volume user basket were tenth lowest among the 30 OECD member countries. Rates for low volume users in the U.S were about 10% cheaper than those in Canada. In the case of medium volume users, rates in Canada were seventh cheapest and about 15% cheaper than in the U.S. For high volume users, on the other hand, Canada was 13th cheapest. Rates in the U.S. in this case were almost 40% cheaper than those in Canada at the time. Once again, Canadian rates ranked favourably compared to those in other OECD countries as well as rates in the U.S., except in the case of the high volume user basket.

By way of comparison, when compared on the basis of currency exchange rates, the OECD rate comparisons in the 2005 Communications Outlook show that Canadian rates for low volume users are equal to those in the U.S., 21% cheaper than those in the U.S. for medium volume users, but more expensive for high volume users (in this case by 27% higher rather than 40% when compared on a PPP-basis)

Overall, the OECD's mobile wireless service price comparison results suggest that Canadian mobile wireless rates have consistently compared favourably with other OECD member countries. Relative to the U.S, they have been comparable or below U.S rates in the case of low or medium volume users, but generally higher in the case of high volume users. However, most OECD countries also have higher rates than the U.S. for high volume users.[58]

SeaBoard Group International Wireless Service Price Comparisons

SeaBoard's mobile wireless pricing study was conducted more recently. It examined prices in effect in the second quarter of 2005 in Canada and the U.S., the U.K., Germany

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57 Ibid. pages 163-164 and pages 184-186.

58 Based on our review of the most current price comparisons for OECD countries (conducted by Teligen Ltd. for the OECD and which will underlie the OECD's next Communications Outlook to be released in 2007), Canada continues to perform well overall relative to other OECD countries and in comparison to the U.S.

and Sweden.[59] SeaBoard considered prices in four Canadian cities, three U.S. cities and one city in each of the three selected European countries. Like the OECD price surveys, SeaBoard constructed mobile service baskets for what it defined as a low, average (or medium) and high volume user profiles.

The SeaBoard's wireless service baskets are more somewhat detailed in terms of the service elements included compared to the OECD study. SeaBoard breaks out call volumes by minutes of use by time of day, domestic and international long distance. In addition, for average and high volume users, calling features (such as voice mail and call display) and SMS and ringtone downloads (for average and high volume users) are also included. Low volume users are assumed to use 70 minutes per month in local calling, average users 500 minutes and high volume users 1,200 minutes. Minutes of use are divided between incoming and outgoing (i.e., 35% and 65% of the total, respectively), since in the selected European countries, users only pay for outgoing minutes under a CPP rate regime.

In the local markets considered in each country, SeaBoard surveyed available wireless service provider offers in order to choose the lowest available rates for each user profile under consideration.

For "low" volume mobile wireless users, Seaboard found that pre-paid rather than post-paid plans were the most economical option in each city considered, with the exception of Stockholm, Sweden. The lowest rates (converted to US$ using a PPP translator) were found in Canada (in the cities of Toronto and Kelowna). Consequently, for low volume users, Canadian rates were found to be the lowest among the cities compared.

Moving to the "average" volume mobile wireless user, the lowest rates are found in Stockholm, Sweden. The next lowest rates were found in the three U.S. cities included in the analysis. Notably, rates in three out of the four Canadian cities included in the study were lower than those found in London, England and Berlin, Germany, the two other European cities included in the analysis. When the rates found in London and Berlin were averaged along with rates in Stockholm, average rates in the three European cities combined were found to be 19% cheaper than those in Canada (i.e., Canadian rates were calculated by averaging rates found in the four Canadian cities included in the analysis). Rates in the three selected U.S. cities, once averaged, were found to be 60% cheaper than those in the four selected Canadian cities, on average.

Moving to Seaboard's high-end, 1,200 minute per month mobile wireless service plan comparisons, once again U.S. rates were found to be lower than those in the selected cities in Canada as well as in Europe. However, it should be noted that for the high-end basket, Canadian rates were found to be lower than those in the three selected European cities, on average. For instance, the lowest Canadian high-end volume rates, found in Winnipeg, were over 30% less than those found in the London, England.

Seaboard notes that the lower rates for high volume customers in the U.S. are largely explained by the fact that American wireless service providers have moved toward "big-minute bucket, all inclusive" plans over the last several years. Not only do these U.S.

[59] The selected cities include Toronto, Saskatoon, Winnipeg and Kelowna in Canada, New York, Los Angeles and Athens (Georgia) in the U.S., as well as London, England (U.K.), Berlin, Germany and Stockholm, Sweden.

plans provide users with a large volume of local minutes, but domestic roaming and long distance minutes are also provided at no additional charge. Consequently, including 50 minutes of long distance usage in the average user basket puts Canadian as well as European rate plans at a disadvantage to the selected American rate plans since the Canadian and European plans include separate charges for long distance and roaming calls. As also noted by Seaboard, the big bucket plans in the U.S. also include many calling features at no additional change. The rate plans considered in the study for Canada and Europe did not. This factor also puts the Canadian as well as European plans at a relative disadvantage to the selected U.S. plans.

In addition, it should be pointed out that SeaBoard's selection of a 500-minute plan as a so-called "average" plan tends to bias its results in favour of the U.S. (which, as noted earlier, has largely moved to "big-bucket" minute plans). In the first quarter of 2005, the period during which prices were gathered for the study, mobile wireless minutes of use (MOU) per month per user in the U.S. were close to 700 minutes, on average, versus 350 in Canada and even far lower still in each of the selected European countries.[60] In fact, in the latter case, SeaBoard estimate the average MOU per month in the U.K. Germany and Sweden combined to be in the order of 150.[61] Consequently, it is not surprising to find that the U.S. compared favourably with both Canada and the selected European countries (with the exception of Sweden) for a 500 minute per month mobile wireless service plan. Such a plan should more appropriately have been labeled as a high volume rather than average volume plan.

Seaboard does point out that it found a Canadian 400 minute per month rate plan that was competitive with U.S. rates at the time, excluding consideration of calling features and data transmission rates.[62] Had SeaBoard defined its "average" user profile to include 300 to 400 local minutes per month, Canadian rates likely would have compared much more favourably to those in the U.S. and Europe.

In this same respect, we note that the OECD's comparable medium or average user profile included 75 calls per month, which at an assumed average duration of 3 minutes a call amounts to 225 minutes per month.[63] What is considered to be an average or medium call volume profile differs markedly between the OECD and Seaboard mobile wireless rate comparisons.

In sum, Canadian rates have generally been found to compare favourably with those found in the U.S. when it comes to low and medium monthly minute volume plans, but not with U.S. high volume minute plans. However, the latter finding would apply in the case of many if not virtually all other OECD member countries. Further, the OECD and SeaBoard studies both suggest that that Canadian mobile wireless service rates compare favourably with OECD member counties as a group.

60 Merrill Lynch, GWM 1Q06, pages 161 and 74, respectively.

61 SeaBoard Group, July 2005, page 9, Exhibit 9.

62 Ibid. page 15.

63 See Teligen, OECD Telecommunications Basket definitions as of June 2000, 20 June 2000.

Revenue per Minute (RPM)

Revenue per minute (RPM) estimates provides an alternative means of comparing prices across carriers and countries. Generally, RPM rates have been declining dramatically for years.

In Canada, as of the first quarter of this year, average RPM for the industry as a whole was estimated to be $0.12. Five years earlier, average RPM in Canada was estimated to be $0.21. Consequently, average RPM has dropped in Canada by 43% over the last five years alone.

Table 5.1 provides a summary of average RPM rates for a number of major OECD countries, including the U.S. RPM rates have been converted into US$ using currency exchange rates. The table also provides 5-year percentage rate reductions for each country (calculated on the basis of local currency-based RPM rates in order to exclude effects of exchange rate fluctuations).

Table 5.1
Average Revenue per Minute (RPM)
First Quarter 2006

Country	RPM US$	5-Year Growth Rate
Canada	$0.11	-43%
France	$0.12	-29%
Germany	$0.20	-35%
Italy	$0.16	-24%
Japan	$0.27	-17%
Sweden	$0.13	-47%
U.K.	$0.17	-27%
U.S	$0.07	-62%

Source: Merrill Lynch GWM 1Q06.

Of the eight countries listed in Table 5.1, average RPM rates are lowest in the U.S. at US$0.07. Over the last five years alone, average RPM has declined by 62% in the U.S. Canada has the second lowest RPM rate of the countries included in Table 5.1, at US$0.11 and the third largest decline in rates over the last five years at 43% (behind the U.S. and Sweden).[64] Canadian RPM rates are well below those of other countries such as Germany, Italy, the U.K. and Japan.

[64] One reason for the lower RPM rates in the U.S. relative to Canada may be due to the fact that interconnection rates paid by wireless carriers in the U.S. are lower than those in Canada. A "mutual compensation" interconnection regime exists in the U.S. under which wireless carriers only pay for the interconnection associated with traffic that originates on their networks and terminates on other wireline and wireless networks. They do not pay for interconnection associated with traffic that is originated on other networks and terminates on their networks. No such regime exists for wireless carriers in Canada, meaning that Canadian wireless carriers pay for the interconnection associated with traffic that originates on their networks and for traffic that originates on wireline networks.

5.3 MOBILE WIRELESS USAGE

In this section we compare Canada's mobile wireless usage rates with those found in the U.S. as well as other OECD countries. In particular, we focus on current levels and trends in monthly MOU per subscriber, monthly ARPU and average data usage per subscriber.

Minutes of Use (MOU)

Mobile wireless usage levels, measured in terms of average monthly MOU per subscriber vary widely from one country to another. Merrill Lynch's quarterly Global Wireless Matrix (GWM) report illustrates this fact well. The GWM report provides wireless industry data, including average monthly MOU data, for most OECD countries as well as many other countries.

In Canada,[65] average monthly MOU per subscriber reached 386 minutes in the first quarter of this year. Five years earlier, in the first quarter of 2001, average monthly MOU per subscriber was only 228 minutes. The average annual growth of monthly MOU per subscriber in Canada was 13% per year. Canadian mobile wireless subscribers have increased their usage of wireless services significantly over the last five years alone.

On the other hand, the U.S. ranks well ahead of virtually all other countries at 789 monthly MOU per subscriber on average. Average MOU per subscriber levels in the U.S. have grown even more rapidly over the last five years in the U.S., increasing from 274 minutes in the first quarter of 2001. This represents an average annual growth rate of 30% a year.

Most other countries (including OECD) countries lag significantly behind the U.S. as well as Canada in terms of average monthly MOU per subscriber levels. For instance, in European countries where mobile wireless penetration rates are very high (i.e., much higher than both the U.S. and Canada), such as the U.K, Sweden and Italy, average monthly MOU per subscriber rates are only 148, 139 and 127, respectively, as of the first quarter of this year. Other European countries, such as Germany, are even lower still at 83. The low usage rates in these countries may be explained in part by the very high ratio of pre-paid to post-paid users (i.e., pre-paid users typically use fewer minutes per month than post-paid subscribers). On the other hand, Japan has relatively few pre-paid users, yet its average monthly MOU per user is only 145.

Of the 49 countries included in the Merrill Lynch report, the weighted average monthly MOU per subscriber is 263 minutes. Consequently, Canada's ranks very highly compared to the weighted average for the surveyed countries and, indeed, ranks second overall after the U.S. among OECD countries.[66]

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[65] Merrill Lynch, GWM 1Q06, page 75. All following MOU per subscriber estimates are drawn from the same source, page 41.

[66] Other than OECD countries, only Hong Kong ranked slightly ahead of Canada with a 408 monthly MOU per subscriber rate as of first quarter 2006.

As noted earlier, the reason that the U.S. leads all other countries can be explained by the fact that most wireless service providers in the U.S. began marketing "big-minute-bucket" national plans over the last several years, which in addition to providing users with a large volumes of local calling minutes also allow users to avoid roaming and long distance calling charges. This had the effect of dramatically increasing monthly MOU per user over the last several years.

It should also be noted that due to differences in per minute rating schemes in the U.S and Canada (i.e., receiving party pays) versus Europe (i.e., CPP), the observed differences in monthly MOU levels can be somewhat overstated. For instance, call minutes between mobile users are effectively double counted in the U.S. and in Canada since mobile wireless users pay for both outgoing and incoming calls. On the other hand, since users only pay for outgoing minutes in Europe, reported outgoing minutes are typically adjusted or grossed up to account for incoming minutes.[67] This adjustment process could introduce error as well when it comes to comparing MOU in North America versus Europe.

As discussed in Section 3.1, wireless penetration rates in European countries are generally much higher than those in Canada and the U.S. One key reason for this difference is the much greater popularity of low-usage volume pre-paid plans in Europe. Due to this fact, higher European penetration rates are counter-balanced by lower average monthly MOU levels per subscriber compared to Canada and the U.S. Indeed, when average monthly MOU levels are measured on a per capita basis, the U.S. ranks first among all OECD countries at close to 550 monthly MOU per capita as of year-end 2005. Canada ranks fifth overall, at just over 200 monthly MOU per capita, behind Finland, Korea and Ireland. On the basis on wireless usage per capita, therefore, Canada compares very favourably with other OECD countries.[68]

Average Revenue per User (ARPU)

ARPU per month is calculated by dividing total revenues by the number of users or subscribers. ARPU levels can be influenced by numerous factors over time such as changes in rate elements (e.g., usage rates), calling volumes (e.g., growth in MOU), changes in the mix of local, long distance and off-net or roaming calls, calling patterns (e.g., time of day), feature subscriptions (e.g., calling features), data service (e.g., text messaging, ringtone downloads and web access) and the mix of pre-paid to post-paid customers, among other factors. As well, when comparing ARPU levels across countries, choice of exchange rate comes into play.

ARPU levels in Canada have fallen significantly since the mobile wireless services were launched in Canada. Canadian ARPU levels have dropped from close to $175 in the

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67 Merrill Lynch applies gross up factors of between 20% and 30%. See Merrill Lynch, GWM 1Q06, page 165.

68 We estimated fourth quarter 2005 monthly MOU per capita using data on population, subscriber levels and monthly MOU levels for OECD countries which is reported in Merrill Lynch's 1Q06 GWM Report. Note that data for three of the 30 OECD countries (i.e., Iceland, Luxembourg and the Slovak Republic) is not available in the Merrill Lynch Report.

late 1980s to roughly $75 in the mid 1990s, and dropped further still to roughly $50 as of 2001.[69] Since that time, ARPU levels in Canada have increased gradually to $52.50 as of the first quarter of this year.[70] The more recent reversal in trend reflects increased MOU per subscriber rates and increased usage of pre-existing and new service features (e.g., data services).

Merrill Lynch's GWM report provides ARPU estimates for close to 50 countries in both domestic currencies and translated into US$ using international currency exchange rates. Table 5.2 provides a summary of ARPU rates as of first quarter 2006 for the same OECD countries listed in Table 5.1, along with 5-year growth rates (based on domestic currency monthly ARPU levels).

Table 5.2
Average Revenue per Subscriber (ARPU) per Month
First Quarter 2006

Country	ARPU/month US$	5-Year Growth Rate
Canada	$46	11%
France	$37	6%
Germany	$21	-15%
Italy	$25	-4%
Japan	$55	-19%
Sweden	$20	-32%
U.K.	$32	3%
U.S	$53	-4%

Source: Merrill Lynch GWM 1Q06.

Of the eight countries listed in Table 5.2, Canada's average monthly ARPU ranks third highest at US$47. Japan is the leader at $55 per month, followed closely by the U.S. at $53 per month. The remaining five countries have estimated monthly ARPU rates of between US$20 and US$40.

The lower monthly ARPU levels observed in countries such as France, Germany, Italy and the U.K. may be due to the higher percentage of pre-paid subscriber accounts in those countries compared to Canada and the U.S.[71] In this same respect, the somewhat lower ARPU level in Canada compared to the U.S. may, in part, be due to the higher relative number of pre-paid users in Canada versus the U.S. -- i.e., roughly 23% versus 13%, respectively, as of first quarter 2006.[72]

In any event, it should be noted that, Canada's average monthly ARPU of US$46 not only ranks third highest among the countries listed in Table 5.1, but also third among all 30 OECD countries.

Also, Canada once again compares very favourably when changes in ARPU over the last five years are considered. ARPU in Canada rose 11% over the last five years (to

69 Source: Statistics Canada as described in the financial overview section of this report.
70 Merrill Lynch, GWM 1Q06, page 75.
71 See the section of this report which deals with wireless penetration rates.
72 Merrill Lynch, GWM 1Q06, pages 74 and 160, respectively.

CDN$52.50 as of 1Q06). In contrast, ARPU in the U.S. has declined 4% over the same period (to US$53.08). The U.K. and France experienced limited increases in ARPU, although well less than the 11% increase in Canada. The other four countries all experienced reductions in ARPU, including a 15% reduction in Germany, a 19% reduction in Japan and a 32% reduction in Sweden.[73]

While Canada clearly compares favourably with other countries in terms of monthly ARPU levels and growth, we do not think that a simple comparative measure of ARPU is necessarily indicative of good or bad market performance -– as noted, there are many factors that can lead to changes in ARPU.

Data Services

At this time, the most commonly used data feature tends to be SMS or text messaging, although usage of from other data services are growing rapidly (such as multimedia messaging, ringtone, wallpaper and game downloads and web access).

In Canada, as of the first quarter of this year, data services accounted for 10% of ARPU (or roughly $5.25 per subscriber per month). Five years ago, data services only accounted for 1% of ARPU; consequently, there has been significant growth in data service usage and revenues in recent years.

Table 5.3 provides a comparison of the percentage of ARPU derived from data services for the same set of OECD countries. Other than Sweden, both Canada and the U.S. tend to have considerably lower shares of total ARPU that are derived from data services (although it should be recalled that Canada and the U.S. have higher total ARPU levels that most of the countries listed in the table). Japan has the highest relative share of data service revenues relative to total ARPU.

It should be noted, however, that the growth in data service revenue relative to total ARPU in Canada as well as the U.S. has grown much more quickly than the other listed countries, increasing 10-fold or more.

Table 5.3
Percentage of Average Revenue per User (ARPU)
Derived from Data Services

Country	Data Share of ARPU 1Q 2001	Data Share of ARPU 1Q 2006
Canada	1%	10%
France	5%	15%
Germany	12%	20%
Italy	7%	17%
Japan	13%	29%
Sweden	4%	7%
U.K.	8%	22%
U.S	< 1%	11%

Source: Merrill Lynch GWM 1Q06.

[73] Ibid, country-specific charts, pages 74 to 161.

Higher data revenue percentages in Europe and Asia relative to Canada and the U.S. are not surprising given the fact that Europeans and Asians rely far more extensively on SMS compared to Canadians and Americans. SMS has been estimated to account for roughly 90% of European wireless operators' data revenues.[74] European mobile subscribers are more likely to use text messaging because it is cheaper than placing a call (due in large part to the CPP rating schemes in Europe and Asia). In contrast, Canadian and U.S. mobile wireless users are more likely to make a wireless phone call because the incremental cost of a call is low. Consequently, while data usage rates (especially SMS rates) are lower in Canada and the U.S. than Europe and Asia, the flip side of this usage pattern is reflected in the much higher monthly MOU per user rates in Canada and U.S.

It remains to be seen what impact the deployment of 3G technologies will have on data revenue. For instance, Japan is generally ahead of both Canada and the U.S. in this regard and its data revenue share is greater than (and has been growing faster than) other OECD countries. However, at the same time, as noted earlier, ARPU in Japan has been consistently declining over the last five years suggesting that the data services have been displacing voice services to a significant degree.

5.4 CUSTOMER ACQUISITION COSTS

The average cost of acquisition (COA) for each new mobile wireless subscriber (or gross addition) includes marketing, advertising and equipment costs, less equipment revenue, divided by total number of new subscribers (or gross additions). Equipment costs primarily consist of handset costs. Given that new customers typically pay only a fraction of the cost of the handset, wireless service providers generally subsidize the cost of handsets for new subscribers (in some cases absorbing the full cost of the handset). Consequently, handset subsidies often account for a significant share of a wireless service provider's COA. Individual wireless service providers, however, may take different approaches in this respect, opting for low (even zero) as opposed to high (even full) handset subsidy marketing approaches.

As well, in terms of retaining existing customers, handset costs are also commonly subsidized in cases where existing subscribers extend contract periods with their service provider and in the process upgrade their handsets.

Table 5.4 below provides a summary of COA estimates for Canadian wireless service providers (including Microcell which was subsequently acquired by Rogers).

[74] FCC, 10th Annual CMRS Report, September 2005, paragraph 192.

Table 5.4
Cost of Acquisition
2003-2005

Wireless Service Provider	2003	2004	2005
Bell Canada Mobility	$426	$411	$400
Aliant Mobility	$415	$410	$399
MTS Mobility	$405	na	$380
Microcell	$255	$250	
Rogers Wireless	$397	$372	$395
TELUS Mobility	$430	$389	$375

Source: NBI/Michael Sone Associates.[75]

As Table5.4 shows, there has been a very moderate decline in COA rates over the last few years, although it has been moderate at best. As of 2005, the average COA was roughly $390. In view of the fact that average monthly ARPU is currently just over $50, it takes between seven and eight months just to cover acquisition costs for the average new subscriber.

Microcell's COA was considerably lower than other Canadian wireless service providers in both 2003 and 2004. This is likely attributable to the lower handset subsidies associated with pre-paid service plans offered by Microcell at the time.[76]

Customer acquisition costs for U.S. wireless service providers vary considerably. In the case of the large national U.S. wireless carriers, customer acquisition costs have been estimated to be close to US$400 in 2005, up from roughly US$350 in 2004.[77] Consequently, COA estimates for the large scale U.S. wireless carriers are similar to those for Canadian wireless carriers (excluding adjustments for exchange rate differences). On the other hand, U.S. wireless service providers such as Leap Wireless, which focuses entirely on pre-paid wireless services, has reportedly reduced its COA to roughly US$140.

Reducing customer acquisition costs provides a potential means of lowering rates charged to subscribers. The lower implicit per minute rates in the U.S. relative to other countries, including Canada, may be in some part due to lower average COA rates for U.S. wireless services providers. However, sufficient information on average wireless industry-wide COA levels for the U.S, Canada and other countries necessary to make such a comparison is not available.

5.5 CONCLUSION

Comparing mobile wireless service prices across carriers as well as countries is a complex task given the numerous rate elements and usage considerations involved. Bearing this caveat in mind, the OECD's mobile wireless service price comparison results suggest that Canadian mobile wireless rates have consistently compared

[75] NBI/Michael Sone Associates, *Canadian Mobile Wireless Communications Services Market Report*, 2005 Edition, December 2005, page 95.
[76] Ibid, page 4.
[77] M. McCall, *Balance Swings to Customer Retention*, Wireless Week, 15 January 15 2006.

favourably with other OECD member countries. Relative to the U.S, Canadian mobile wireless rates also compare favourably, except in the case of high volume users -- however this is the case for virtually all OECD countries, not just Canada.

The recent SeaBoard wireless pricing comparison study shows that Canada compares favourably with Germany, Sweden, the U.K. and the U.S. for low call volume users. However in our opinion, the "average" user, as defined by SeaBoard in its study, should more accurately have been labeled a "high" volume user. Consequently, the fact that the U.S. was found to have the lower rates for high volume users compared to Canada was not surprising. Had the SeaBoard study been broader in scope, like the OECD pricing studies, Canada would have been found to compare favourably for a true "average" user of wireless services.

Average RPM rates are currently lowest in the U.S. While RPM rates in Canada are higher than those in the U.S, they are nevertheless well below RPM rates in many other OECD countries, including Germany, Italy, the U.K. and Japan.

In terms of average monthly MOU levels, Canada lags the U.S. However, at 400 MOU per month, Canada nevertheless ranks well ahead of all other OECD countries in terms of monthly MOU levels. Moreover, Canada also ranks very favourably among OECD countries in terms of monthly MOU per capita.

In terms of average ARPU levels, Canada also falls somewhat short of the U.S. However, Canada nevertheless ranks third highest among OECD countries in terms of ARPU. In addition, Canada's average ARPU has been increasing over the last five years whereas in many OECD countries it has been declining.

Lastly, In terms of data usage levels, both Canada and the U.S. lag Europe in terms of data revenues as a percentage of total ARPU. However, this is largely due to the fact that Europeans and Asians rely on SMS as a substitute for voice calling due to the high cost of calling in those countries.

Overall, therefore, Canadian wireless usage rates and prices generally compare very favourably with those of other OECD countries.

6. WIRELESS PENETRATION: CANADA v. the U.S.

6.1 INTRODUCTION

In this section we examine mobile wireless penetration rates in Canada and the U.S. In this respect, the CWTA has specifically requested that we assess whether a wireless penetration "gap" exists between Canada and the US. To address this question we analyze historical wireless penetration rates in the two countries and provide explanations of the differences that have developed since wireless services were first launched twenty years ago.[78]

6.2 SUBSCRIBER GROWTH IN CANADA AND THE U.S.

Mobile wireless services in the U.S. were launched in late 1983 whereas they were launched in 1985 in Canada. The U.S. wireless service providers had a head start of roughly a year and a half in terms of gaining subscribers.

Since the launch of mobile wireless services, the number of wireless subscribers has grown rapidly in both Canada and the U.S. By the end of the 1980s there were 3.5 million wireless subscriber in the U.S. and 317 thousand subscribers in Canada. Ten years later, at the end of the 1990s, there were 86 million subscribers in the U.S. (an increase of 25-fold) and 6.9 million subscribers in Canada (an increase of 23-fold). As of year-end 2005, there were 208 million and 16.9 million subscribers in the U.S. and Canada respectively.[79] Subscribers in both countries increased a further two and a half fold over the last six years. Annual estimates of Canada and U.S. subscribers are provided in the Appendix to this section.

As a rule of thumb, the ratio of the U.S. to Canada population is usually considered to be ten to one. In fact, it is more correctly a little over nine to one.[80] One would expect that over time the number of wireless subscribers in the U.S. relative to Canada would naturally gravitate towards a nine or ten to one ratio once wireless services became well established in both countries. However, this has not been the case.

As illustrated in Figure 6.1, following the initial launch periods for wireless services in the two countries, the ratio of subscribers in the U.S. relative to Canada declined rapidly to a ratio of roughly ten to one in 1991. By the mid to late 1990s, the ratio grew to roughly 13 to one and, since that time, the ratio has declined slightly to roughly 12 to one. As of year-end 2005, it stands at roughly 12.4 to one.

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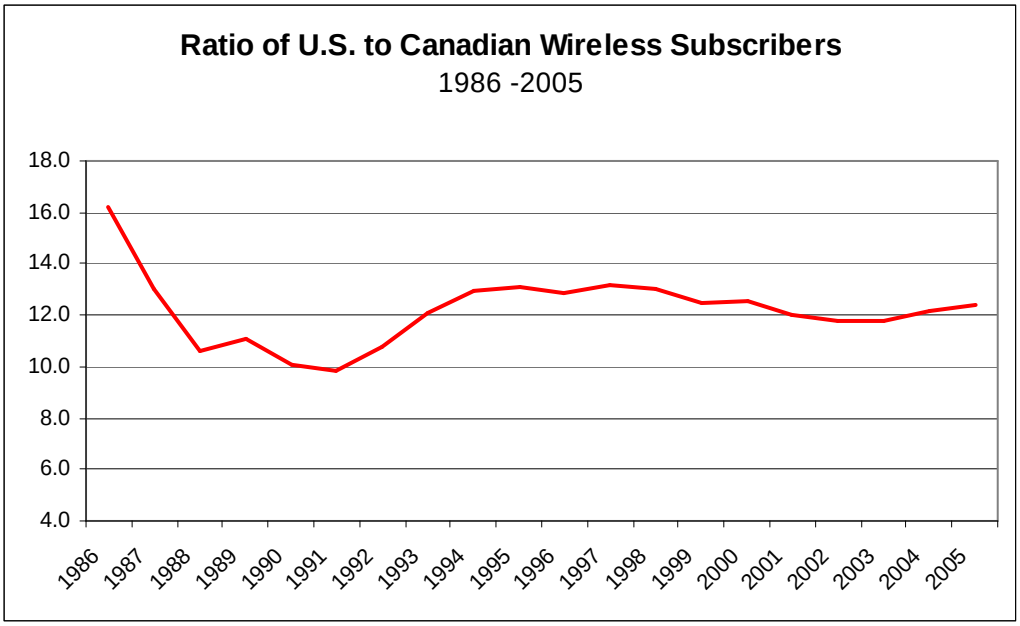
78 Note that a discussion of differences in penetration rates in Canada and the U.S relative to other OECD countries is provided in Wall Communications' concurrent report, also prepared for the CWTA, entitled: *An Examination of Issues raised in the Telecommunications Policy Review Panel's March 2006 Report regarding the Canadian Mobile Wireless Services Industry*, September 29, 2006.

79 Note that Canadian and U.S. subscriber data are from the CWTA and CTIA, respectively.

80 The population in Canada as of year end 2005 has been estimated to be roughly 32.4 million whereas the population in the U.S. at the same time was roughly 297 million.

Figure 6.1



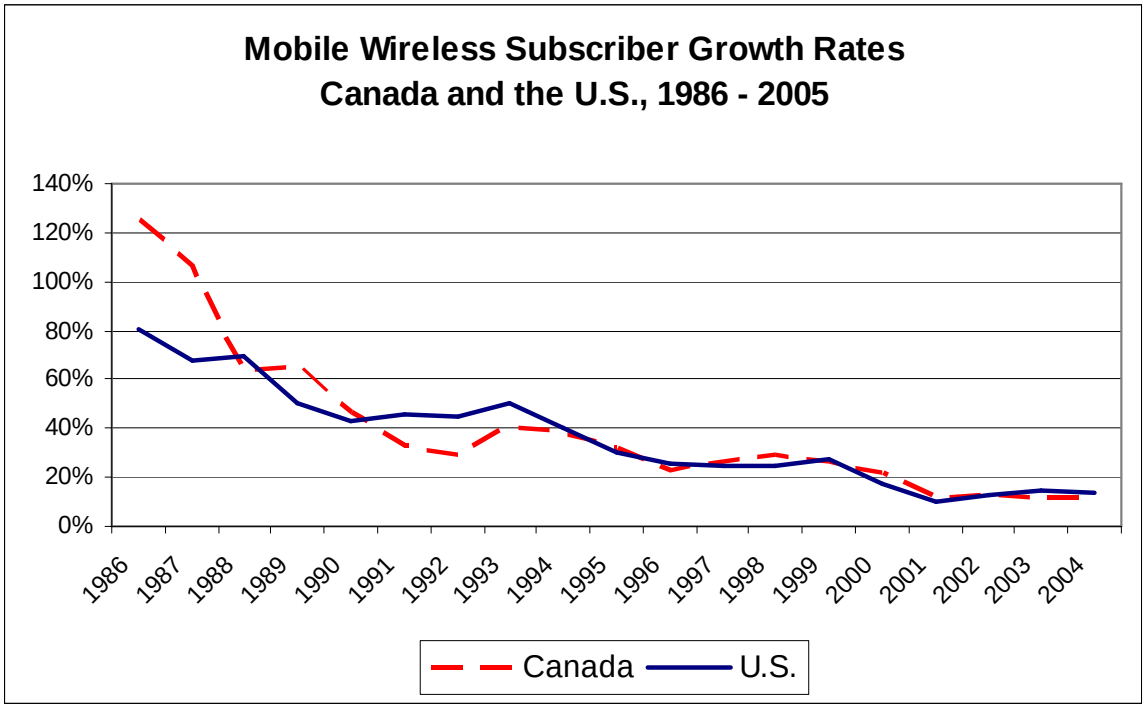
Source: Based on CTIA and CWTA historical wireless subscriber data.

Over the last twenty years, the growth rates of wireless subscribers in both Canada and the U.S. display very similar trends. As shown in Figure 6.2, subscriber growth rates were very high in the initial start-up years for the industry (and have been left off of the chart for this reason). Subscriber growth rates in the late 1980s exceeded 60% annually, and into the early 1990s growth generally exceeded 40% per year. Since that time, year-over-year subscriber growth rates have steadily declined.

The only times when subscriber growth rates in the U.S. significantly exceeded those in Canada occurred in 1988 and during the three-year period 1992 to 1994, just before the launch of second generation (2G) digital wireless services. There were several other years where U.S. subscriber growth rates were marginally greater than those in Canada, such as in 1995 and 2004 and 2005; but otherwise, subscriber growth rates in Canada have generally been equal to or greater than those in the U.S.

Indeed, over the period 1986 to 2005, the average annual rate of growth of subscribers was 35% in the U.S. versus 37% in Canada. Considering the ten-year period prior to the launch of 2G services (1986 to 1996 inclusive), the average annual rate of growth of subscribers in the U.S. was 52% versus 55% in Canada, whereas following the launch of 2G services (1996 to 2005 inclusive), the average annual rate of growth of subscribers in the U.S. and Canada were both 19%. Consequently, there is no gap in the growth rates of wireless subscribers in Canada compared to the U.S.

Figure 6.2



Source: Based on CTIA and CWTA historical wireless subscriber data.

6.3 WIRELESS PENETRATION IN CANADA AND THE U.S.

Wireless penetration rates are typically measured in relation to population -- i.e., the ratio of total mobile wireless subscribers in a country relative to the country's total population. As well, from a consumers' perspective, penetration can also be measured as the percentage of households within a country that own at least one cell phone and have at least one wireless service subscription. We consider both in comparing penetration rates in Canada versus the U.S.

Population-based Penetration Rates

As noted, mobile wireless services were launched in the U.S. roughly 18 months ahead of Canada. Consequently, the population-based penetration rate in the U.S. has always been greater than in Canada since mobile wireless services have been available.

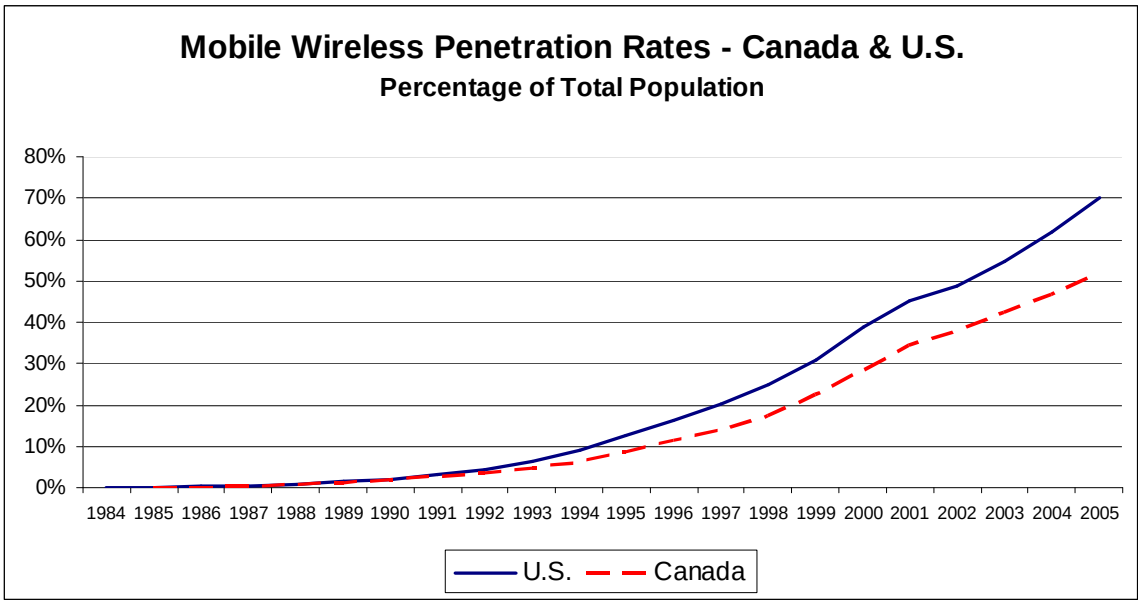
Figure 6.3 below illustrates the growth in wireless penetration over the last twenty years in both Canada and the U.S.[81] By 1990, the wireless penetration rate in the U.S. was slightly above 2% of the population. A decade later, in 2000, U.S. wireless penetration

[81] Note that we have calculated penetration rates for this section of the report based on historical wireless subscriber estimates reported by the CTIA for the U.S and the CWTA for Canada and historical population estimates reported by the U.S. Census Bureau for the U.S. and Statistics Canada for Canada.

had grown dramatically to roughly 39% of the population. As of year-end 2005, U.S. wireless penetration was roughly 71%.

In Canada, the wireless penetration rate was slightly below 2% as of 1990 and, by year-end 2000, had grown to over 28%. As of year-end 2005, the wireless penetration rate in Canada was roughly 52%.

Figure 6.3



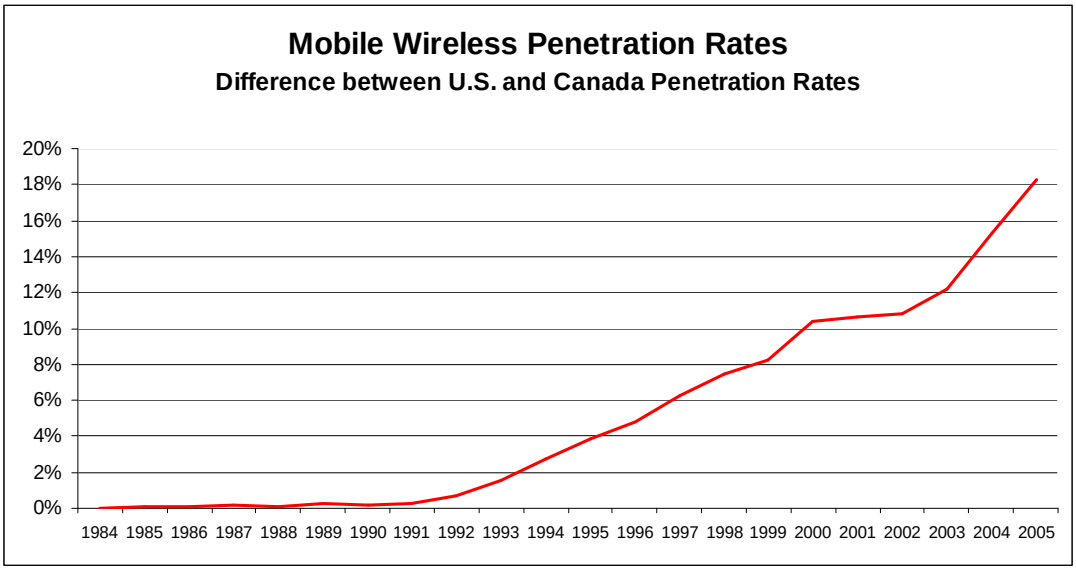
Source: Based on CTIA and CWTA historical wireless subscriber data.

While a gap between the Canadian and U.S. penetration rates has always existed, as Figure 6.3 shows, it became more noticeable in the early 1990s when the wireless industry reached penetration rate levels of 5% or more.

Figure 6.4 shows the absolute difference between the U.S. and Canadian wireless penetration rates over the course of the last twenty years. Between 1984 and 1992, U.S. penetration rates were consistently higher than in Canada. The magnitude of the differences in penetration rates were relatively small during this period due to the fact that wireless services were very new, largely marketed to business and professional customers and at the time, penetration rates were very low in both countries.

The differences between the penetration rates in the two countries began to grow noticeably in 1992 and continuing through to 2000 as penetration rate levels grew with the mass market adoption of mobile wireless services. As noted in the previous section, subscriber growth rates in the U.S. briefly accelerated well ahead of Canada during the 1992 to 1994 period, and subscriber growth was slightly higher in the U.S. in 1995. This acceleration in growth expanded the existing penetration difference between the countries and, since that time, the gap grew steadily through to 2001. The difference leveled off temporarily in 2001 through 2003, but began to grow again in 2004 and 2005. In the latter two years, subscriber growth rates were slightly higher in the U.S. relative to Canada.

Figure 6.4



Source: Based on CTIA and CWTA historical wireless subscriber data.

There are a number of economic factors that could explain the greater acceleration of penetration rates in the U.S. relative to Canada, such as prices or incomes.

In the first case, mobile wireless prices have generally declined since the services were first introduced, and especially so during the 1990s. Falling prices have no doubt had a strong effect on stimulating subscriber growth. According to CTIA data, average local wireless bills have declined significantly in the U.S., which implies that average prices declined as well. Between 1990 and 2000, the average wireless bill declined from US$81 to US$45, a drop of 44%. In Canada, the average revenue per subscriber (ARPU) dropped from CDN$108 to CDN$51, an even greater decline of 53%.[82] Wireless prices dropped significantly in both countries and, indeed, even faster in Canada.

As well, in recent years (2003 – 2005), subscriber growth rates have been somewhat greater in the U.S relative to Canada. During this period, ARPU in Canada increased whereas it decreased in the U.S.[83] Furthermore, revenue per minute in both countries declined sharply during this period, but more so in the U.S. relative to Canada.[84]

Therefore, for much of the period wireless services have been available in the two countries, changes in price levels do not seem to explain differences in penetration rates. The exception may be in recent years where prices have declined more quickly in the U.S. compared to Canada and penetration rates have grown more quickly in the U.S. compared to Canada. The "big bucket" rate plans and "family plans" introduced in the U.S. over the last several years are likely responsible for the recent deviation in price trends in the two countries.

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82 Statistics Canada, *Broadcasting and Telecommunications Service Bulletin*, Catalog No. 56-001, historical statistics.

83 Merrill Lynch, Global Wireless Matrix 1Q06, 27 June 2006, page 75 and 161.

84 Ibid.

In the second case, relative income levels may also have played a more important role in penetration rates growing faster in the U.S. relative to Canada during the initial start-up decade of the industry. In this respect, we note that pre-paid services are far more popular in Canada relative to the U.S. The percentage of Canadian wireless subscribers that were on pre-paid plans as of year-end 2005 was roughly 23%.[85] On the other hand, the percentage of pre-paid to total subscribers in the U.S. was only 12% that year. Prep-paid plans were introduced in Canada in 1998 about one year ahead of the U.S. Between 1998 and 2005, the percentage of pre-paid to total subscribers in Canada has been from two to four times higher than in the U.S. This suggests that Canadians may be more price sensitive to wireless services than Americans as a result of the gap in average income levels between Canada and the U.S.

However, the most important factor that appears to explain the vast majority of the current difference in penetration rates between Canada and the U.S. is the fact that the U.S. had an 18 month head start in the provision of mobile wireless services relative to Canada. While subscriber growth rates in the two countries have for the most part been very similar over the last twenty years (as discussed earlier), the U.S. has consistently been about one and half years or slightly more ahead of Canada in terms of penetration. Indeed, if U.S. penetration rates are adjusted to remove the 18 month head start (so as to place the U.S. on an equal footing with the launch date of wireless services in Canada), we find that the penetration rates in Canada and the U.S. would have be largely equal over the course of the last twenty years, with the exception of the last few years.

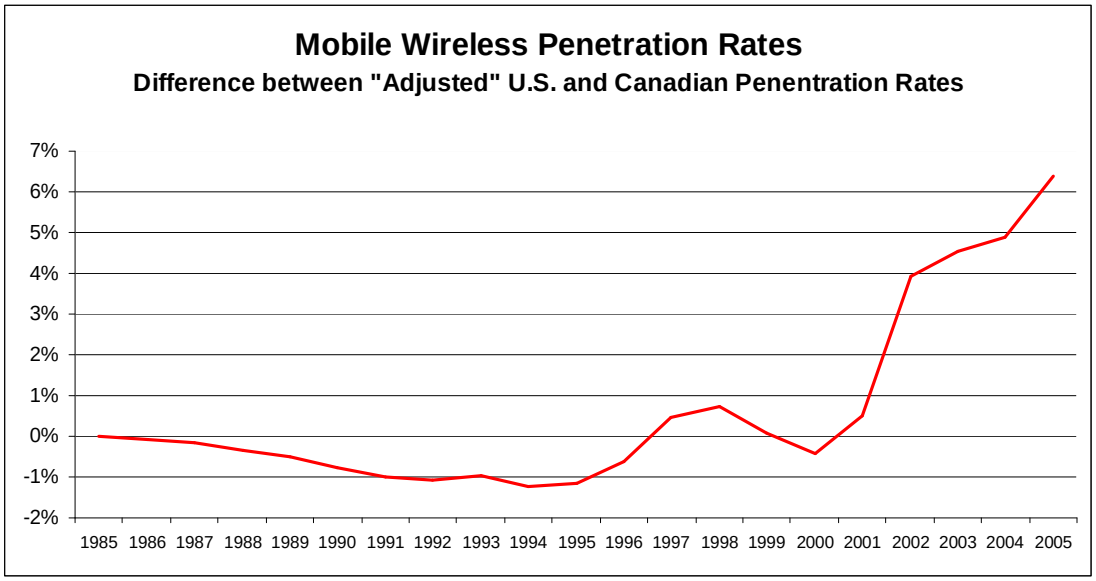
Figure 6.5 provides a summary of the difference in penetration rates when the U.S. penetration rates are "adjusted" to exclude the 18-month head start over Canada. The difference between adjusted U.S. penetration rates and the Canadian penetration rates hovers around zero for most years, starting in 1985 through to 2002. It should also be noted that there was also approximately a two year lag in the introduction of 2G digital PCS services in Canada relative to the U.S. This may explain the moderate increase in the "adjusted" penetration rate gap between 1996 and 1998 (i.e., shifting from 1% in Canada's favour to 1% in favour of the U.S.); although, this minor shift in adjusted penetration rates was closed back down in 1999 and 2000.

However, "adjusted" U.S. penetration rates begin to accelerate ahead of the Canadian penetration rates in 2002. This appears to be explained by slightly higher growth rates in U.S. subscribers over the last few years. As of year-end 2005, an "adjusted" gap of 6% exists, which is roughly a third of the gap that exists when comparing concurrent (i.e., unadjusted) penetration rates for the two countries.

One additional point worth noting is that fact that total population has grown slightly less quickly in the U.S. relative to Canada over the last 20 years. Thus, the denominator in the penetration rate formula has been growing less quickly for the U.S. relative to Canada during this time period which has had the effect of inflating the difference in penetration rates between the two countries. This factor, however, explains only a relatively small part of the overall difference in penetration rates between the two countries.

[85] Source: CWTA subscriber data.

Figure 6.5



Source: Wall Communications, based on CTIA and CWTA wireless subscriber data.

Regional Population-based Penetration Rates

Penetration rates vary significantly by region within Canada. Table 6.1, which provides penetration estimates by province for the five-year period 2000 to 2004, illustrates this fact. Penetration rates are highest in the wealthier provinces, such as Alberta, Ontario and BC. As well, in provinces or regions with smaller urban centres and larger rural populations, such as the Atlantic Provinces, Manitoba and Saskatchewan, penetration rates are lower. Moreover, the magnitude of the differences in penetration rates can be very large. For instance, in 2004, the estimated penetration rate in Alberta is 20 percentage points greater than the rate in the Atlantic Provinces.

Table 6.1
Wireless Penetration Rates by Province
Percent of Population, 2000 - 2004

Province	2000	2001	2002	2003	2004
Atlantic Provinces	21%	25%	30%	33%	38%
Québec	22%	31%	32%	39%	36%
Ontario	33%	37%	42%	44%	52%
Manitoba	21%	29%	35%	37%	37%
Saskatchewan	26%	30%	35%	38%	43%
Alberta	36%	48%	47%	51%	58%
British Columbia	29%	32%	36%	41%	48%
Canada	28%	34%	38%	42%	46%

Source: Statistics Canada, Catalog No. 56-001. Note that there are some apparent errors in Statistics Canada's historical penetration estimates (e.g., the rate for Quebec in 2004) which are likely due to variations in survey data from one year to the next. Note also that there are minor differences between aggregate penetration rates reported by Statistics Canada and those we developed based on CWTA historical subscriber data.

Detailed regional penetration rate data is also available for the U.S. For instance, the Federal Communications Commission (FCC) provides population-based penetration rates for 174 Economic Areas (EAs) across the U.S. in its annual Commercial Mobile Radio Services (CMRS) reports. There are just over 170 EAs which cover all 50 U.S. states. Each EA is made up of one or more economic nodes and the surrounding areas that are economically related to the node and is constructed based on commuting patterns linked to urban centres.

At this level of detail, variations in penetration rates are far more pronounced than those observed for Canadian provinces. As of 2004, the highest EA penetration rates were found in Atlanta and Washington-Baltimore 80% and 79%, respectively. Other large urban centre based EAs such as Los Angeles, New York and Philadelphia ranked very high as well -- i.e., 69% or 70%. These areas were all above the estimated penetration rate for the U.S. as a whole, which was 62% in 2004. On the other hand, low population density EAs such as San Angelo, Texas, and Greenville, Mississippi had estimated penetration rates in 2004 of 38% and 40%, respectively.[86]

Thus, regional penetration data suggest that larger economic centres with higher population densities tend to be characterized by higher mobile wireless service penetration rates. Given the larger size, greater number of large urban centres and higher population density of the U.S of relative to Canada, it is possible that the U.S. market support a somewhat higher penetration rate in the Canada in the longer term. However, further research would be required to determine whether this is the case or not.

Household-based Penetration Rates

Wireless penetration is also commonly measured with respect to households rather than total population. In this case, survey methods are used to estimate the percentage of households with mobile wireless service (including households which possess one or more cell phones and have one or more active mobile service accounts).

Statistics Canada's household expenditures and equipment survey provides annual estimates of the percentage of households in Canada that have a cellular phone. According to Statistics Canada's estimates, roughly 42% of Canadian households had cellular phone service in 2000. Five years later, as 2004, the percentage had risen sharply to 59%.[87] More recent estimates are not yet available.

Decima Research (Decima) has also provides periodic survey-based estimates the percentage of households in Canada that have a cellular phone service (or, more precisely, own or have access to one or more wireless phones).[88] Decima's estimate of

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86 Estimates are drawn from the FCC's 10th Annual CMRS Report, 30 September 2005, Table 2, pages 81 to 85.

87 Statistics Canada, *Selected dwelling characteristics and household equipment*, 2000 – 2004, http://www40.statcan.ca/l01/cst01/famil09b.htm.

88 Decima Research, *Usage of Wireless Communications in Canada*, prepared for: Canadian Wireless Telecommunications Association, April 2006.

the percentage of Canadian households with wireless phone service in 2000 was 44%, slightly above Statistics Canada's estimate. Decima's most recent estimate, for the first quarter of 2006, places the percentage of households in Canada with wireless service at 64% or almost two out of three Canadian households.

In the U.S., the Bureau of Labour Statistics (BLS) has produced estimates of the percentage of U.S. households with wireless phone service as part of its Consumer Expenditure Interview Survey. Estimates from this source date back to the mid-1990s when wireless penetration was estimated to be below 10% of U.S. households. The latest available BLS estimates are for first quarter 2003, at which time over 45% of U.S households were estimated to have mobile wireless service.[89] More recent BLS estimates do not appear to be available.

The available BLS estimates are considerably lower than those available for Canada by Statistics Canada (as well as earlier estimates available from Decima). They also seem to be well below other available estimates for the U.S. which are provided by market research firms (such as Gartner, Forrester Research, J.D. Power & Associates, etc.). This may be explained by the fact that respondents to the BLS study were asked if their household received a cell phone bill and, therefore, this would generally exclude cell phones used for work and/or paid for by an employer.

In any event, more recent estimates of wireless penetration among U.S. households are available from various market research firms. However, these estimates tend to vary considerably. In its annual CMRS reports, for instance, for 2001, the FCC has cited estimates of household wireless penetration rates for the U.S. of between 52% and 61%.[90] Subsequently, for 2002, it referenced a household wireless penetration rate of 56%.[91] More recently, the FCC referenced estimates that suggested that as of 2005, wireless penetration among U.S. households was in the order of two-thirds.[92]

In addition, as of late 2005, Forrester Research estimated that 71% of U.S. households own at lest one cell phone.[93] As well, Ipsos Insight has estimated that 75% of U.S. households own at lest one cell phone, whereas 61% of Canadian households own a cell phone.[94] The latter estimate is slightly below Decima's estimate of 64%.

Consequently, when wireless penetration is measured on the basis of households, the U.S. is once again ahead of Canada. Indeed, as in the case of population-based penetration measures, it appears that the U.S. is about 18 months ahead of Canada. Therefore, the same reasons that explain the difference between population-based

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89 See C. Tucker, Bureau of Labour Statistics, et al, *Household Telephone Service and Usage Patterns in the U.S. in 2004*, Figure 1.

90 FCC, 7th Annual CMRS Report, page 32, footnote 206, where surveys by Gartner and J.D. Power and Associates are referenced. Note that the lower-end figure was for a 25 urban centres in the U.S.

91 FCC, 8th Annual CMRS Report, page 49, which references an updated J.D. Power and Associates survey covering 27 urban centres in the U.S.

92 FCC, 8th Annual CMRS Report, page 72, which references a survey conduced by Forrester Research.

93 J. White, *Wireless technology changing work and play*, CNN.com, 18 Oct 2005.

94 Ipsos Sight, *Fourth Annual Internet Fact Guide*, 2006, http://www.ipsosinsight.com/industryfocus/techandcomm/

penetration rates between the two countries also explain the differences in household-based penetration measures

6.4 CONCLUSION

Since the launch of mobile wireless services in the mid 1980s, the sustained growth in wireless service subscribers in both Canada and the U.S. has been very impressive. Moreover, the average annual growth rates in the two countries have been identical. Consequently, there is no “gap” in the average annual growth rates of wireless subscribers in Canada compared to the U.S.

On the other hand, whether measured on a population or household basis, penetration rates have been consistently higher in the U.S. compared to Canada since the launch of the mobile services in the two countries. As of 2005, wireless penetration in the U.S. was roughly 70% of the total population versus 52% in Canada, representing a difference or “gap”” of 18 percentage points.

In explaining the difference in Canadian and U.S. penetration rates over the last twenty years we found that relative price changes between to the two countries likely played some role, primarily over the course of the last few years. In addition, we would expect that relative incomes levels also played some role in keeping the U.S. ahead of Canada. However, the majority of the difference appears to be explained by the 18 month head start enjoyed by the U.S. From the outset, U.S. wireless penetration was ahead of Canada. With growth rates in subscribers largely being equal over the course of the last 20 years, the gap simply grew in proportion to the relative underlying bases of subscribers in the two countries.

There is some evidence suggesting that wireless penetration rates in the U.S. may have accelerated somewhat relative to Canada in the last few years. This may be a result of recent price reductions in the U.S. relative to Canada (i.e., result from the introduction of “big-minute-bucket” lower-price, high-volume rate plans in the U.S.).

6.5 DATA APPENDIX

Table 6.A1
Canadian and U.S. Historical Wireless Subscriber Levels, Growth and Penetration Rates

Year	United States			Canada		
	Subscribers (000s)	Growth Rate	Penentarion (% Pop.)	Subscribers (000s)	Growth Rate	Penentarion (% Pop.)
1983	na					
1984	92		0.0%			
1985	340	271%	0.1%	6		0.0%
1986	682	100%	0.3%	42	600%	0.2%
1987	1,231	81%	0.5%	95	125%	0.4%
1988	2,069	68%	0.8%	195	106%	0.7%
1989	3,509	70%	1.4%	317	63%	1.2%
1990	5,283	51%	2.1%	526	66%	1.9%
1991	7,557	43%	3.0%	771	47%	2.8%
1992	11,033	46%	4.3%	1,024	33%	3.6%
1993	16,009	45%	6.2%	1,321	29%	4.6%
1994	24,134	51%	9.2%	1,869	41%	6.5%
1995	33,786	40%	12.7%	2,584	38%	8.8%
1996	44,043	30%	16.3%	3,415	32%	11.5%
1997	55,312	26%	20.3%	4,207	23%	14.0%
1998	69,209	25%	25.1%	5,317	26%	17.6%
1999	86,047	24%	30.8%	6,883	29%	22.6%
2000	109,478	27%	38.8%	8,731	27%	28.4%
2001	128,375	17%	45.0%	10,679	22%	34.3%
2002	140,767	10%	48.8%	11,935	12%	37.9%
2003	158,722	13%	54.5%	13,442	13%	42.3%
2004	182,140	15%	62.0%	14,984	11%	46.7%
2005	207,896	14%	70.1%	16,809	12%	51.8%
CAGRs						
1986-1996		52%			55%	
1996-2005		19%			19%	
1992-2005		25%			24%	
1986-2005		35%			37%	

Source: Based on CTIA and CWTA wireless subscriber estimates and U.S. Bureau of Labour Statistics and Statistics Canada population estimates.

7. THE STATE OF COMPETITION IN MOBILE TELEPHONY

7.1 INTRODUCTION

The specific competition measurements employed in this Study are grouped into five categories: product-related measures, price-related measures, entry/exit conditions, market share/rivalry, and other measures/considerations[95]. It is our view that reviewing these five areas will provide a good indication of the overall state of competition in the Canadian mobile wireless market.

We would note that several recent studies have examined some of these areas. These studies offer a starting point for our analysis and we have frequently drawn on the results of those studies.

7.2 PRODUCT-RELATED MEASURES

Product-related measures refer to non-price product or service considerations. Degree of consumer choice is perhaps the most significant non-price consideration and it is manifest in a variety of characteristics such as supplier options (i.e. number of suppliers and coverage), service package options (i.e. minutes of use, unlimited off-peak calling privileges, handsets), opportunities to customize service (i.e. off the shelf versus create-your-own packages), availability of features (such as call waiting and call messaging) and availability of service applications (such as email, music services, video messaging and mobile TV).

The Canadian market has seen a reduction in the number of network-based service providers (NBSPs) with Rogers' purchase of Microcell in late 2004[96]. Although the FIDO brand/service has been retained in the market (along with a distinct service approach), the networks have or are in the process of becoming integrated. Thus the Canadian market has shrunk to three national network providers from four.[97] At the retail level the number of suppliers has actually increased in the last few years with the entry of virtual network operators (MVNOs) such as Virgin Mobile, President's Choice, Amp'd Mobile, Primus and others that resell the service of one of the network-based suppliers. Recently, Videotron, the largest cable operator in Quebec, announced a resale service

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95 For a description of the underlying methodology and choice of these measures, see Wall Communications Inc., *A Competitive Assessment of the Canadian Mobile Wireless Industry*, conducted for Radio and Spectrum Policy, Industry Canada, November 2001.

96 NBSPs include Rogers, TELUS, Bell (and its Aliant affiliate) and the regional-based companies Telebec, SaskTel and MTS as well as the municipally operated Thunder Bay Tel. Bell no longer has a marketing arrangement with the ex-Mobility Canada members although there is some non-formal coordination and information sharing with SaskTel Mobility.

97 Leaving aside the degree of substitutability, the growth of wireless hot-spots and Wi-Fi capable phones that can use the Internet for carrying traffic has introduced another form of network based competition. At this point, it appears that such services are not a viable alternative for most consumers but may become more important over time. See Merrill Lynch, Global Wireless Matrix (GWM) 1Q06 Report, 27 June 2006, page 7.

and there is speculation that other cable operators may follow suit. From a consumers' perspective, there are now more service provider options at the retail level than there were five years ago.

Our review of service package options indicates that consumers today generally have at least as many options as they did five years ago. For example, TELUS offers fifteen base plans of various minute and feature combinations (excluding family plans, business plans and long distance plans), FIDO offers twelve base plans, Rogers offers eleven base plans, and Bell offers nine plans (excluding family and business/long distance plans). By comparison, these carriers offered about thirty-five base plans in total five years ago, versus the more than forty-five offered today.

Not only is there greater variety in any-minute packages offered by NBSPs but the ability of customers to customize a package by blending anytime, evening, weekend and long distance minutes (as well as text, other features and no-charge calls from family or in-region same service customers) has also improved[98]. Handset options have also improved with a proliferation of camera and music player phones as well as web-enabled phones. The introduction of new services such as mobile TV, video messaging, satellite radio and new ringtone and music services have further enhanced the variety of consumer choices. While measuring the exact degree of change in choice related to the above-mentioned services and features is problematic (since some services and features get dropped while others are introduced to the market) our view is that Canadian consumers have a greater choice in mobile offerings today than five years ago (when there were only limited or no opportunities for services such as mobile TV, satellite radio-over-cell phone and video messaging).

The introduction of new services has been largely enabled by the migration of network capabilities to 2.5G and then 3G networks and the faster data speeds they support. Rogers and Fido were the first to offer higher-speed 2.5G EDGE service and Bell Mobility and TELUS have followed suit with 3G 1x EV-DO (Evolution Data Optimized) services in large Canadian cities. 1x EV-DO outpaces EDGE, promising download speeds of between 400 and 700 kbps (kilobytes per second), though bandwidth may vary. Rogers is planning to implement 3G CDMA (UMTS)/HSDPA in large cities later this year.[99]

Although mobile TV is very much in its infancy (with a reliance on uni-streaming as opposed to a broadcast type of distribution), both video and TV services have been introduced to the Canadian market. Downloadable videos as well as clips from TV programs can be accessed by customers of the major wireless providers. Rogers has just announced a video service that provides Blackberry users with daily clips of CanWest Global content[100]. The announced service price is $5 per month.

TELUS also recently announced a venture with Amp'd Mobile. The relationship is not a typical MVNO relationship, in which a retailer typically leases space on someone else's network. The service is called "Amp'd powered by TELUS" and customers will have a direct service relationship with TELUS, and will have access to premium Amp'd services

98 The price for packages and features is discussed in a later section.

99 A discussion of alternative 2.5 and 3G wireless technologies being introduced in Canada is provided in Section 4.

100 The Ottawa Citizen, *CanWest, Rogers unveil Blackberry media player*, August 9, 2006.

and content via TELUS. Amp'd is responsible for branding and marketing efforts and providing the content while TELUS will handle sales, distribution, customer care and pricing.[101]

We would also note that new plan and service introductions continue to characterize the market. In August, 2006 in addition to the TELUS/Amp'd arrangement, Rogers Wireless introduced a new rate plan for Fido customers dubbed "Urban", that is suited to urban dwellers who rarely travel outside of the area where they live and work, and Vidéotron unveiled its plans as a mobile virtual network operator (MVNO) with Quebec City being the first city to receive the service and a roll out of the wireless offering to the remainder of its service territory by the end of this year.[102]

In summary, while the acquisition of Microcell by Rogers has reduced the number of network based suppliers, Canadian consumers still enjoy a healthy and growing number of alternatives, both in suppliers (at retail) and in mobile services and features.

7.3 PRICE-RELATED MEASURES

The question of whether Canadians are paying more for mobile telephone service today versus five years ago is difficult to answer definitively. According to ARPU data, Canadians are spending more on average, but they are also receiving more in terms of additional services and features. In addition, the ability of customers to customize their services to better suit individual tastes and needs permits greater control of their monthly bills. That is, they can reduce what they spend – although they may not choose to do so. Further, the availability of desirable new services may lead to higher expenditures, but customers are better off even though they are spending more.[103]

The average price for most anytime-minutes packages has tended to decrease relative to five years ago. The current average price is 10 cents a minute for most carriers no matter how many minutes are in the package, while five years ago two providers had average minute prices of between 10 and 15 cents per minute, depending on the package (see Table 7.1 below). Further, today's packages tend to offer more weekend or evening minutes at roughly the same package price of five years ago. Per minute prices for pre-paid plans typically average $.30 today versus $.33 five years ago. Moreover, the ability to get unlimited calls from family members or customers within a specific region or for incoming calls allows consumers to lower their monthly bill, depending on their calling patterns and needs.

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101 RCR Wireless News, August 4th, 2006. TELUS said it has rolled out CDMA EV-DO service in 19 Canadian communities over the past nine months and that Amp'd products will be sold within those coverage areas. Users will have access to music, 3D mobile gaming, live sports and concert video streaming, as well as traditional mobile phone functionality

102 Decima, Report on Wireless, *More Services, Packages and Rates Hit Canadian Wireless Market,* September 8, 2006.

103 While some consumer advocates see higher monthly expenditures as a negative development, it is also a sign that consumers believe they are getting good value and have chosen to purchase wireless services over other communications and entertainment services available to them.

Table 7.1
Average Price per Minute – Various Packages 2001 vs. 2006

2001	**BELL**	**MICROCELL**	**ROGERS**	**TELUS**
200 Minutes	$.125	$.10	$.15	$.10
400 Minutes	$.1125	$.10	$.125	
700 Minutes		$.10		
900 Minutes			$.1111	
1000 Minutes		$.10		$.10
1500 Minutes	$.106			$.10
2500 Minutes	$.10			
2006	**BELL**	**FIDO**	**ROGERS**	**TELUS**
200 Minutes	Na	$.10	$.10	$.10
1000 Minutes	Na	$.10 (+ UL E/WE)		$.10

Source: Various company websites. Note: Bell average price cannot be computed given that its packages are a blend of anytime and off peak minutes.

Pre-paid service peaked in 2001 with approximately 850,000 subscribers before falling to under 300,000 in 2003 and 2004. However, it appears to be rebounding with net additions of over 400,000 pre-paid subscribers reported in 2005. Part of the renaissance appears to be driven by CMVNO Virgin Mobile[104]. Virgin has targeted the pre-paid market since its entrance in March 2005, reportedly adding up to 250,000 new pre-paid subscriptions on its own[105].

Table 7.2
Pre-Paid Plan Pricing: 2001 vs. 2006

2001	**BELL**	**MICROCELL**	**ROGERS**	**TELUS**
Unit/rate	$.35/min	$10($.33/min)	$10($.33/min)	$10($.40/min)
		$25($.33/min)	$25($.33/min)	$25($.33/min)
		$50($.33/min)	$50($.33/min)	$50($.29/min)
Expiry (days)			30,90,180	30,60,60
Can/U.S. LD	$.35	$.10	$.66	$.25
Features	ID, Text (ltd.)	VMail, ID	VMail, ID	VMail, Waiting
2006	**BELL**	**FIDO**	**ROGERS**	**TELUS**
Unit/rate	$.30/min for first 2 mins and $.05 thereafter	$10 ($.30/min)	na	$10($.40/min)
Prepaid Cards	$15	$15 ($.15/min)	na	$25($.33/min)
	$25		na	$50($.25/min)
Expiry (days)	30/60	30/15	na	30,60,60
Can/U.S. LD	$.40	$.20	na	$.25
Features	CW, CF, CD	VM, ID,CW	na	VM, CW, ID

Source: Company websites and Wall Communications Inc.

104 CWTA website.
105 Decima, Report on Wireless, July 27, 2006.

However we note there have also been some price increases for certain service elements. For example, pricing for both basic and advanced voice mail and caller ID has increased for three network operators by roughly $1 per month (although one NBSP has kept the same price). Charges for long distance calls have typically risen (usually by $.05 per minute) in most low-cost plans and in some cases international roaming charges have increased over the last year. In addition, all carriers now typically charge a $6.95 monthly system access fee. These price increases can significantly affect some users, depending on their usage patterns.

As discussed earlier, price comparisons are not straightforward for many reasons. Further, even if price trends can be satisfactorily determined, upward trending prices can be an indicator of a reduced level of competition or of other factors. For example prices may increase due to the need to fully recover costs or more generally to remain financially viable. A healthy state of competition does not require that firms lose money. In this regard we would note that the industry has only become cash flow positive in the last two years although it has been in operation for more than twenty years.

With respect to comparing prices in Canada versus other countries, a full discussion is provided in an earlier section of this study. Comparing mobile wireless service prices across carriers as well as countries is a complex task given the numerous rate elements and usage considerations involved. Bearing this caveat in mind, the OECD's mobile wireless service price comparison results suggest that Canadian mobile wireless rates have consistently compared favourably with other OECD member countries. Relative to the U.S, Canadian mobile wireless rates also compare favourably, except in the case of high volume users -- however this is the case for virtually all OECD countries, not just Canada. Other studies have found Canadian prices to generally be higher than U.S. prices, at least for high-volume users.

In summary, Canadian wireless prices generally compare favourably with those of other OECD countries, although some service prices appear to have moved upward in the past few years. We would also note that there have been some downward pricing adjustments and greater customization opportunities that have allowed customers to lower their bills. As a matter of assessing the state of competition, we believe that pricing behaviour is an area that merits ongoing monitoring but it does not, in and of itself, send up a red flag of concern.

7.4 ENTRY/EXIT CONDITIONS

Unlike many other industries, mobile wireless faces a significant natural entry barrier: the need for radio spectrum which is limited in supply.[106] Because radio spectrum is a limited public resource and because interference must be minimized, any new entrant must be licensed by Industry Canada. The licensing process can be both arduous and costly, with no guarantee that an applicant will succeed. Perhaps most significantly, entry (other than resale) has been limited to just four national network operators to this point in time, with only three currently in operation. Until such time as Industry Canada chooses to release more radio spectrum, or until such time as an existing operator leases or sells some of its spectrum to a new party (subject to Departmental approval),

[106] Technological advances can potentially mitigate the impact of spectrum scarcity; however, increasing demand for spectrum usage will heighten this barrier.

no new network entrants can emerge. Moreover, the Department will generally choose the timing for new entry (if it in fact occurs), rather than the normal course where an entrant chooses the place and time for entry.

The Department has also used spectrum caps to balance the holdings among firms. Until 2004, the cap limited any individual operator to 55 MHz of spectrum, but the cap was rescinded in that year.

Over the years Industry Canada has released the following spectrum resources for high mobility wireless services: 50 MHz of cellular spectrum in 1985/1991 in the 800 MHz band; 80 MHz of PCS spectrum in 1995 in the1900 MHz band; 40 MHz of PCS spectrum in an auction in 2001 in the 1900 MHz band; and up to 15 MHz in the 800 MHz trunked mobile band for ESMR/iDEN. Therefore a total of 170 +15 MHz of mobile spectrum is available to the existing wireless carriers.

Rogers has the largest holdings of spectrum with 85 MHz across Canada, except for 75 MHz in Southern Ontario. Bell Wireless has 55 MHz in Southern Ontario, 45-55 MHz in other parts of Ontario, Quebec and Atlantic Canada as well as 30 MHz in the Telus BC/Alta serving area.[107] Telus has 45 MHz in Alberta and BC and 5-15 MHz of ESMR, 30-40 MHz in Saskatchewan and Manitoba with ESMR spectrum, 40 MHz in Southern Ontario with up to 15 MHz of ESMR spectrum, 40 MHz in Quebec and Ontario with 10 MHz of ESMR, 55 MHz in the Quebec Tel area and 30-40 MHz in Atlantic Canada.

It should be noted that current operators seem to have sufficient spectrum for current and short-term future needs with the possible exception of Southern Ontario. In the 2001 spectrum auction, spectrum in Southern Ontario generated $1,238 million out of $1,481 million for all the bids across the country, or 84% of the revenues. This suggests if there is a bottleneck in Canadian spectrum supply, it is probably only in Southern Ontario.

A recent financial analyst report made several relevant points regarding entry costs for a new entrant into the Canadian market.[108] The fixed cost requirement of a new entrant is in the range of $1.2 billion (excluding spectrum) or $2 billion (including spectrum).[109] Spectrum would likely come from the 1.7 GHz or 2.1 GHz bands, which would likely result in a smaller footprint than existing operators. Moreover, incumbent operators would have the advantages of being able to bundle other services (such as wireline, internet, and video delivery) that the new entrant would not likely be able to match (although it could make resale arrangements with an existing operator).

The financial commitments necessary to build and operate mobile wireless network are substantial. The capital costs (generally fixed in nature) for the Canadian industry total billions of dollars and the industry has spent an average of over $1.5 billion per year between 2000 and 2005. Since 1987 the industry has spent a cumulative total of almost $20 billion.

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107 Bell also has a resale arrangement with TELUS across Canada that augments the network coverage and traffic capacity for both operators.

108 Scotia Capital, *Fourth Wireless Entrant Economics Don't Work*, May 16, 2006.

109 The report (ibid.) also notes that Microcell had invested roughly $3 billion before declaring bankruptcy.

The costs of sales and marketing can also be relatively high. The costs of acquiring subscribers (COA) can include a subsidy for the handset, marketing, advertising, and sales commissions. Sales commissions alone can be in the $35 - $150 range.[110] Total COA is estimated to be in the $400 range, although individual company situations can vary.[111]

As noted earlier, the costs of entry into the mobile market are significant, estimated to be in the range of $2 billion when spectrum charges are included. While perhaps not a major cost item, gaining access to appropriate antenna sites can in some instances be difficult, especially for the newer licensees. It takes time to apply and receive municipal and other approvals. In certain cases, the best (i.e. least expensive and best located) sites may already have been claimed by the original cellular firms. Obtaining suitable sites can prevent or increase the cost of entry into some geographic markets.

Perhaps the most immediate opportunity for new entry comes not from the use of conventional mobile networks (including 3G) but from Wi-Fi and related wireless technologies that allow the use of a handheld voice device (like a cell phone) to make calls from any available hotspot or region over the internet. For example, Vonage is offering a portable handset configured with the company's Internet phone service, thus offering a (limited) mobile service that is not subject to minutes of use charges.[112]

As noted elsewhere, entry has occurred via MVNOs with a concomitant increase in competitive activity at the retail level.

Industry Canada is getting ready to release new spectrum designed for broadband internet and/or video services that could conceivably form the backbone spectrum base for a new entrant. The wireless industry's response to an Industry Canada consultation paper on the timing for auctioning 90 MHz of AWS spectrum (bands 1710-1755/2110-2155 MHz) in 2004, generally advocated that a suitable timeline would be after 2006.[113] It is likely that this spectrum will be released in 2008. Although the FCC has just completed (in August 2006) the auction of 90 MHz of AWS spectrum for $13.5 billion, in many large market centers the spectrum is partially occupied by the U.S. Department of Defense and the spectrum will therefore not likely be available before 2008.

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110 Dundee Investment Research, page 14.

111 NBI/Michael Sone Associates, *Canadian Mobile Wireless Communications Services Market Report*, 2005 Edition, December 2005,

112 See www.vonage.com. The FT1000 handset also allows access to your voicemail, call waiting, three-way call, call forward, caller ID and a battery that can provides five hours of talk time and up to 100 hours standby

113 "… the BWA considers that the Department's anticipated timing of this licensing process is one of the key matters raised in this consultation. In this regard, the Department's discussion paper anticipates that the spectrum being addressed in the Consultation will be licensed in the 2005 to 2006 timeframe. The validity of this assumption is important since it will define the timeframe within which the licensing processes, including related additional public consultations, triggered by this Consultation will unfold. The BWA is of the view that this licensing process must be directly linked to the wireless carriers' operational requirements for this spectrum. In this regard, and based on a careful analysis of its future operational requirements, the BWA considers that the 2008 to 2009 timeframe would be a more realistic view of when its members will require additional spectrum and the timeframe in which spectrum should be licensed." Rogers indicated not earlier than 2007 (before acquiring Microcell) and TELUS indicated that the 2005-2006 timeframe was premature.

Furthermore, Industry Canada has set out a spectrum and licensing policy aimed at refarming spectrum in the 2500-2690 MHz band.[114] This includes permitting incumbent licensees to use part of their assigned spectrum in this band for high-mobility service on the basis that approximately 33% of their assigned spectrum is returned to Industry Canada. Any spectrum that is returned in this respect will be auctioned to accommodate other mobile and/or fixed services. For instance, the Rogers-Bell Alliance, which is operating a fixed broadband network in the 2500-2596 MHz band, could seek licensing authority from Industry Canada to operate mobile services in this band once they return 33% of the spectrum it has been allocated in this same band.

A key issue is whether it is appropriate to set-aside some spectrum for new entrants. Industry Canada may have used a variant of a set-aside in 1984 with the assignment of a cellular block to a non-wireline entrant national license. However, in 1995 and 1999, Industry Canada did not adopt a set-aside for new entrants, but rather implemented a spectrum cap to ensure that new entrants had access to sufficient amounts of spectrum in the PCS and LMCS services. As part of the FWA/WCS auctions, there were auction caps introduced to ensure that there would be minimum number of wireless operators.

Other countries have used some form of a set-aside to ensure the potential for new entry. The UK established a set-aside block in 2000 for a UMTS license specifically for new entrants. Hutcheson/TIW was the winner of a license for close to $10 billion. The FCC employed a type of set-aside in 1984 by assigning a cellular block to non-wireline entrants using a lottery process. However, in 1995 the FCC used both a spectrum cap to support new entrants in the provision of PCS services, and also earmarked two blocks of PCS spectrum for small enterprises, minority and women entrepreneurs. Under the U.S. *Telecom Act*, Section 309(j) (4)(D), the FCC is obliged to provide the opportunity for these interested parties to participate. Tools used by the FCC have included limits on the eligibility to qualify, special rules of auction entry and preferred financial arrangements and timelines for paying for the spectrum.

The efforts by the UK, the U.S. and Canada clearly indicate the importance that has been placed on the preservation of the potential for new entry.[115] It is also important to examine the costs of this policy measure. Costs of a set aside can be divided into two areas: 1) loss of potential auction-related revenues to the government; and 2) encouragement of inefficient or non-sustainable entry. Each of these concerns is addressed in turn.

A primary argument advanced against the notion of a set-aside is that it generates lower revenue than an auction with no set-aside, therefore failing to return to a government the full value of that scarce resource. In theory, a lower number of bidders (particularly bidders with deep pockets) can lead to lower realized auction revenue under certain circumstances (i.e. when the maximum potential amount the smaller number of bidders is willing to bid is less than the expected value of the spectrum according to the excluded

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114 This spectrum band is designated world-wide as IMT-2000 spectrum for advanced wireless technology applications such as Wi-MAX.

115 It is worth noting that in the FWA/WCS spectrum auctions Industry Canada stated that: "The Department found no compelling arguments demonstrating that spectrum set-aside for new entrants would significantly advance new service offerings and expansion of wireless services." http://strategis.ic.gc.ca/epic/internet/insmt-gst.nsf/en/sf05375e.html

bidders). However, purchaser behaviour at auctions does not always follow what logic and reason would dictate. Nor is revenue for the set-aside spectrum completely lost – it is just lower than what otherwise might have been achieved.

It is also possible that a set-aside mechanism could encourage entrants who are not capable of succeeding in the market or who will not make as efficient use of the spectrum as incumbents. While this is possible, in our view it is equally or more likely that new entrants could be more innovative, more efficient and/or more successful over a period of time.

An in-depth cost estimation analysis should ideally be conducted to gauge the magnitude of potential set-aside costs but this was not possible within the time and parameter constraints of this Study. To provide some context, one financial institution has estimated that a new entrant would need to purchase roughly $800 million worth of spectrum (presumably at market prices).[116] If a set-aside results in a discounted spectrum price, the revenue collected at auction would accordingly be lower. For example, a ten percent "discount" would result in lower auction revenue of $80 million; a 5% discount would result in $40 million less in auction revenues.

An equally important question is what is the value of preserving the possibility of a new network-based entrant? As a rough contextual gauge, the total operating revenue of the industry in 2005 was just over $11 billion. If reserving spectrum for a new entrant resulted in overall prices being ten percent lower than they otherwise would be, consumers would pay $1.1 billion less per year; if the effect of the set-back was prices at 5% lower, the effect would be worth roughly $550 million.

It should be noted that the discount and valuation factors noted above are purely for illustrative purposes. Moreover, estimating either the value of lower auction revenues (arising from a set-aside rule) or the value to consumers of retaining the potential for new network based entry (via a set-aside) is beyond the scope of this Study. However, it should be a key consideration for Industry Canada in any upcoming spectrum auctions or allocation processes.

Finally it should be noted that Canadian foreign ownership rules pose a significant entry barrier. The rules can be summarized as follows:

(i) Canadians must own a minimum of 80% of the voting shares in facilities-based carriers;

(ii) At least 80% of the board of directors must be Canadian;

(iii) An investor company is "Canadian" if 66 2/3 of the voting shares are held by Canadians; and

(iv) The corporation must not be otherwise controlled by persons that are not Canadians.

[116] This estimate is consistent with the $1.5 billion paid by operators in 2001 for 40 MHz of PCS spectrum. Twenty MHz on a national basis (the minimum required for a new entrant) therefore would cost about $750 million.

There are several ways in which foreign ownership rules impede entry. The rules tend to increase the cost of capital to Canadian firms and therefore the attractiveness of entry into the Canadian market.[117] For example, Canadian firms are forced to utilize less equity financing and increase their reliance on high yield debt financing. This is particularly critical for new entrants, which account for an increasing share of capital spending relative to incumbent carriers.

Most importantly, the rules prevent a particular class of entrant (i.e. foreign-owned) from fully participating in the Canadian market. Given the presence of several vigorous mobile operators in the U.S. and elsewhere, the Canadian environment loses out on the competitive discipline which their entry, or even potential entry, would provide.

In summary, a very powerful mechanism (i.e. ease of entry) to prevent non-competitive behavior is absent from the mobile wireless industry since a new network-based entrant will require spectrum that only the government can make available (assuming spectrum would be unavailable from current spectrum licensees). While entry can (and has) occurred via MVNOs that has added a valuable competitive element to the Canadian market, and other technologies can (and have) provided additional competitive pressure, we believe that preserving an opportunity for new network-based entry is extremely important to disciplining market behaviour, irrespective of whether a new entrant would ultimately succeed in the market. There are several ways that this might be best accomplished and we expect that this issue will receive considerable attention in future policy discussions.

7.5 MARKET SHARE/RIVALRY MEASURES

Market share can be measured by subscribers or revenues or some other measure (such as capacity). The CTRC estimates of market share (using revenues) for recent years are very similar to market share measures using subscriber count. We have used subscriber-based measures in Table 7.3 below.

[117] For a more complete discussion, see Wall Communications Inc., *A Policy Study of the Canadian Telecommunications Foreign Ownership Regime*. January 28, 2000.

Table 7.3
Market Share based on Subscribers (1986-2005)

Year	BWA (or equivalent)	MICROCELL	ROGERS	TELUS	CLEARNET
1986	53%		47%		
1987	53%		47%		
1988	51%		49%		
1989	50%		50%		
1990	49%		51%		
1991	55%		45%		
1992	55%		45%		
1993	57%		43%		
1994	58%		42%		
1995	59%		41%		
1996	60%	.05%	40%		.1%
1997	59%	2%	37%		2%
1998	56%	5%	33%		6%
1999	52%	8%	31%		8%
2000	35%	11%	29%	25%	
2001	37%	11%	28%	24%	
2002	37%	10%	28%	25%	
2003	38%	9%	28%	25%	
2004	37%		37%	26%	
2005	36%		37%	27%	

Source: CWTA, Wall Communications Inc

With respect to facilities-based carriers, the Canadian wireless market share data reflects the entry of new carriers (in 1996), separation (in 2000) as well as consolidation (in 2000 and 2004). There have been as few as two carriers (1986 to 1995) and as many as four carriers (1996 to 2000). Currently the market shares of the defined carriers indicate that the two largest carriers have roughly equal shares (36-37%) while the third carrier still has a sizeable 27% market share.

Market shares can be an indicator of market power and the ability of companies to charge higher than normal prices. We would note that the market shares of each of the three facilities-based carriers are high enough to be of potential concern in this regard. However, market share should be examined in the context of other factors. The Competition Bureau recently noted that other factors in the wireless industry mitigate market share concerns: "Given the amount of subscriber growth that is expected in this industry, as well as the prospects for technological change, current market shares are not viewed at this time to be an adequate indicator of how much market power individual companies will have in the future."[118]

It should also be noted that the market share data reported above does not reflect the activities of MVNOs such as Virgin, Loblaws and others. While competition at the retail level is dependent to a degree on the underlying prices charged by facilities providers to the MVNOs, aggressive marketing and service innovation can still occur at the retail level.

[118] Competition Bureau Technical Backgrounder, *Acquisition of Microcell Telecommunications Inc. by Rogers Wireless Communications Inc*., April 12, 2005.

It is also interesting to examine market share data by province. As revealed in Table 7.4 below, the market share ratios between NBSPs vary considerably on a provincial basis. However, there tends to be a more even distribution in the larger provinces with the share of any individual operator achieving more than 50% only in the fourth largest province and all other smaller provinces.

Table 7.4
Wireless Subscriber Market Share by Province, 2005

Province	Bell Group	TELUS	Rogers	Other
British Columbia	10%	46%	44%	0%
Alberta	12%	61%	26%	0%
Saskatchewan	0%	3%	17%	79%
Manitoba	0%	12%	28%	60%
Ontario	38%	18%	44%	1%
Quebec	48%	20%	33%	0%
New Brunswick	73%	6%	21%	0%
Nova Scotia	63%	11%	26%	0%
Prince Edward Island	81%	10%	10%	0%
Newfoundland and Labrador	86%	10%	4%	0%
The North	100%	0%	0%	0%

Source: CRTC Telecom Monitoring Report 2006

Descriptive and anecdotal evidence from industry analyst reports, CSRs and other phone company representatives indicates that industry-wide promotional and marketing efforts, including significant price reductions, became pronounced after the entry of Microcell and Clearnet. Our sense is that rivalrous behaviour may not be quite as rigorous today as the period when Microcell was competing. However, even with the acquisitions of Microcell[119] and Clearnet, an examination of current behaviour (based on a review of carrier websites) suggests that promotions and marketing efforts are still relatively aggressive, but with an emphasis on features, bundling, packaging, service differentiation and short term bonus offerings or savings rather than specific price points.

In its examination of the Rogers acquisition of Microcell in 2005, the Competition Bureau noted:

[119] In fact, FIDO, the branded service of Microcell, still operates as a separate service from Rogers.

> *There were a number of factors behind the Bureau's finding that there would continue to be vigorous and effective competition remaining following the merger, some of which included the introduction of a variety of new plans that combine minutes of use, handsets, service features and prices; the ability of competitors to add new customers, and; the willingness of Bell Mobility, Rogers and Telus Mobility to respond to price changes by others and to go after each others' territories.* [120]

More recently, the CRTC made the following assessment of the state of rivalry in the wireless market: In a past proceeding, "the Commission considered that the wireless market was characterized by rivalrous behaviour and was robustly competitive. The Commission considers that this assessment continues to be valid with respect to the current state of competition in the wireless market. "[121]

The presence of MVNOs is also worth noting as their marketing efforts appear to be aggressive. The entry of MVNOs is relatively recent, but aggressive targeting of certain demographic segments and high-profile marketing campaigns have led to significant customer acquisition in a relatively short period of time for at least some MVNOs.

In summary, the market share for the largest NBSPs has increased with acquisitions. Recognizing that more is usually better for consumer choice, we would note that the loss of the fourth NBSP has been off-set to some extent by greater competition at the retail level from several new MVNOs. In addition, rivalrous behaviour may not be quite as vigorous today as the period when Microcell was competing but it still exhibits plenty of aggressive marketing and promotional effort to lure customers from one provider to another.

7.6 OTHER CONSIDERATIONS

Integration between various types of telephone companies has become prevalent in North America. In Canada, both Bell and TELUS have wireline operations (including the provision of telephony and broadband services, among others). Bell is also affiliated with satellite, international telecommunications, and broadcasting business lines. Rogers wireless services are integrated with cable television, cable telephony, high-speed Internet and broadcasting business lines and, with its recent acquisition of Call-Net, long distance and business voice and data services. The most important type of integration to a wireless carrier is arguably an affiliation with wireline activities although a marketing emphasis on triple-play or quadruple-play bundling is prevalent in the market.

To the extent that integrated companies can gain cost advantages over competitors, certain operators may be better positioned to compete.

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120 Competition Bureau, Technical Backgrounder, *op cit.*

121 Telecom Decision CRTC 2006-33, *Part VII application by Superior Wireless Inc. against TBayTel alleging unjust discrimination*, 25 May 2006, paragraph 29.

The standard economist concerns about the potential for upstream or downstream price abuse do not seem warranted with respect to mobile/wireline integration since the relations are more horizontal than vertical. However, because linkages between the industries exist and because the services of currently distinct telecom service markets may become more substitutable in the future, ongoing monitoring and further attention is warranted.

Perhaps a more relevant potential concern relates to the very small number of network-based competitors in the broader telecom/broadcasting field and the growing affiliations between those competitors.

For example, on October 17, 2001, Bell and Telus announced extended roaming and resale agreements in each other's primary operating territories.[122] The ten-year agreement significantly lowers roaming charges on each other's digital networks. In theory, this agreement will allow additional competition to occur more quickly, particularly in rural and small to medium-sized communities[123] but it also brings two competitors into a partnership arrangement.

Similarly, Rogers and Bell are now partners in Inukshuk, Canada's largest network-based wireless broadband internet provider. Inukshuk was originally a business venture formed by Microcell in 1999 to build and operate a terrestrial wireless broadband internet network and service across Canada.[124] In 2000, Industry Canada awarded Inukshuk 12 of 13 available MCS licenses in the 2.5 GHz spectrum band.[125] These licenses have a term up to March 31, 2011, although Industry Canada will typically renew licenses for licensees that have met their license obligations. After Rogers acquired Microcell in 2004, Rogers and Bell announced a 50/50 joint venture in Inukshuk the following year.[126]

While there have been no discernible competitive slackening (to our observation) in the last few years as a consequence of growing partnership arrangements. However, continued consolidation in the telecom/broadcasting field accompanied by growing business affiliations among network-based providers is of some concern, even though the benefits of those affiliations are identifiable and perhaps significant.

In summary, consolidation and growing affiliations between competitors have the potential to reduce the tenacity of competition. While a slackening of competition has not been observed as yet, the need for ongoing monitoring of competitor relations and market concentration is warranted.

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122 The Ottawa Citizen, Oct. 18, 2001.

123 Infrastructure sharing agreements have also occurred in Germany after that countries regulatory agency announced the allowance of such arrangements in June, 2001.Deutsche Telecom and BT as well as Telefonica and E-Plus have announced 3G network sharing agreements.

124 Inukshuk was co-founded by Microcell and Look Communications on a 50/50 investment basis. In 2001, Microcell purchased Look's 50% share for $150 M

125 In 1995, Industry Canada had realigned the 2.5 GHz band to be used by both MCS (two-way communications) and MDS (broadcast distribution) operators. Manitoba had been licensed prior to 2001 and SaskTel received the 2.5 MCS license for Saskatchewan.

126 Bell had been a partner with another shareholder in Inukshuk before Microcell was acquired by Rogers.

7.7 CONCLUSION

Comparing the state of competition today with five years ago, the major structural changes in the market have been the loss of one facilities-based provider and the entry of several MVNOs. In terms of performance characteristics, there appears to be some lessening of focus on price reductions with more emphasis on the introduction of several new services and packages, particularly in the data area.

As was the case five years ago, from a competitive analysis perspective, the limited opportunity for network-based entry remains the single most important issue. Whether a new network-based entrant can survive in the market is a relevant question as there is evidence that the market does not have the ability to support a fourth network provider. Nonetheless, predictions of market behaviour and survivability are just that: predictions. Reality can, and often does, differ from predictions.

In any event, economists place considerable reliance on the ability of new players to enter a market as an important trait that can help discipline competitive behaviour. As long as new competitors can enter relatively quickly, existing competitors must be vigilant in maintaining a healthy competitive posture. While the ability to enter is readily available at the retail level (as an MVNO for example), ease of entry is lacking at the facilities level.

We would note that net income in the industry has been positive and growing (after many years of losses) in the last three years. Is this a sign of a less competitive market or the inevitable outcome of "just rewards" after several years of no profitability? Clearly, the industry could not continue to survive while shouldering losses indefinitely, so achieving financial health is not surprising nor undesirable. Further, customer choice still remains relatively strong. However, we believe that even though industry performance has been admirable in many respects over the last five years, retaining the means to permit or even encourage new facilities-based entry should be an ongoing policy consideration based simply on the relatively small number of facilities-based service providers. The exact mechanism for ensuring there is an ongoing potential for new entry will likely require further policy debate and discussion.