Spectrum Policy as Competition Policy: A Good Choice for Canada?

Jeffrey Church

Professor of Economics
University of Calgary

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1 Curriculum vitae is attached as JRC Exhibit-1.
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**EXECUTIVE SUMMARY**

1. Canadian consumers are eager participants in the explosion in wireless data services happening around the world. This explosion is being fuelled by the arrival of revolutionary devices in the form of Smartphones and tablet computers. The possibility of being able to perform just about any task, or consume just about any form of entertainment, from just about any location is enticingly close to becoming a reality. The next wave of wireless broadband deployments in Canada, probably occurring within the next 12 to 24 months, will utilise so-called Long-Term-Evolution (LTE) technology. This next wave of network deployments will likely see wireless broadband services that are on a much more equal footing with wireline broadband offerings, resulting in a substantial increase in data traffic carried over mobile networks. Cisco System’s VNI Usage “widget” predicts (for example) that mobile data traffic in Canada will grow more than 30-fold between 2009 and 2014.

2. However, to sustain this “boom”, with the benefits it brings in the form of consumer welfare gains and perhaps even increases in economic productivity and output, the release of additional spectrum for wireless broadband and voice services will prove essential. At some point, in the next half-decade, engineering forecasts provided as part of Rogers Communications Partnership’s submission suggest that spectrum might well become a key constraint on firms’ ability to expand their services. Other forecasts, ranging from those prepared by the International Telecommunication Union (ITU) and for Ofcom (the U.K. telecom regulator) suggest qualitatively similar inferences: in the medium-term, availability of spectrum might become a crucial factor in determining the expansion of wireless broadband services.

3. Against this backdrop, the concerns about the distribution of spectrum between “entrants” and “incumbents” that is implicit in Industry Canada’s Consultation Document on 700 MHz spectrum, seem misplaced and if translated into policy, will prove counterproductive. Industry Canada implemented a substantial set-aside of spectrum in the AWS band in 2008 (reserving 40% of such spectrum for entrants). Concerns about Canada “falling behind” other countries and (implicitly) concerns about a lack of competition with only three national wireless operators informed Industry Canada’s past set-aside decision. Set-asides can be justified if there is significant room for further welfare-improving entry in the wireless market and if absent such a set-aside, entrants would not be able to acquire spectrum. If these conditions do not hold, however, then set-asides simply result in the parties that are best able to utilise valuable and scarce spectrum being prevented from acquiring that spectrum. The evidence strongly suggests

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1 The following report was commissioned by Rogers Communications Partnership. However, the views expressed are those of the authors and not of Rogers Communications Partnership, as is the responsibility for errors and omissions.

that in the circumstances of the current Canadian wireless market, the conditions
justifying a set-aside do not hold, and the costs of imposing a set-aside are rather high.

4. The nuances associated with the limits to entry as well as the misallocation of spectrum
are explained subsequently in this paper. But put very simply, in a mature wireless
market new entry has a high probability of failure associated with it; alternatively, new
entry in such market conditions may also carry the risk of being “business-stealing” entry
in which market share is transferred from relatively efficient (low cost) firms to relatively
less efficient firms. Neither of these two possibilities is desirable, especially not when a
large amount of spectrum is effectively withdrawn from competitive bidding in order to
facilitate such entry. The withdrawal of this large amount of spectrum ends up raising the
deployment costs of incumbent operators, and also their network quality and coverage. It
could thus affect the quality and costs of services available to consumers.

5. Our concerns regarding the prospects for new entry and new entrants are borne out by
developments in international wireless markets. Looking across a sample of developed
countries, one sees three to four national facilities-based wireless operators in most
markets. Since in most of these markets, licensing is on a national basis, this implies
there are three to four wireless operators seeking to serve any given regional or urban
market. There are some exceptions to this rule, but even in these instances, one sees a
trend towards consolidation: the U.K. now has only four operators and (given press
interest around this issue) may well have only three if antitrust authorities let a large
efficient operator acquire the struggling fourth operator. In the U.S., the market has
developed very substantially on the heels of substantial industry consolidation.

6. These limited variations in competition and concentration levels across markets suggest
that there is a certain tyranny of market structure imposed by the natural technology-
driven scale economics of the wireless business. Simply put, concentration levels in the
wireless market today reflect the fact that new firms would find it hard to compete in the
market because they would not be able to cover the considerable costs of setting up
networks and continuing to fund large network investments over many years. High
concentration levels or even high levels of short-term profits do not mean that there is
“insufficient competition.” Instead they reflect the fact that the wireless business is risky
and scale-driven. Policies that attempt to shoehorn more entry or to favour inherently
unviable entrants—and policies such as aggregate spectrum caps or set-asides fit the
bill—into crowded markets are very likely to fail. Such policies rest on a presumption
that there is a problem of “insufficient competition” and that this problem can actually be
“cured.” There is, in reality, no real evidence (as we discuss) of a problem of insufficient
competition, or indeed of a “cure” that works to address this problem.

7. The track record around the world of (post-2000) new entrants into developed wireless
markets has been very poor, with many returning their licenses before they even began
offering services, others launching services only after a prolonged delay, yet others
merging with larger rivals, and even the most persistent entrant in many markets—

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of Hutchison “3” hints at further consolidation in the absence of favourable rulings on spectrum,
while the reporter suggests that the firm has been the subject of takeover rumours, but that regulators
might prevent such a consolidation from happening.
Hutchison—continuing to suffer significant negative cash-flow, year after year. The struggles of new entrants suggest that the “natural limit” in most developed country wireless markets has already been exhausted.

8. It might be argued that the Canadian market has “room to grow” based on a comparison of typically measured “penetration rates.” However, an even somewhat careful analysis of the fact suggests that this “room to grow” is very limited. The Merrill Lynch Global Wireless matrix for Q3 2010 estimates that between year-end 2009 and year-end 2010 wireless “penetration” increased from 68.3 to 72.6 SIM card-equivalents per 100 Canadians. Thus the growth rate of penetration was some 6.3%, whereas in the period from 2005-2009, the annual average growth rate was closer to 8%, and was around 11% in 2005 alone. This evidence is consistent with the expected “S”-shaped diffusion pattern in which the growth rate of penetration slows as the market matures. New entry does not seem to have fundamentally changed market dynamics, which is inconsistent with the notion that demand in Canada’s wireless market had been previously suppressed by high incumbent pricing. Indeed, new entrants appear to be targeting urban areas where the room for growth is surely least, instead of exploiting untapped market segments such as rural, remote and older Canadians.

9. The current Canadian market is rather “normal” by international standards. Concentration and market structure are within international norms, as are broad measures of market performance and profitability. The industry did enjoy a period of profitability in the mid-2000s, but this period represented payback for the substantial and risky initial investments that the successful firms of today made in pioneering the wireless business in Canada. This is particularly true for Rogers Wireless. Evaluated over a period that resembles the life-cycle of a typical telecommunications network asset (around 10 year), we demonstrate that Rogers’ prosperity of the mid-2000s onwards was the bare minimum it required to compensate its investors for the risks that it had taken in building up the business.

10. Both the evidence on the similarity of market structure internationally and on the absence of evidence of monopoly profits for Rogers are inconsistent with the premise that competition in Canadian wireless is insufficient. The rationale for set asides necessarily depends on a demonstration that competition in wireless in Canada is insufficient and that set asides will result in efficient entry. We do not think that sustaining additional entry via set asides is likely efficient or for some even possible.

11. The evidence that new entrants elsewhere have failed, and that Canada itself has seen industry consolidation (the acquisitions of Clearnet and Microcell), means that one must be appropriately sceptical about policies that aim to tilt the playing field in the direction of “entrants”, whose prospects are inherently uncertain. This is particularly the case when the instrument used to tilt the balance is the allocation of a valuable resource such as spectrum. One critical consequence of Industry Canada’s set-aside policy in 2008 was that it artificially restricted the possibility of having three separate incumbent networks using the AWS spectrum to offer LTE services because Bell Mobility and Telus failed to separately win 20 MHz in key provinces.4 Another consequence was to needlessly raise

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4 Even if the network-sharing agreement between Bell and Telus likely does not represent a reduction in competition between incumbent firms in the short-term, the problem with the 2008 set-aside is that it
the cost of acquiring spectrum for incumbents, with indirect consequences for such operators’ ability to invest (and thus with direct consequences for Canadian consumers too). Against this, there is too little evidence to pronounce definitively on the long-term (or even medium-term) viability of Canadian entrants.

12. Not only are we sceptical that there is room for efficient new entry, but we are also sceptical that a set-aside was needed in 2008 to facilitate such entry. Economic theory suggests that there are circumstances in which incumbents will indeed pay a pre-emption premium to block entry, but economic theory also suggests there are circumstances in which the incentives and ability to block entry are limited. The facts of the Canadian wireless market are inconsistent with the existence of a “pre-emption” premium.

13. The evidence from recent auctions speaks for itself. In the European 3G auctions, newcomers were successful in winning spectrum at auctions in several countries, with only the U.K. using set-asides. In Germany, with no set asides, the auction structure implied a theoretical maximum of six licensees, whereas there were only four incumbents. If the incentives of incumbents to foreclose entry were truly that strong, it is surprising that there were six successful licensees at the end of the auction. Similarly, in the more recent U.S. auctions of AWS and 700 MHz spectrum, there have been a range of non-incumbent players able to win significant spectrum across several key metropolitan areas of the United States without a set aside policy. The largest holding of contiguous spectrum is that of Clearwire, not of Verizon and AT&T. Finally, in Canada too, there is evidence from recent auctions that incumbent firms do not simply purchase spectrum to keep it out of the hands of newcomers.

14. Having already implemented a large set-aside in 2008, Industry Canada now seeks comments as to whether such a set-aside is required to “sustain” competition. A set-aside of 700 MHz spectrum in 2012, makes even less sense than in 2008 and could cause real damage. First, such a set-aside ignores the fact that new entrants currently have only 2% of the market and probably will not have more than 5% of the market by year-end 2012. Relative to their actual network load, these entrants are not likely to see spectrum as a major constraint on their expansion in the next few years. Competition can be “sustained” if these entrants are able to successfully develop brands, forge supplier relationships, deploy networks, beef up their customer services operations and do all the other things that are required to achieve substantial scale. Spectrum is not the critical factor determining these firms’ expansion paths, at least not in the near term. An abundance of spectrum has not, for instance, lifted the clouds over Clearwire’s prospects in the U.S. market.

15. Further, 700 MHz spectrum is a crucial part of the North American LTE Ecosystem as both Verizon and AT&T will use this spectrum to deploy LTE. LTE is especially useful resulted in Bell and Telus being substantially constrained in their ability to make choices regarding their future network evolution.

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5 Even if these effects were not particularly pronounced after the 2008 AWS auction, there are instances (such as Europe in the early 2000s) where substantial auction overpayments had a serious impact on the financial viability of even large firms such as France Telecom and British Telecom (the former had a brush with bankruptcy, while the latter divested its wireless assets to relieve its debt burden).

6 Merrill Lynch forecasts that such entrants will have a combined market share of 4.9% by end-2012.
for offering comprehensive coverage in urban areas and for offerings in rural and low-density areas. Only a limited amount of such spectrum will be made available in Canada. In such a context, a set-aside creates even starker trade-offs between promoting competition and creating a misallocation of a very valuable resource. Given the limited probability that “affirmative” policies in developed wireless markets will create viable new entrants, and the rather higher probability that an inability to acquire sufficient 700 MHz spectrum will lead to one or more incumbents being severely curtailed in its LTE deployment plans, the likelihood is that any set-aside will prove seriously damaging to the Canadian wireless market and thus to the Canadian public. In fact, a set-aside of similar proportions (40%) applied to a smaller amount of spectrum (50 MHz) would not only cement the existing situation wherein Bell and Telus are constrained, but might even result in a situation where it is not possible for both Rogers and a unified Bell-Telus to win sufficient 700 MHz spectrum to offer separate LTE networks that use that band. Such a reduction of intra-incumbent competition should surely worry Industry Canada.

16. One can put things even more bluntly. Not so long ago (in the early 2000s) serious doubts were being raised about Rogers Wireless’ own viability. However, Rogers took risks, made the right business decisions, invested in its brand and its relationships, and began to thrive. It has survived a rigorous and difficult process of selection by the market, and has succeeded where others (such as Microcell) failed. Suppose an Industry Canada policy resulted in Rogers not acquiring sufficient 700 MHz spectrum to deploy LTE services in low-density parts of Ontario and offering a service inferior to what it could otherwise provide in bigger cities. Such a policy would actually impoverish consumers by depriving them of the services of a firm that has been “tried and tested”, which has scale, scope and network advantages, and which can also bundle its wireless services with other services. In this context, it would be a mistake to simply assume that what matters is the number of competitors without paying attention to the characteristics of competitors. A policy that “replaces” a versatile integrated and proven firm like Rogers with unproven wireless-only firms is not competition policy, it is industrial policy that deliberately chooses winners and losers. Worse, it does so in a particularly obtuse fashion.

17. In summary, the evidence does not indicate that there is insufficient competition in the wireless sector in Canada, further entry (including the AWS entrants) may not be viable and may not be efficient. While that entry may have resulted in short term reductions in prices for certain service offerings, it is unlikely that those prices are sustainable and more likely that consumers will actually be harmed in the long run. This might be the case even if entry is sustained.

18. What applies to set-asides applies also to aggregate spectrum caps, another policy instrument that Industry Canada wants to discuss. Spectrum caps or spectrum aggregation limits are a policy instrument of bygone years. The analysis of their applicability and their effects is similar to the analysis of a set-aside, but one must note that spectrum aggregation limits that assume that different spectrum bands are perfect substitutes for each other are particularly rigid and flawed policy instruments. Indeed, our conclusion is that the inflexibilities associated with an aggregate cap might even

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7 Access to the 700 MHz band appears to be important for the quality and coverage of an LTE network, as well as a vibrant ecosystem.
preclude or hinder efficient secondary market transactions from occurring. Against this, an alternative of a “soft cap” or “auction cap” that limits the amount of spectrum that any one party can purchase at a given auction is a less distortive policy instrument which can be used to ensure a minimum amount of entry.

19. Canada should identify substantial additional spectrum that can be freed over coming years (including AWS and further 700 MHz spectrum). Making more spectrum available is the easiest way to create an environment in which one can test whether further entry is viable without imposing substantial costs and distortions on existing industry participants. Further, a policy of imposing binding and non-negotiable roll-out obligations on spectrum licensees will minimise the risk that any party—entrant or incumbent—will simply ‘warehouse’ or sit on its spectrum.

1. INTRODUCTION

20. We have been commissioned by Rogers Communications Partnership to write a report commenting on the optimal framework for the auction of 700 MHz spectrum in Canada. Such spectrum might be used to offer mobile broadband services, and may be a particularly attractive option in low-density areas. Our report focuses on key policy levers that Industry Canada proposes to use as part of its effort to promote and sustain competition in the wireless sector.

21. In releasing its Consultation Document on the matter, Industry Canada described its policy goals in the following fashion:8

Industry Canada is committed to ensuring that Canadian consumers, businesses and public institutions continue to benefit from the availability of new, advanced and affordable telecommunications services in all regions of the country. Such services directly impact the adoption and use of digital technologies and, more generally, the competitiveness and productivity of the Canadian economy. In pursuing these objectives, the Department has acted to encourage a competitive telecommunications marketplace, as it believes that competition stimulates innovation and investment by the industry, which can lead to lower prices, better services and more choice for consumers, businesses and public sector users.

In developing a policy and licensing framework to make additional spectrum available, the Department takes into consideration the need to provide spectrum access for new services and technologies, including broadband, the impact of such a framework on all stakeholders and the Spectrum Policy Framework for Canada (SPFC) policy objective to maximize the economic and social benefits that Canadians derive from the use of the radio frequency spectrum.

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22. We agree with Industry Canada’s overall policy objectives and agree that competition is valuable as a means to achieving these ends. However, for reasons related to the intrinsic technological and cost characteristics of the wireless industry, it is not clear that simply increasing the number of competitors will achieve these policy objectives. It is possible, in fact, that specific measures enacted to increase the number of competing wireless networks may be at odds with Industry Canada’s stated policy objectives, sometimes (or even mostly) in unintended ways. An example was the reservation by IC of a large block of AWS spectrum (as much as 40% of available spectrum) for what it termed “entrants” in the 2008 AWS auction. Through this set-aside, Industry Canada hoped to achieve additional entry into the Canadian wireless market.

23. Certainly at the end of the auction, a partial list of parties that had acquired spectrum in the AWS range and which announced plans or indicated the possibility of eventual plans to compete in the Canadian wireless market included Videotron/Quebecor, Shaw, Data and Audio Visual (DAVE), Public Mobile and Wind/GLOBALive. By this measure, and by the fact that it raised some $4.4 billion for the Canadian government, the AWS auction and the policy instruments used in that auction were spectacularly successful. However, the correct measure to evaluate the set-asides is the extent to which they achieved the policy objectives of lower prices, better services, and more choices for Canadians and at what cost.

24. The use of auctions as a mechanism for primary allocation of spectrum is predicated on the basis that a well-designed auction allows spectrum to be acquired by those parties that value it the most and that private values reflect social values. That is, that the winner of spectrum at an auction will also create the most social value when utilizing its spectrum. Given the wider benefits of wireless network deployments, whether for voice use or data use, regulatory bodies such as IC must pay attention to not just the private values (which reflect the private benefits, such as profits, that bidders expect to receive from using the spectrum) of bidders, but to the social value (the value to society, as measured (for instance) by consumer surplus or increased economy-wide output) created by particular firms’ use of spectrum. There are circumstances under which private values are substantially different from social values for reasons we explain in this report.

25. In such circumstances, departures from the general principle of awarding the spectrum to those with the highest private values for the spectrum might be justified. In economic theory, at least, these circumstances are likely to arise when incumbent operators bid more than their true “use value” for the scarce resource (spectrum) in an effort to foreclose entry into the wireless market. This divergence between the private value of spectrum to incumbents, and the further assumption that the private value and social value of spectrum are well-aligned for entrants, are required for set-asides and other measures that limit spectrum holdings and access to incumbent firms to be in the interests of Canadian users of wireless services.

26. It is worth noting here that the “use value” includes the option value of holding spectrum so as to provide flexibility in meeting network demand. For instance, Rogers may ultimately have access to 2.5 GHz spectrum that is currently held via Inukshuk Wireless. Additional such spectrum has been acquired by purchasing it from entities that have decided to exit the “fixed wireless” broadband market for which such spectrum was originally being used (examples of such exits include Craig Wireless and Look
Communications). Rogers may not be currently utilising this spectrum band to offer service, but it could do so in the near-future. However, the fact that this spectrum is not currently used is not evidence of “hoarding” for anti-competitive purposes: if another user could actively utilise that spectrum (now or in the future) better than Rogers could, then it would pay more for that spectrum (keeping in mind that Inukshuk paid relatively small sums for this spectrum). In fact, other firms could have acquired such spectrum from Look Communications or Craig Wireless, or indeed can acquire other such spectrum from other firms that have 2.5 GHz spectrum. But so far they have not.

27. The services provided by incumbent operators do create substantial social value, incumbent operators with mature networks are faced with the demands of growing data traffic, and incumbent operators might be particularly well-placed to bring new products and services to market if they had adequate access to the (presumably scarce) spectrum resource. Further, the wireless business is driven by scale and scope economies to some possibly very significant degree. These economies, together with the presence of what economists call “sunk costs” put a limit on the number of facilities-based competitors that can be sustained in the wireless market, suggesting that the social value of additional wireless networks could be limited. In short, preventing incumbents from acquiring spectrum can also be socially costly because it potentially restricts the range of services offered by incumbents, the quality of their services, and raises the costs of service for incumbents. As well, the competitive benefits of additional entry may be limited.

28. In essence, then, the type of policy that Industry Canada used in 2008 to promote new entry is justified: (a) if absent such a policy, parties other than the incumbent could not acquire spectrum, (b) the market can sustain efficient new entrants whose entry enhances the market by increasing the availability and adoption of services or through substantial product and service innovation, (c) the benefits created by new entry outweigh potential costs of preventing the relevant spectrum from being acquired by incumbent operators. What we are describing is a trade-off between efficiency gained by permitting greater

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9 Economies of scale arise because there are substantial fixed costs in the production process. Although these economies of scale are possibly less significant in the wireless business than in the fixed-line business, they are nonetheless significant. For instance, even an initial network deployment usually covers a substantial number of customers. There are fixed costs associated with running this network, and a firm will make every attempt to acquire sufficiently many customers to cover these fixed costs as quickly as possible. It is true that in the wireless business, some degree of adjustment to increasing demand can be made via cell-site splitting and other measures, but fixed costs still loom large. Indeed an important long run fixed cost can be the cost of spectrum. Economies of scope arise because common elements of infrastructure can be used to supply more than one service—in other words, two services (voice and data) can be provided without necessarily doubling the cost or requiring duplicate facilities.

10 Sunk costs are those costs that are irreversible (they cannot be recovered by exiting the business). Such costs are frequently incurred because firms entering the telecommunications business must make huge initial investments in networks (and in acquiring spectrum), and a substantial portion (or even all) of these costs cannot be recovered if the firm decides to, or is forced to, leave the business. However, it is important to note that the expenditure on spectrum need not be entirely a sunk cost if spectrum can be resold to other parties and some of the initial expenditure recovered. Indeed the acquirers, depending on their use, may even be willing to pay more for it, in which case none of the initial expenditure is sunk.
scale and through complementarities by aggregating spectrum against the benefits of new
entry, keeping in mind the inherently limited potential for new entry in the wireless
business.

29. In the body of this report, we spend a considerable amount of time evaluating the
necessity and wisdom of Industry Canada’s spectrum set-aside policy. We find that the
policy was not required to promote efficient new entry (and even less urgent in promoting
competition for the acquisition of the spectrum resource) in 2008. Given the
circumstances of the Canadian wireless industry, with three incumbent operators and only
limited (if any) room for efficient new entry, but also limited incentives for incumbent
operators to wish to foreclose new entry, the balance of evidence suggests that the set-
aside policy was neither necessary nor likely to be beneficial for Canadian consumers.
On the one hand it raised the costs of acquiring spectrum for the incumbents, may have
limited competition between the three incumbents, and may have resulted in the
significant misallocation of what is considered a valuable resource—spectrum. The
economic costs of this misallocation depend on the amount of time it will take to re-
allocate spectrum to its most efficient users. On the other hand, the advantage of the
entry created appears limited (and mostly in the voice market, especially the pre-paid
segment) and may not be sustainable.

30. The starting point for a set-aside (or indeed a policy such as a cap) is that there is
insufficient competition in the market. The secondary point is that this insufficient
competition is entrenched via a control of the spectrum resource by incumbent operators.
However, an inference of insufficient competition based on looking at short-term
profitability and at concentration levels is a misleading inference. There is a limit to how
many firms can operate viably in the wireless market. Only if we were demonstrably
below such a natural limit (and thus could clearly accommodate more entry) could one
conclude that there is insufficient competition and that more competition can be
introduced. The evidence we have seen on long-term profitability and on concentration
levels does not suggest that the Canadian market clearly has room to accommodate more
entry. Further, the evidence that we have seen from other spectrum auctions, combined
with the predictions of the literature on pre-emption suggest that incumbent firms do not
have strong reasons to foreclose new entrants by pre-emptively acquiring spectrum. The
conditions justifying a set-aside did not exist in 2008 and do not exist now, while the
potential costs of continuing with set-asides and other “pro-entry” instruments are rather
clearer.

31. One highly relevant question for the 700 MHz auction framework, then, is whether the
set-aside that was implemented in 2008 needs to be paralleled in 2012. We trust that
neither industry participants nor Industry Canada are thinking in terms of new facilities-
based entrants to join the current list of market participants. Thus the main justification
for offering a set-aside similar to that offered in 2008 would be to protect the new
entrants of 2008 from the possibility of being deprived of sufficient spectrum by
incumbent operators who wish to foreclose their expansion by acquiring 700 MHz
spectrum. Indeed, Industry Canada posits the question in terms of whether or not
affirmative measures are required to sustain existing entry, as opposed to inviting new
entry.
32. One significant difference between “now” and “then” is that the entrants of 2008 already have, in some cases, significant amounts of AWS spectrum over which they could be deploying services. Further, the concentration of spectrum shows substantial variation along regional lines, as Videotron has 40 MHz of AWS spectrum in Quebec. These developments perhaps alter the nature of the trade-off described previously, especially as at least one but perhaps more of the incumbent firms are perhaps more likely to face capacity constraints in the next five years than are some of the 2008 entrants whose spectrum holdings (especially if they augment their current spectrum holdings with further set-aside spectrum) might continue to allow them to efficiently expand via greater network investment. We offer no comment on the absolute probabilities of a “spectrum scarcity”, but instead only note the balance of risks as it exists between incumbents and entrants. Cisco Systems forecasts that mobile data traffic in Canada will be 32 times in 2014 what it was in 2009.

33. Much of this growth in traffic will be borne by “incumbent” networks. In this medium-term world, spectrum might well be a constraint on growth, before gains in spectral efficiency and other technological improvements result in less spectrum “consumption” per unit of output. These developments, combined with the substantial uncertainty surrounding the evolution and ultimate success of new entrants serve to increase the risk (comparative to 2008) that a new set-aside will result in a substantial amount of spectrum remaining under-utilised. At the same time, incumbent firms might face constraints or extremely high costs as they seek to roll out LTE networks over AWS and perhaps also 2.5 GHz spectrum in urban centres, while unable to access 700 MHz spectrum for deployments in rural areas and to provide ubiquitous high quality coverage in urban areas. If these risks existed in 2008—and they did, since Industry Canada did consider the possibility that entrants would prove unviable but concluded (incorrectly) that this would not result in significant waste—they would only be made greater by a parallel set-aside in 2012.

34. Our concerns are somewhat amplified by the awkward position of Canadian operators in a global mobile ecosystem dominated by very large American and European firms, who have substantially more independence regarding their choice of spectrum bands in which to deploy next-generation mobile broadband services. Canadian operators are very small in a global context, and if their deployment options were significantly different from the rest of the world, they would face serious difficulties in obtaining appropriate handsets and network equipment. Thus, in North America, 700 MHz spectrum and the AWS spectrum are the announced choices of Verizon and AT&T for their LTE deployments. In Europe, the primary band for LTE deployment is the 800 MHz band, with the 2.6 GHz band also being used in dense urban areas (the 700/800 MHz and AWS bands have fetched much higher valuations at auction than the 2.5/2.6 GHz bands, except in Hong Kong).

11 It is our understanding that among major North American wireless operators, Verizon will (is) offer(ing) LTE services using 700 MHz spectrum, whereas AT&T, Rogers, and Bell and Telus could use AWS and the 700 MHz, bands for deployment of LTE (and in some cases perhaps 2.5 GHz). We understand that AT&T is more or less definite that its deployments of LTE will take place in the 700 MHZ and AWS bands.
35. A policy that places a large amount of highly valuable 700 MHz spectrum “off limits” to Canada’s incumbents means this: the firms that were almost certainly the most cost-efficient and effective providers of LTE services will find that their deployment costs are raised substantially relative to the costs that would be achievable if “normal” amounts of 700 MHz spectrum were available. It might be countered that this would be made up for by the increased “competition” from the entrant operators, but all this means is that Industry Canada would have allocated an inefficiently large amount of spectrum to the highest-cost operators, whose ability to make the large investments in networks, customer and supplier relationships, and brand is very unclear at present. This is particularly true for Ontario, where Industry Canada’s (witting or unwitting) policy of picking winners and losers would mean that the “void” might be filled by Globalive or other providers that are stand-alone wireless businesses that lack the ability to offer the bundled services that consumers rather value.

36. In the 2008 AWS auctions, Industry Canada’s unprecedentedly generous set-aside resulted in a “foreclosure” of another kind: Bell and Telus could not separately acquire enough spectrum to make it viable for them to offer LTE over separate networks using the AWS spectrum. Thus one potentially efficient set of network facilities was eliminated from the mix, and substituted in by higher-cost and potentially less capable firms. This policy error might well have significant implications for future spectrum awards in Canada, and change the dynamics of wireless competition in Canada in a possibly unfavourable direction.12

37. Telus and Bell may well have entered into the joint venture even without the set asides: but the presence of the set asides meant that they had little choice. Continuing with a policy of set asides for the 2012 auction may well again restrict the commercial decisions and flexibility of the incumbents that adversely effects competition. In fact, given the likelihood of there being substantially less 700 MHz spectrum on offer than there was AWS, there is even the possibility that a substantial set-aside will only allow for one incumbent network to deploy LTE in the 700 MHz band. Access to the 700 MHz band appears to be important for the quality and coverage of an LTE network, as well as a vibrant ecosystem.

38. Thus even if one gives the benefit of doubt to Industry Canada’s set-aside in 2008, one would have to acknowledge that the risks of misallocation of a valuable resource would be made greater by “matching” the terms of the 2008 AWS auction in 2012. Of course, as we demonstrate in this report, there is a substantial likelihood that Industry Canada may have chosen the wrong side of the trade-off in 2008, and thus choosing the same course in 2012 will only exacerbate matters.

39. Besides the set-aside provision, IC’s consultation document also contemplates a number of other potential policy instruments. Specifically, it contemplates the possibility of caps either on spectrum holdings in the aggregate, or on the amount of spectrum that can be purchased by any one party at the auction. The effect of an aggregate cap might be similar to that of a set-aside, but perhaps even worse. Aggregate caps were tried in the

12 Our point here is not so much that the network sharing agreement between Bell and Telus is anti-competitive in any way, but the choices of Bell and Telus going forward have been artificially constrained by the policies pursued by Industry Canada.
U.S. and Canada in the 1990s, and may have been useful and justifiable tools when the goal was to reassure relatively naive auction bidders that high bids would result in winning licenses. They were discarded in both countries in the early 2000s, and primarily remain in use today in developing country markets in Latin America and India where their consequences have not been benign either. Caps have largely fallen out of favour in the developed world.\footnote{See, for example, Roetter, Martyn (Arthur D. Little), “Competition and Spectrum Caps”, Independent Report prepared for the GSM Association, 2009, at http://www.asocel.org.co/pdf/Spectrum_Caps_Report.pdf.}

40. Imposing an aggregate cap requires a judgement on the part of the regulatory body regarding how much spectrum is “too much.” Particularly at a time of high and uncertain growth in the demands placed on wireless networks, such a determination about what is enough and what is too much would seem unduly bold.

41. Further, a cap would be a relatively inflexible instrument. In some cases, it would result in the most efficient user of a spectrum band being unable to bid for use of (or even purchase in the secondary market) a portion of that spectrum band because it has hit its “cap.” For instance, a cap of 110 MHz would result in Rogers being unable to bid on 700 MHz spectrum in an auction in 2012. This would fly in the face of the reasonable possibility that Rogers would actually be the socially most valuable user of a portion of that spectrum. It may make it somewhat easier for entrants to acquire spectrum by eliminating competition for the spectrum, but given the uncertainties surrounding their prospects, it is hard to say that the benefits of such a policy will outweigh the costs. As an example, if 700 MHz spectrum is particularly useful in low-density areas, why deny users in such areas the benefits of Rogers’ participation in the contest to provide service to such customers? Rogers (as well as Bell and Telus) are more likely than the entrants to provide services in rural areas and the advantages of size and bundling suggest in many instances that consumers presently unserved or under served in rural areas would benefit more if the incumbents had unrestricted access to the 700 MHz spectrum.

42. As a practical institutional consideration one would also be concerned that once a cap is set and determined, it would be a contentious and difficult process (involving much lobbying) for any operator to have its cap revised or updated. This would be a particularly strong concern if there were substantial shocks to demand that could be resolved through purchases of spectrum in a functioning secondary market, but the functioning of such a secondary market itself could well be restricted by the presence of a cap that required regulatory approval for a substantial subset of transactions.

43. The use of a cap based on aggregate spectrum holdings would also ignore the reality that most major firms would perfectly justifiably wish to hold a diverse spectrum portfolio for technological and technical reasons. Looser caps, such as limiting the amount of spectrum purchased by any one party at auction might be a way of ensuring minimal levels of entry while not causing the harm that a hard aggregate cap might cause. Such “soft” or auction-specific caps have been used in Europe.

44. Finally, the peculiar position of Canadian wireless operators in the global wireless environment adds a perhaps distinctly Canadian twist to the issue of aggregate spectrum
caps. Aggregate caps are based on the assumption that spectrum bands are perfectly substitutable. They are not. The 2.5/2.6 GHz band has less favourable properties in terms of propagation and in-building penetration than spectrum bands below 1 GHz. In other countries, however, this effect of imperfect technical substitutability is (at least on an ex-ante basis) compensated for by the fact that operators will pay much less for such spectrum than for spectrum below 1 GHz. However, in Canada, the substitutability of one spectrum band for another is governed not just by intrinsic technological trade-offs but by technology choices that have been made elsewhere. Thus when assessing the 2.5 GHz band, a Canadian operator would have to look at the choices being made elsewhere – for instance, they will note that the 2.5 GHz band in the U.S. is being used for Wi-Max, and that fact may have a bearing on the value attached to that band in Canada.

45. In the ultimate analysis, it probable that set-asides and caps based on the size of a firm’s aggregate spectrum holdings were and are unjustified in the Canadian wireless context, and it is also probable that these policies get the trade-off between efficiency benefits and benefits from additional competition wrong. These policies share a fundamental fallacy too: they are predicated on a fundamental confusion between inputs and outputs. Merely putting spectrum (the input) into the hands of non-incumbent firms does not create more competition, and might instead create wastage of a resource that government policies in many countries have helped to make relatively scarcer than it could be. Spectrum, the input, may not even be the most critical barrier to entry. For Rogers, for instance, expenditure on spectrum in the past decade is only a little above 20% of the capital expenditures made on the network.14 In fact, by repeatedly setting aside substantial amounts of spectrum (a set-aside of 40% of spectrum for entrants is, to our knowledge, unprecedented) Industry Canada may be doing far less to affect the actual dynamics of competition than it might assume, and far more to create resource waste and unnecessary scarcity.

46. It is worth noting here that there is increasing discussion in some circles about the desirability of spectrum in frequency bands below 1 GHz as opposed to frequency bands above 1 GHz.15 Spectrum in the lower frequency bands permits propagation over longer distances and allows better in-building penetration. It thus makes it easier for operators to offer good quality of service while incurring lower capital expenditure. This may lead some regulators to conclude that they require different rules for the lower frequency bands than for the upper frequency bands—that is, it is especially important to ensure that entrants have access to the valuable spectrum. In fact, one can just as easily draw the opposite conclusion: if such lower-band spectrum is truly limited, then the costs of

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14 The Wireless Intelligence dataset shows that Rogers invested around $6.5 billion (in total, and in nominal terms) in capital expenditure between Q1 2000 and Q4 2009, and during this period it paid around $1.4 billion in acquiring PCS and AWS spectrum.

15 The Industry Canada Consultation Document notes this at p.42, although it does not make an explicit connection between these superior qualitative characteristics and “pro-entry” policies. It does, however, discuss the possibility of licensing at a more fine-grained level so as to permit somewhat localized entry. Again, it is interesting that Industry Canada can define an “entrant” or an “incumbent” based on its national market share, and present graphs and charts showing the concentration of spectrum holdings by using national-level data, while contemplating substantially more fine-grained and localized licensing processes.
preventing firms with the best track records and the highest likelihood of translating spectrum acquisition into widespread and sustainable network deployment would be correspondingly high.

47. Finally, we cannot help but note that many of the problems inherent in using spectrum allocation as a lever for promoting competition can be avoided by substantially increasing the amount of spectrum that is available. Doing so would make it less likely that access to spectrum is the pivotal barrier to entry and expansion for the entrants. This can be done in two ways: (a) by freeing up and auctioning off as much spectrum as is usable for wireless services as soon as possible, and (b) by promoting a substantial secondary marketing in trading of spectrum. Making a lot more spectrum available for wireless services makes sense at several levels.

48. First, the social surplus from using spectrum to provide wireless voice and broadband services is very significant comparative to most of the “next best uses” of such spectrum. Second, making more spectrum available makes it all the harder for incumbent firms to successfully exercise any “foreclosure” strategies because it increases the costs of exercising such strategies. Thus increased competition and entry—to the extent that such are feasible—are promoted by making more spectrum available. Thirdly, the expectation that spectrum will be scarce might actually result in a market for speculative purchases of spectrum (which could happen despite the prevalence of “use it or lose it” conditions in licenses). Greater spectrum availability reduces the rewards for such behaviour.

49. Of course, most regulators and government agencies in Europe and the United States (and one suspects Canada) would agree with this general goal. Finding and identifying more spectrum to be used for provision of wireless broadband services is indeed one of the key planks of the United States’ National Broadband Plan. However, there is often a gap between what is practiced and what is preached. Thus while the European Commission has been suggesting that “digital dividend” spectrum be freed up for broadband use by January 2013, many member states want to push that deadline back by about two years. In turn, Canada is substantially behind the United States, which auctioned off 700 MHz spectrum in 2008.

50. In summary, then, it is our belief that the best spectrum policy for Canada is to make as much spectrum available with as few restrictions as possible. We think that the set-aside policy followed in 2008, along with proposals for other restrictive spectrum policies are more likely to hinder rather than help the Canadian wireless market. The scope for further competition in the market is unclear, and this in itself makes it risky to repeatedly implement policies that place a major share of a valuable resource in the hands of parties whose ability to utilise that resource to provide valuable services that generate substantial social surplus is very uncertain. These risks are greater in 2012 than they were in 2008.

51. In the remainder of this report, we pursue the following structure:

- Section 2 begins with a conceptual overview of what should really inform spectrum allocation policy. It also provides the conceptual underpinnings of the arguments for and against set-asides: notably the risk and consequences of foreclosure of efficient

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16 The National Broadband Plan aims to identify and make available 500 MHz of additional spectrum for broadband use.
entry by incumbents against the risks and consequences of inefficient entry. It formulates the intuition behind the trade-off that we repeatedly refer to this in paper. In doing so we establish the concept of a natural limit on the number of competing networks and the welfare effects of further entry. We explain that even if entry in the short run leads to lower prices, it can still harm consumers in the long run if it raises the costs of incumbents. If this additional entry also restricts the extent of spectrum available to incumbents it could reduce competition from incumbents by raising their costs and reducing the coverage and quality of their networks. Finally, if the reduction in prices results in insufficient gross margins, in the long run prices will rise as some firms exit and/or there is consolidation.

- Section 3 discusses competition, concentration and profitability in the Canadian and global wireless market. We find striking empirical regularities in the concentration levels observed across markets around the developed world, and we find that the Canadian wireless industry performs reasonably well. We also show that Rogers’ wireless division has, over the past decade, achieved a pre-tax nominal internal rate of return of around 10%, not compatible with the idea that there are “excess” returns in the Canadian wireless sector. These findings on competition, concentration and “excess” profits strongly suggest that there is not inefficient competition or a problem with the inefficient exercise of market power in the Canadian wireless market. They also suggest that there is limited scope for further profitable entry into Canadian wireless, and thus the risks of inefficient entry promoted through a set-aside or cap policy loom large;

- Section 4 returns to the specifics of spectrum set asides in Canada. It applies the analytical framework developed in Section 2 to establish that incumbents are unlikely to have an incentive to foreclose, that entrants have not been foreclosed from spectrum at auctions, that the natural limit suggests that some entry into the Canadian market may not be viable, that entry is likely to be costly, with little benefit in the long run;

- Section 5 discusses spectrum caps, both “hard caps” and “soft caps”, using the economic framework developed in previous sections;

- Section 6 provides very brief concluding thoughts.

2. **SPECTRUM ALLOCATION POLICY: TO WHAT END?**

52. The most basic consideration that should inform government policy towards allocating spectrum is the following: wireless voice and broadband services are among the most successful and consumer-surplus-generating services offered in recent decades. By most estimates, annual consumer surplus from wireless service is close to the annual service

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17 It is possible that further continued subsidization of an entrant might result in the entrant persisting in the market and ultimately displacing an incumbent firm, but such entry is not likely to be economically efficient (as we discuss subsequently).
revenues of wireless operators.\textsuperscript{18} In Canada, this means that annual consumer surplus is in the region of $17 billion (CAD) per year. By contrast, the wildly successful AWS auction of 2008 yielded some $4.4 billion in auction revenues. If one were to use AWS per-MHz-POP pricing and apply it to (a) the AWS spectrum and (b) the 170 MHz of spectrum held by all incumbents across all non-AWS spectrum bands, one would obtain a value of roughly $11 billion for the entire licensed spectrum in Canada.\textsuperscript{19} Converting this to an annualised flow (i.e., calculating the constant annual payment that if made over ten years—the lifetime of the license—would yield a Net Present Value equal to $11 billion at a 6\% discount rate) yields an annualised flow of around $1.4 billion.\textsuperscript{20} This is less than $1/10\textsuperscript{th} the potential annual consumer surplus from the use of this spectrum.

Thus the consumer surplus generated from the use of spectrum by wireless service providers is an order of magnitude (at least) greater than the revenues generated for the government by auctioning off such spectrum. Since consumer surplus can be substantially affected by the structure of the downstream market, one might then assume that ensuring and promoting effective competition in the downstream market is a highly important goal for spectrum allocation policy.

We are in full agreement with Hazlett and Munoz when they lament the fact that too many economists still tend to evaluate the result of spectrum policies through the lens of revenue generation rather than through the lens of promoting effective use of spectrum. Of particular note is their comment on Klemperer who lauds the Greek and Belgian auctions of 3G licenses in 2000/01\textsuperscript{21}.

\textit{Klemperer endorses the policy implemented in 3G license auctions held in Belgium and Greece in 2001. Both countries appear to have raised incremental revenue by imposing reserve prices. The result was that each country sold three wireless licenses, with a fourth unsold. Klemperer credits the authorities for producing receipts of about 45 Euros per person, a rent extraction generating some public financing efficiency. Excluded from the analysis, however, is the fact that each unsold license was allocated approximately 35 MHz of bandwidth, and that this frequency space could have been productively employed by a fourth network (if a willing entrant had come forth at a license price of between 0 and 45 Euros per capita) or divvied up among the three incumbent networks to expand capacity.\textsuperscript{22}}

\textsuperscript{18} See Hazlett, Thomas and Roberto E. Munoz, “What Really Matters in Spectrum Allocation Design”, AEI Brookings Joint Center Working Paper No. 04-16, August 2004, at p.5. In an updated (2010) version of this study presented at a conference in April 2010, the authors estimate that consumer surplus was between 1 and 1.3 times annual service revenue in the United States.

\textsuperscript{19} This is based on the calculations presented in Campbell, Glenn, “Spectrum: It’s Rented, Not Owned”, Merrill Lynch, Telecommunications Equity Report, July 31, 2010. Campbell estimates that applying the AWS valuation to the “older” spectrum yields around $7.0 billion, while the AWS spectrum was worth $4.4 billion.

\textsuperscript{20} Discount rates of 5\% to 6\% are commonly used as “social discount rates.”

\textsuperscript{21} They are careful to note that Klemperer himself is aware of the incentives that governments have to favour rent-creation over competition in output markets.

55. We hasten to note that these tensions between revenue-generation and promotion of competitive downstream markets are not at the fore of current Canadian debate regarding spectrum allocation policy. Rather the issues that are more germane are policy levers designed to promote or sustain competition.

2.1. **Auctions, efficient outcomes and foreclosure**

56. In the previous discussion, we describe – and we think we would find IC and indeed most involved with the current policy framework—in agreement that the goal of spectrum allocation policy should be to maximise total social surplus. It is in pursuit of this goal that IC has put competition at the forefront of its recent spectrum policies.

57. The principal mechanism used for primary allocation of significant amounts of spectrum in Canada and in many (if not most) other jurisdictions is the auction mechanism. It is not our purpose here to detail the merits and demerits of auctions per se, or to offer any detailed comments on the exact auction format to be used by Industry Canada. Here, we simply note that there are two attractive properties of auctions that have led to their widespread use.

58. The first attractive property is that auctions represent a pure transfer from bidders to the government. As a revenue-generating mechanism, they involve no distortion of work effort or incentives in the wider economy, and thus there is no deadweight loss associated with the revenues raised via an auction. By contrast, conventional estimates suggest that the deadweight loss per dollar of revenue raised by taxation is around $0.33.  

59. A well designed auction should extract Ricardian rents—rents that accrue to firms because of the cost advantage they have over rivals from access to the scarce resource (spectrum). Rather than accrue to service providers auctions are a mechanism for the public, the owner of the resource, to extract scarcity or Ricardian rents.

60. The second attractive property—if primarily a theoretical one—is the “truthful revelation” property. A well-designed spectrum auction elicits truthful revelations from bidders about their valuation of the spectrum, and this in turn yields the best allocation of spectrum. Spectrum goes to the bidder who values it the most and who is thus most likely to use it productively. This property turns out to be the crucial one for our discussion.

61. It turns out that the “efficiency” of the auction hinges on the absence of market power in the downstream market for providing services that use the spectrum. That is, private values will equal social values and auction mechanisms will result in the efficient allocation of spectrum and extraction of Ricardian rents under certain conditions, one of

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23 Auctions also tend to reduce the extent to which productive resources are used to allocate spectrum, unlike more administrative processes. That is socially wasteful expenditures on rent seeking are likely less when auctions are used to allocate spectrum.

24 However the government should minimize the extent of scarcity rents by avoiding creating artificial spectrum scarcity. While a revenue-maximizing government would restrict spectrum to create monopoly rents, this is not consistent with recognizing that the goal of spectrum allocation should not be revenue maximization, but efficiency.
which is that markets for downstream services are competitive. If, for example, a monopolist is already offering service in the wireless market, there might be circumstances under which this monopolist is the highest bidder for a tranche of additional spectrum, but from a social perspective would be the wrong user of such spectrum. Specifically, a monopolist may bid more than the revenues it would get from its additional spectrum tranche, if it seeks to protect profits from its existing license. Cramton et al (2010) consider competition for the additional license between the incumbent monopolist and the new entrant, using the analysis of Gilbert and Newbery (1982).

62. Gilbert and Newbery is a simple model that illustrates the problem. Suppose that production of the downstream good requires access to an input that is in finite supply. Denote the finite supply of this resource, which could be raw materials, human capital, technology or spectrum, by $X$. Suppose initially that the current stock is controlled by a downstream monopolist (firm 1). Assume an additional finite amount of the input becomes available, equal to $E$.

63. If $E$ is acquired by the incumbent monopolist, then its monopoly will be preserved. If on the other hand, the incremental supply of $E$ is acquired by another firm, it can enter downstream and compete with the monopolist. The maximum that an entrant (firm 2) would be willing to pay for $E$ is the net present value of duopoly profits: $\pi^D_2(X,E)$. The maximum that the incumbent would be willing to pay is equal to the difference between the net present value of its profits if it acquires $E$ (and remains a monopolist) and the net present value of its profits if it does not acquire $E$ and there is successful entry: $\pi^M(X+E) - \pi^D_1(X,E)$. The incumbent will be willing to pay more for $E$ if

$$\pi^M(X+E) - \pi^D_1(X,E) > \pi^D_2(X,E)$$

or

$$\pi^M(X+E) > \pi^D_1(X,E) + \pi^D_2(X,E)$$

(1)

64. We would normally expect that (1) would be true. The left-hand side is industry profits when the incumbent monopolist has control over both its stock of the resource and $E$. The right-hand side equals industry profits when there is duopoly competition between the incumbent and the entrant. The expectation is based on the fact that a monopolist by setting the same prices and outputs as when there is a duopoly could at least replicate the

25 The equivalence also may break down if there are multiple objects to be auctioned. See Jehiel, P. and B. Moldovanu (2003) “An Economic Perspective on Auctions,” Economic Policy, April, pp. 271-301.


duopoly equilibrium, and in general, will be able to do better since competition is eliminated. The result that a monopolist will outbid an entrant for access to an essential input required to enter the monopolist’s downstream market is known as the “efficiency effect”. The two sets of circumstances when (1) does not hold are (i) perfect collusion between the entrant and the incumbent and (ii) if $E$ is of sufficiently higher quality that it renders $X$ economically redundant, i.e., acquisition of $E$ allows the entrant to become a monopolist and displace the incumbent. In this case both the incumbent and the entrant are bidding to be the next monopolist.

65. In this case, the monopolist is the highest bidder but its high bid is motivated by its desire to protect its profits from its existing license. This may be a situation in which the highest bidder is not the best bidder from society’s perspective. There may well be static and dynamic efficiency gains from adding a competitor to the market—the new entrant may help to expand output in the short term and in the long term, exert greater pressure upon the incumbent firm to innovate (the “dynamic” efficiency aspect). In this circumstance, society might be better off if a policy such as a set-aside resulted in the spectrum being in the hands of a new entrant.

66. There is another effect, identified by Arrow (1962), however, that lowers the willingness to pay for the scarce resource by the monopolist. Arrow considered the willingness to pay of a secure monopolist, one that is not worried about the scarce resource being acquired by a rival that would then enter. Because it is already a monopolist, the value to it of $E$ (when there is no possibility of entry) is equal only to the difference between monopoly profits with $X$ and monopoly profits with stock $X+E$: $\pi^M(X+E) - \pi^M(X)$. That is, the monopolist is willing to pay the difference between being a monopolist with access to input $X$ or being a monopolist with access to input $X+E$. The value of $E$ is reduced to the incumbent since that value is based only on its use (to the extent it lowers costs or enhances demand), not on both the value of $E$ in deterring entry and use.

67. In the limiting case when $E$ might allow the entrant to replace the incumbent as a monopolist, the entrant would be willing to spend more than the incumbent: it acquires all of the monopoly profit, the incumbent just the difference between the two monopoly profit streams. The result that an entrant would spend more because it will receive all of the monopoly profit, not just the increment created by acquiring $E$ is known as the “replacement effect.” Symbolically the entrant outspends the incumbent because

$$\pi^D(X,E) = \pi^M(X+E) > \pi^M(X+E) - \pi^M(X)$$

(2)

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28 Malueg, David. and M. Schwartz (1991) “Preemptive Investment, Toehold Entry, and the Mimicking Principle,” RAND Journal of Economics, 22, pp. 1-13. The authors highlight the ability of the incumbent to mimic the market outcome that would have prevailed with entry while deterring entry for the optimality (typically) of entry deterrence.

68. In general (2) will hold even if acquisition by the entrant of $E$ does not eliminate the incumbent, but instead allows the entrant to dominate, i.e. instead of $\pi^M(X+E) = \pi^M_2(X,E)$, $\pi^D_2(X,E)$ is large enough that

$$\pi^D_2(X,E) > \pi^M(X+E) - \pi^M(X)$$

(3)

69. Reinganum (1983) shows the importance of the replacement effect for the results of Gilbert and Newbery if there is uncertainty over whether there will be entry if the entrant acquires $E$. If it is reasonably certain that acquisition of $E$ will result in entry, the efficiency effect will dominate the replacement effect and the incumbent will outbid the entrant. If on the other hand the probability that $E$ will lead to actual entry is small, the replacement effect will dominate and the entrant will out bid the incumbent.

70. Moreover, the efficiency effect will be small and the replacement effect more important if the impact of entry on the incumbent’s profits is small, i.e. the entrant is not a very effective competitor. In this case $\pi^D_2(X,E)$ is small and $\pi^M(X+E)$ close to $\pi^D_2(X,E)$. Moreover, the longer it takes for the entrant to enter if it acquires $E$ the more important the replacement effect and the less important the efficiency effect. So in both of these cases the entrant is likely to out bid the incumbent.

71. These considerations are likely to be particularly important for wireless markets since the expected marginal value of blocking entry likely declines sharply as the number of competitors increases. This is a reflection of increasing uncertainty about whether entry will actually prove effective—in turn, this is a reflection of the important fact that the wireless business is inherently concentrated because of its underlying technological characteristics. The industry is characterised by large sunk costs (particularly network construction costs) and high fixed costs, all of which imply that entry is difficult and that economies of scale make survival as a “fringe” player rather difficult. In fact, these very effects also give rise to concerns about the efficiency and social value of new entry into the wireless space.

72. Moreover, there are three other considerations which suggest that entrants might out bid incumbents for spectrum. These are: (i) there are multiple incumbents; (ii) there are multiple licenses; and (iii) entrants are more optimistic than incumbents regarding the profitability of entry.

73. If there are multiple incumbents then Vickers (1985) has demonstrated that the fall in profits of an incumbent if entry occurs may be less than the profits of an entrant because the burden of increased competition is borne not just by a single incumbent, but by all incumbents. Moreover, if entry deterrence is costly and the probability of entry uncertain, there may be under investment in entry deterrence by the incumbent firms. The benefits of entry deterrence accrue to all, but the costs are borne privately, giving entry deterrence

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31 See also Boone, Jan (2001), “Intensity of Competition and Incentives to Innovate”, *International Journal of Industrial Organization*, 19, pp.705-726, for a similar conclusion.

characteristics similar to a public good (from the perspective of all incumbents). This means that each will have an incentive to free ride on the investments in entry deterrence of rival incumbents, resulting again in the possibility that entry will be successful.

74. If the number of licenses (or spectrum) is not perfectly inelastically supplied, then preemption by an incumbent monopolist can be very costly and hence not profit maximizing. This point is emphasized by Lewis (1983), Dasgupta (1986), and Malueg and Schwartz (1991). In particular Malueg and Schwartz note that to deter all entry the price for each is duopoly profit. With enough licenses the cost of pre-emption will exceed monopoly profit and the incumbent will find it optimal to allow some entry.

75. Katz (2008) makes this point with the following example:

> Attempts to warehouse spectrum to prevent the entry of competitors are especially costly when an entrant needs only a small fraction of the available spectrum in order to be a viable competitor. This is so because the incumbent would have to purchase licenses to all of the blocks of spectrum that the entrant might utilize, while the entrant need purchase a license to only one. A numerical example illustrates this point. Suppose that there are 270 MHz of suitable spectrum available for license in blocks of 30 MHz each. Also suppose that a service provider needs one such block in order to be a viable competitor. Lastly, suppose that incumbents currently hold licenses to 150 MHz of spectrum in some geographic market. Any one of the four remaining 30-MHz blocks could be used by an entrant to become a new competitor. Hence, an incumbent would have to purchase licenses for all four remaining blocks in order to deter entry. Thus, if an entrant were willing to bid up to $50 million in order to obtain a 30-MHz license, the incumbent would have to spend $200 million to block entry through spectrum warehousing.

76. Gilbert and Newbery observe that entrants may also outbid incumbents if their expectations regarding the profitability of the market exceed that of incumbents. Incumbents, by virtue of their incumbency, may be less likely to overvalue the profitability of additional spectrum, while entrants may be more likely to be subject to the winner’s curse.

77. Thus far, we have shown that (a) incumbent firms may have significant incentives to foreclose entry, but (b) that foreclosure is far from a foregone conclusion, because (c) foreclosure is costly, and its perceived value is affected by the presence or absence of

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uncertainty regarding the success of new entrants, multiple incumbents, a less than perfectly inelastic supply of spectrum, and asymmetries of information regarding the profitability of entry. These considerations suggest that there are a limited number of circumstances in which a set-aside may be required to promote entry. However, besides all of this, the marginal social value of new entry might well be declining as the number of competitors in the market increases. The possibility of a set-aside raising costs and increasing scarcity for existing efficient market participants in order to induce entry that is ultimately unviable arises precisely from this effect. That is, increasing the number of competitors may not be efficiency enhancing or good for consumers. We turn to this discussion next.

2.2. More entry: neither invariably possible, nor invariably good

Network industries such as telecommunications are highly capital-intensive, the construction and capital costs are sunk, and they are characterized by economies of scale and scope. Economies of scale arise from long run fixed costs associated with construction and indivisibilities associated with the components of the network (the average cost of capacity of network components declines as capacity increases). Economies of scope arise because the network can be used to provide multiple services.

In the telecommunications world, size and scope (that is, the ability to provide a wide range of services and products, many of which are complements in use or complements in production) are distinctively advantageous. The preponderance of fixed costs over marginal costs lends significant advantages to those firms that can recover these costs over the largest production volumes (in this case, the largest number of subscribers). Further, because many services share the same underlying plant (for instance, local and long-distance services share the same “last mile” infrastructure, as do voice services and broadband services, and even wireless services often use elements of wire-line infrastructure for transport purposes), the average incremental costs of providing multiple services is below the average cost of providing these services on a stand-alone basis.

Larger and more diverse firms are thus more efficient, and in fact are able to charge lower prices to their customers.

Competition is a selection mechanism. Firms compete by striving to reduce costs and only the efficient survive. Competitive pressure results in firms adjusting scale and scope to minimize costs. If there are economies of scale and scope we should see successful firms growing in size, either by expansion or merger. That is precisely what has occurred in telecommunications. If one were to apply the survivorship principle of Stigler (1958)\textsuperscript{35}, the increasing integration and scale of telecommunications firms in itself demonstrates the advantages of scale and integration across functions and capabilities. That is, the remaining firms in many markets have been created by integrating with other firms and acquiring increasing scale economies and product scope.

This is most clearly seen in the U.S. telecommunications market. In the long-run, there appear to have been virtually no substantial benefits from the decades-long effort to break up the Bell System. Competition concerns about the impact of a vertically integrated

Bell System on new entry into the long-distance market could have been met by implementing simpler equal access requirements rather than implementing the radical option of divestiture. Noam (2009) compares the evolution of prices, overall market concentration, employment and investment in R&D for the United States over the period 1984-2009 with that in Canada, which for much of this period pursued less aggressive regulatory policies, and which did not break up its own “Bell.”

His conclusion is that the Bell System died in vain. Ultimately, economies of scale and scope led to a significant reformation of the Bell System in the shape of a “new” AT&T and Verizon, which are by far the two largest telecommunications firms in the United States. The existence of scope economies—which provide significant efficiency gains from vertical integration—is demonstrated by the mergers between what were “long-distance” companies and local exchange carriers (Tardiff, 2006).

2.2.1. **A natural limit on competitors?**

Both wireline and wireless markets will be characterized by a limit on the number of viable market participants (that is, those who can compete and survive without policy intervention designed to advantage them or subsidize them). This limit is determined by the interaction between the economies of scale and the demand that is available to be served.

The substantial fixed and sunk costs associated with network deployment mean that short-run avoidable costs will be less than long run average cost. Economies of scale mean that short run marginal cost will be less than long run average cost. Both mean that there is some natural amount of market power, where market power is defined as the ability to profitably raise price above short run average avoidable cost or short run marginal cost, necessary for firms to break even. If there are too many networks in the short run, the competitive price will reflect short run costs and firms will not break even. In the long run, consolidation and exit will occur until firms are at least able to raise price over short run costs sufficient to break even. There is a minimum gross margin required for the marginal network to be just profitable and the number of networks will adjust in the long-run to ensure this margin is realized.

While the Canadian (and other) telecommunications sectors might seem highly concentrated because there are only a handful of operators of consequence, this is the natural result of the cost structure of the telecommunications industry. As noted by the U.S. Department of Justice in recent comments filed with the Federal Communications Commission, one cannot expect the textbook model of competition to prevail in broadband and telecommunications markets:

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We do not find it especially helpful to define some abstract notion of whether or not broadband markets are “competitive.” Such a dichotomy makes little sense in the presence of large economies of scale, which preclude having many small suppliers and thus often lead to oligopolistic market structures.39

86. The more extensive economies of scale and scope the fewer the number of firms. Whether or not market size makes much of a difference to concentration in a given industry may depend on both the nature of the “set-up” costs associated with establishing oneself in the industry and their relative magnitude. The relationship between concentration and market size (e.g., available demand) depends also on the relationship between market size and “set-up” costs, and whether these set-up costs are endogenous or exogenous.

87. In some situations, firms may choose to increase their set-up costs by investing more in certain activities that improve quality of their product, or differentiate their product from others. This choice by firms may lead to a market structure in which increasing market size does not attract more entry because entrants would themselves have to incur very high set-up costs. This is the “endogenous” case. The exogenous case is the more familiar one in which large set-up costs are involved because of the technology underlying the business. Sutton suggests that when set-up costs are relatively large in relation to total demand, concentration will tend to be similar across markets of different size, regardless of the precise nature of the set-up costs. In wireless telecoms, concentration tends to be relatively similar across countries with different size, although one observes that in the United States, one sees urban markets supporting more facilities-based competitors than rural or suburban ones, and large coastal metropolitan areas having notably more intensive levels of competition than other areas. Within Europe, however, one sees that the market structure in Germany is not notably different from that in much smaller Sweden (to provide just the one example).

88. Regardless of whether telecommunications can be regarded as an “endogenous sunk cost” industry, there is a strong suggestion that the “three or four competitors” rule that seems to characterise wireless markets is the result of the large set-up costs involved with constructing networks, providing adequate network coverage, and providing adequate service quality.

89. Thus there is a basic question about how much more entry is viable. The global data suggest that the scope for entry is exhausted relatively quickly. Indeed, few markets have more than four nationwide competitors, and even in ones that do, two or three competitors have overwhelming market shares, suggesting that the fourth competitor is truly marginal.

90. For these reasons, when one evaluates the costs and benefits of a set-aside, one should consider whether more entry in the market is actually feasible. If not, then a set-aside might be futile, or even constitute a serious misallocation of resources. One would imagine that a set-aside would be highly effective and desirable in the context of moving

from a monopoly to a competitive market, or even if there are just two competitors present. The evaluation is much harder if a set-aside is imposed in a market with three competitors (with the balance of evidence suggesting that the fourth competitor would be tenuous), and in a market with four competitors, it would seem that the set-aside would have a very high probability of being wasted upon an unviable entrant.

91. Subsidizing entry by an additional firm beyond the natural limit will likely lead to a short run reduction in price, but that puts pressure on gross margins and is not sustainable. Instead in the long run the natural limit will be restored as firms exit or there is consolidation and rationalization until gross margins are sufficient to at least recover sunk costs.

92. Besides the feasibility of entry, there is also a basic question about what the effects of additional entry would be in a market which is close to the “natural limit” on the number of competitors. Even if the subsidized entry proves viable or durable, there are basic questions as to whether such entry is actually socially beneficial. We consider this in the next section.

2.2.2. Welfare effects of entry

93. Economic theory suggests that there are circumstances in which more entry is not necessarily a good thing, and where the appropriate public policy stance towards entry is, at best, a neutral one.40 This is particularly likely to be the case in industries with large fixed and sunk costs. In such cases, particularly when entrants offer products that are duplicative of what incumbent firms already offer, the effect of entry is likely a “business stealing” effect in which the entrant firm predominantly wins market share from existing firms rather than expanding market output.41 In this case, entry raises industry-wide average costs and leads to a reduction in efficiency.

94. The social benefit of entry is the value of the expansion in output, while the private benefit of entry is the profits of the entering firm. The private benefit is greater than the social benefit because of the business stealing effect. The profits of an entrant include the profits earned on incremental industry output and the units that it competes away from incumbents. The transfer of revenues and profit from the diversion of existing sales from incumbent networks is a private benefit to the entrant, but not a social benefit since those sales would have been produced in any event. These transfers may make an entrant’s network privately profitable, even though the net social benefits do not justify the costs and as a result the entry is inefficient. If the products of the entrant are similar to those of the incumbent the concern is that there are excessive incentives for entry.42

41 Berry and Walfdogel (1999) offer a particularly simple example in the case where products are perfect substitutes and all costs and prices are fixed. The entry of another firm that wins half the market share from the incumbent firm provides no increase in consumer benefit, although it increases “competition.” Further, twice the amount of resource is used to provide the same level of output, thus reducing aggregate social welfare.
42 The analysis would change if asymmetries existed post-entry that meant that barriers to entry implied profitable entry deterrence. See Church and Ware (2000) for the difference between barriers to entry and profitable entry deterrence.
95. A policy that lowers the costs of entrants sufficient to enable entry but maintains constraints on the incumbents makes it substantially more likely that the business stealing effect dominates the output-enhancing or variety-increasing effects of entry. Set asides are required to induce entry of another network when the firm would \textit{not have entered} in their absence. In the absence of a monopoly premium, this means that in an unrestricted auction their use value is less than the other firms that acquire spectrum. The difficulty is that the circumstances under which set asides are required to promote entry are also circumstances under which entry is particularly prone to being inefficient since the use value of spectrum is low. This implies that the costs of the entrant are higher or their products relatively similar to that of the incumbents. A policy that lowers the costs of entrants sufficient to enable entry makes it substantially more likely that the business stealing effect dominates the output-enhancing or variety-increasing effects of entry and is inefficient.

96. These considerations are not purely theoretical ones. Berry and Waldfogel (1999) found that in the radio broadcasting industry “free entry” (that is the absence of any restriction on the number of market participants) reduced welfare by an amount equivalent to 45 percent of industry revenue or a deadweight loss of $2.3 billion per year.\textsuperscript{43} This welfare loss arose in the form of higher costs to radio broadcasters.

97. In the short run even inefficient entry is likely to lead to a reduction of at least some prices, benefiting at least some consumers. However, in the long run, there are three reasons why such entry might not benefit consumers. First, if the reduction in scale of the incumbents raises their marginal cost, entry might \textit{raise prices}. Second, if the temporary reduction in prices results in insufficient gross margins, in the long run prices will rise as some firms exit and/or there is consolidation. Third, it is also likely that consumers will be harmed because incumbents are denied spectrum, raising their costs (as they substitute capital for spectrum inefficiently), reducing the quality and coverage of their networks, and perhaps product variety, relative to what they might have been if the incumbents had more spectrum. Hence it is entirely possible that increasing the number of providers by using set asides could harm consumers relative to the allocation of spectrum that would result without set asides because it weakens competition and reduces quality.

2.3. \textbf{Summary of considerations: A trade-off}

98. In summary, we believe that:

- There are instances in which spectrum allocation policies can be used constructively to promote competition;
- Whether or not such policies actually end up promoting competition depends at least partly on circumstances in which they are implemented and how well the specific policy instruments are designed;

Concerns about incumbents paying “foreclosure premiums” and the like are real ones and valid ones, and in some circumstances, may match the reality sufficiently to justify policies such as set-asides of spectrum (or more generally, “affirmative policies” towards new entrants);

At the same time, a variety of factors ranging from uncertainty to the costs of implementing a foreclosure strategy may reduce the likelihood that such a strategy is implemented;

Beyond this, the ability to promote additional entry might be limited, given the existence of a natural limit on the amount of competition that the wireless industry can actually sustain;

Entry may not be efficient if the gain from increased competition is less than the costs. This is particularly likely if entry promotion is done by set-asides, since not only does entry reduce the ability of firms to realise scale economies and raise industry average cost, it also denies incumbents access to spectrum they would have used to lower their costs and enhance the quality and coverage of their networks.

In the following section, we attempt to provide some empirical backbone to the arguments presented above. Specifically we consider whether Canada’s wireless industry is particularly uncompetitive or whether it simply fits the international bill in terms of conforming to a quite normal market structure. We find that differences in performance between countries do not necessarily correlate well to structural variables such as concentration levels. This suggests that the traditional “structure-conduct-performance” paradigm is of perhaps limited value in analysing the wireless industry (although in practice, what one sees is really an attempt by some commentators to map structure to performance with little said about conduct).

However, we do observe empirical regularities and limited variations in competitive levels across countries. Further, we see that different institutional models have shaped market outcomes to a substantial degree, with the result that North America and Europe and Asia look different in terms of their outcomes, with none of the interesting differences necessarily linked to a “lack of competition” in one place or the other.

Of course, cross-country comparisons are not a sufficient or even usual basis upon which to opine on market power. However, even the “usual” competition policy metrics may not provide an accurate picture of true profitability, market power and scope for entry in an industry that is both highly capital-intensive and technologically dynamic. For instance, in this industry, firms must make periodic large lumps of investments: a wireless carrier probably made a very large lump of investment to deploy its initial network, and then periodically had to make several more large lumps of investment to upgrade to the latest technologies, and in any case has to make substantial annual investments just to replace plant and to expand or maintain its service levels.

In this case, simply looking at EBITDA margins, a measure of short-run profit is not sufficient. The firm’s profitability must be evaluated over many years, reflecting its ability to return cash to investors over the life-cycle of an investment. In this case, the firm will need some years of very high margins over short-run marginal costs (this is
what EBITDA or “price-to-marginal cost” margins measure) to compensate for initial years where cash-flow is low or even substantially negative. The good years are simply the “payback” that is required for investors to tolerate the short-term “hit” to cash-flow as a result of the need to make large periodic investments.

103. We use data to shed some light on whether there are genuinely excess profits that can be competed away in the Canadian wireless sector. In our view, given the life-cycle of a typical large sunk investment in telecommunications plant, the appropriate measure of profitability is whether the investor (the provider of capital) earns above a “normal” rate of return over the lifetime of that investment. For Rogers’ wireless operations, we find that there is no evidence of excess profits being earned, and in fact, the high profits and cash-flows of recent years are an incomplete payback for the substantial risks that the firm took in entering and remaining in the business.

These results matter. Looking at these results, one is able to better understand where the balance of risks as between excessive concentration and promotion of costly entry currently lies. The analysis in Section 3 lays the foundations for the evaluation contained in Sections 4 and 5.

3. **THE CANADIAN WIRELESS INDUSTRY**

3.1. **Cross-country comparisons of performance: Is Canada an outlier?**

104. *Figure 1* shows a graph the likes of which has been presented several times in meetings and conferences in Canada and around the world. We see the familiar metric of “mobile penetration” as measured by mobile subscribers per 100 population, and Canada languishing in last place in the OECD. *Figure 2* shows an almost equally familiar graph, Average Revenue per User (or ARPU), widely used as a metric for price, and here Canada is among the priciest countries. *Figure 3* shows a scatter plot that shows a strong negative correlation between the measure of price (ARPU) and the measure of output (penetration). At least on this somewhat casual basis, there appears to be a predictably negative relationship, thus suggesting that Canada’s exceptionally low penetration is explained by its exceptionally high prices.

105. Yet when one turns to measures of “unique users” (the proportion of the population who own a mobile phone) one sees that the immensely high “penetration” rates of European countries are mythic (*Figure 4*). Because of the preponderance of pre-paid contracts in these countries, and because these countries use “calling party pays” as a protocol for interconnection charges, the count of “subscribers” greatly exceeds the count of “unique users.” Specifically (a) there is a “counting” problem with inactive pre-paid subscribers being retained in the subscriber counts of operators from whom they have churned away, and (b) calling party pays is a protocol in which the calling party’s wireless operator pays termination charges to the receiving party’s operator for terminating calls on its networks. Regardless of whether one feels that these termination charges reflect monopoly power in termination (the European Commission’s view) or whether they are in fact required to cover fixed network costs,
they create a substantial incentive for firms to charge high termination rates and thus for calls made from one network to another network to cost the caller a significant amount of money. At the same time, these practices create a substantial wedge between “on-net” and “off-net” calls, and this in turn leads some customers who have contacts on multiple networks to seek out multiple subscriptions so that they can minimise calling costs.

106. Further, it is interesting that when one looks at Average Revenue per Minute (ARPM) as opposed to ARPU, one finds that Canada has among the most affordable usage costs for mobile phone subscribers (Figure 5). In this figure, the “affordability” of either a subscription or of usage in measured in terms of costs in relation to GDP per capita (a measure of average income). One finds that ARPU as a proportion of GDP per capita is relatively high in Canada, but ARPM as a proportion of GDP per capita is the third-lowest in the sample of countries that we looked at. Note that the United States is another country that shows a similar trend to Canada, with high ARPU but low ARPM in relation to average income.

107. There has been much commentary on the OECD pricing indices, and other indices, that show Canada and the United States as relatively high-cost countries. However, these indices have historically been substantially flawed since they do not take any account of actual usage patterns. Thus the OECD attempts to measure effective prices for “high use” customers, as does the consultancy Teligen. But their definition of “high use” is interesting. Teligen defined “high use” as 1800 voice minutes per year, or 150 voice minutes per month. Even taking just outgoing minutes into account, this is significantly below the average usage levels recorded in many countries, including Canada, and well below the levels recorded in the USA.44 The heterogeneity across markets in usage patterns and consumer preferences also makes such pricing comparisons rather meaningless—for instance, how does one account for the fact that in the U.S., most wireless customers benefit from free national roaming and no distinction between local and long-distance charges? To compare free national roaming and long-distance over the vast expanse of the United States to the same within a small European country would seem not to be a comparison of equals.

108. Overall, then, institutional differences drive differences in market outcomes between Europe and North America, although the performance of the wireless sector in both areas has been little short of astounding. In Europe, usage subsidises access, in that European operators have developed a business model in which pre-paid subscribers predominate, who are sold cheap subscriptions but pay high calling costs and thus ration their usage. In North America, network fixed costs are recovered by a relatively high mark-up over “access” or “subscription”, but usage costs are far lower. Economic theory suggests that the North American model is more economically efficient since the burden of recovering fixed costs falls more on the inelastic component of demand (access) rather than on the elastic component (usage).

109. Of course, just as the European data tend to overstate subscriptions, they also substantially underestimate usage per individual. Thus the British regulator Ofcom, in

44 See Ofcom, Mobile Wholesale Voice Call Termination Review (May 2009), Consultation Document at Annex 5 for a discussion of these issues.
a recent review of wholesale mobile termination rates in the U.K., suggested that a useful metric of industry performance was “minutes of use per capita”, which amounts to (minutes of use per subscriber) x (subscribers per capita). The distortion inherent in each individual measure is “cancelled out” in the multiplication. Ofcom describes “minutes per capita” as its preferred measure of industry output.\textsuperscript{45} \textbf{Figure 6} shows our calculations of minutes per capita, which show that the Canadian wireless industry compares relatively well on this composite measure (and very well if one focused just on minutes of use).

\textbf{110.} In summary, when considering high level measures of performance, the only metric on which Canada’s performance might seem something of a puzzle is penetration. According to the data on unique users from Yankee Group, unique user penetration in Canada is just 56 percent, against a “headline” penetration rate of 74 \textit{subscribers} per 100 individuals (estimates for 2010). The U.S. has some 97 subscribers per 100 individuals, but a unique user penetration rate of around 84 percent. The U.S. rate matches the penetration rate measured by the Pew “Internet and American Society” Project’s survey data. It is unclear why there should be a proportionately greater variation between penetration and unique users in Canada as compared to the United States. In both countries, pre-paid subscribers are around 20 percent of the total subscriber base, and termination charges are similar. It would seem that the Yankee Group data are perhaps significantly understating “unique user” penetration in Canada and that the true “unique user” penetration rate is around 60 percent (in the same ratio as the U.S. unique user penetration to the U.S. “SIM Card” penetration rate).

\textbf{111.} However, even this rate seems puzzlingly low. Although ARPU as a proportion of per capita GDP is relatively high in Canada, there are other countries (such as Korea and Japan) that have higher proportionate ARPs. Similarly in emerging Europe several countries have very high penetration rates by any measure, even though ARPU-to-GDP is higher than in Canada. For example, (monthly) ARPU-to-GDP is 1.4% in Canada and 1.7% in the Czech Republic, yet the Czech Republic has more than 50% higher penetration than Canada.\textsuperscript{46} This is all the more puzzling given that once the subscription is purchased, Canadians face significantly lower usage charges.

\textbf{112.} The explanation lies outside the wireless industry. Canada had an unusually well-developed and unusually affordable fixed-line network when the wireless era began. In addition, Canada and the USA had teething problems in ramping up wireless penetration compared to Europe in that the North American markets featured fragmented technologies and issues with inter-area roaming and interconnection charges in the early days. These issues were eventually resolved (and indeed competition between GSM and CDMA standards may have been beneficial in the long run), but the effect was to create something of a lag in wireless penetration that the U.S. has recently closed. Canadian regulatory policies that effectively restrained the

\textsuperscript{45} \textit{Ibid.}

\textsuperscript{46} Source: BRG analysis of Yankee Group data. This is true whether one looks at SIM cards or unique users.
price of fixed-line users likely reduced the willingness of some consumers to adopt wireless phones.\textsuperscript{47}

\textbf{113.} While we did not undertake significant new analysis of the effect of fixed-line penetration on subsequent wireless uptake, we did confirm that fixed-line telephony was unusually affordable in Canada. Specifically for the group of 13 countries that we present in the comparisons in this section, we ran a regression of fixed-line penetration over the 1991-2004 period against per capita GDP. We found that in Canada, fixed line penetration was 13\% (but not 13 percentage points) higher over this period than was predicted by its per capita GDP (\textbf{Figure 7}).\textsuperscript{48} In other words, Canada’s fixed line penetration was substantially higher than predicted by per capita GDP, suggesting that fixed line telephony was unusually affordable in Canada. This would provide some confirmation of Quigley and Sanderson’s earlier analysis, and indeed it suggests that very cheap fixed line telephony has played a significant role in explaining Canada’s relatively low mobile penetration rate.

\textbf{114.} In summary, looking just at high level measures of “performance”, Canada’s performance is generally good. The penetration rate is somewhat anomalous, but voice usage levels are high (there is no comparable data that we are aware of on actual mobile data usage as measured by MB or GB per capita to compare with “minutes per capita.”). On the composite measure of “minutes per capita”, Canada is actually one of the best performers.

\textbf{115.} In the next sub-section, we see two things: (a) market structure is quite similar across a wide range of countries; (b) the Canadian market is far from being unusually concentrated by any measure. We then proceed to show that operating margins in the Canadian wireless industry are also normal, and that capital investment is high. The relatively high levels of capital investment (as a share of revenue) in Canada suggest also that Canada is a relatively high-cost environment for network deployment. Thus to the extent that Canadians pay high prices this has some relationship with network deployment costs.

\textbf{116.} A key rationale underlying set asides is that the performance of the Canadian wireless sector lags other countries because of insufficient competition. In this section we have shown that Canada’s international performance on some important measures (relatively low ARPM) is very good and that Canada’s relatively low penetration performance may have more to do with the quality of its wireline networks and their regulation than insufficient competition. In the next section we consider the extent of competition in the Canadian wireless market.

\textsuperscript{47} Quigley, Neil and Margaret Sanderson, “Going Mobile –Slowly”, C.D Howe Institute, Commentary No. 222, December 2005 explore the relationship between penetration rates for wireless in Canada and the pricing of traditional telephony.

\textsuperscript{48} The regression was a pooled regression for the group of 13 countries of log (fixed pen) against log (per capita GDP). The coefficient of penetration against GDP was 0.45, and was highly significant (t-statistic of 10.67).
3.2. Market power, market structure and profitability

3.2.1. Concentration ratios, market shares and profitability

Table 1 shows that Canada’s wireless industry is less concentrated than the wireless industries of several other countries. Although the presence of regional players in the U.S. and Canada makes comparisons of concentration with European and Asian countries where all players operate at a national level somewhat difficult, this is less of a problem in Canada where historically the regional players have been in provinces with relatively low population shares. Thus the standard HHI index of concentration shows that Canada’s wireless market is less concentrated than markets in the Far East (Japan and Korea) and in parts of Europe (France, Spain, the Netherlands). Only the U.S. and U.K are substantially less concentrated and the U.K. market is undergoing a substantial consolidation with the merging of the U.K. operations of T-Mobile and Orange.

Table 1 also shows the share of the top two firms in the market. Again, Canada has a lower two-firm concentration ratio than most other countries. Indeed, Canada has three firms that are roughly equally balanced, whereas in other markets there are often two firms with a very dominant market share, and one or two fringe players with much lower market shares and a much more tenuous existence. On the other hand, EBITDA margins in Canada (for 2010) are among the highest in the OECD, which on first glance would seem to confirm the notion that Canadian wireless operators are more profitable than their overseas rivals. However, even here it is worth noting that Italy has the highest EBITDA margins, but also the highest penetration rate among all countries (even when measured by the more accurate metric of “unique users”, Italy has among the highest penetration rates). This offers just a small suggestion that there is no easy mapping from structure to “performance.” (Note that these margin comparisons are comparisons for the weighted average profitability of the top three operators in each market, although in some cases, data limitations permitted us to only capture the top two operators).

However, EBITDA margins are but an incomplete measure of profitability, and in some cases, a misleading one. Telecommunications is a capital-intensive business, and the costs of replacing the capital assets to sustain network service and expand service are very substantial. Further, these costs are significantly larger in Canada than in much of Europe. The Federal Communications Commission (FCC) now calculates profitability of the wireless industry using EBIDTA less “capital expenditure” as a share of revenue, a measure that we label the “cash flow margin.” As the FCC notes in its 14th CMRS report,

*Measures of profitability are useful indicators of absolute and relative provider performance, entry and exit conditions, growth conditions, and the intensity of rivalry. Because measuring the profitability of firms in a capital-intensive industry such as the mobile wireless industry is not as straightforward as in other industries, industry analysts often employ more than one measure. Analysts sometimes use Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) as an indicator of profitability, but this metric does not include the*
substantial cost of capital investment in tangible asset such as networks or in intangible assets such as spectrum licenses.\textsuperscript{49}

120. Note that this measure still does not account for the investment by firms in intangible assets, including spectrum and including goodwill paid for acquiring other operators. At least for North American operators, these are not recorded as capital expenditures.

121. Figure 8 shows that by this measure, Canada’s wireless industry is not exceptional. These data reflect the 2004-2009 period, the period of greatest prosperity for the Canadian wireless sector, and even during this period, when financing of investment from cash flow is taken into account, Canada’s wireless operators are “part of the pack” of international wireless operators with cash-flow margins in the 24 percent to 30 percent (of revenue) range.

122. Table 2 shows that the average cash-flow margin earned by Canadian wireless operators during the 2004-2009 period has been around 30%, more than in many other countries, but less than what has been observed in markets such as Italy, Germany and Spain. In particular, capital intensity in these countries (and in European markets generally) has been significantly lower than in Canada or the United States.

123. Further, it is interesting to note that in Canada, there is no one firm that dominates the market. The largest wireless firm by subscribers has around 37% of the market, whereas in France, Spain, the Netherlands, Sweden and Australia, the largest firm has over 40% of the market. In Canada, the share of the top two firms has actually dropped from 70% to 67% over the 2004 to 2009 period. In some other countries, the top two have more than 80% of subscribers.

124. Thus, again there is little evidence that the Canadian industry is an outlier by international standards. Three to four competitors in most markets seems to be an international norm, and it is usual for the top two firms to have 70% or more of the market. In terms of cash flow margins, arguably a better way to measure profitability in such a capital intensive industry, Canada’s wireless firms are again not unusual by international standards.

125. So far we have presented evidence above regarding profitability taking not just price-marginal cost margins into account, but also taking into account the very large capital requirements that operators face. However, even this evidence relies upon data from 2004 to 2009, the period of peak profitability for Canadian wireless operators.

126. While our analysis indicates that the Canadian wireless industry is not inconsistent with that in other countries, the level of concentration does appear to be relatively high, as are margins, relative not to other countries but other industries. However these measures typically used as indicators of market power in other industries are not appropriate for the wireless industry.

\textsuperscript{49} FCC 14\textsuperscript{th} CMRS Report (2010) at p.12.
3.2.2. **What does “market power” really mean?**

127. By the very nature of their costs, telecommunications firms cannot price at short run marginal cost as competitive firms would. Instead they must price at levels in excess of short run marginal cost, thereby exercising market power. However, it would be wrong to expect that pricing above short run marginal cost is a measure of inefficient market power. Firms must be able to price so that they recover at least their average long run cost of production, given the fixed costs associated with operating in the industry. The exercise of market power by firms whose costs are characterized by economies of scale and scope is problematic only if it is significant and durable. The term “significant” means that prices exceed long run average cost.

128. This implies that the appropriate measure of market power involves considering the net present value (NPV) of total cash-flow generated over the life-cycle of a network investment. This is the relevant consideration for investors funding new cycles of network investment. Such investors will anticipate that initial cash-flows will be low or even negative, but that high margins in later years will remunerate them sufficiently for high initial capital outlays—for instance, all else equal, a large-scale new network investment will depress cash-flows in the year that the investment is made, but capital requirements will drop in subsequent years, leading to the impression that even cash-flow margins are improving and “market power” is increasing, when in fact all that is happening is the normal dynamics of the investment cycle. Only if firms are able to realize returns that are substantially above their opportunity cost of capital over the life-cycle of an investment project can one even begin to draw conclusions about abnormal levels of profitability and market power.

129. Even if it appears that firm earnings exceed the opportunity cost of capital, care must be exercised to determine if the excess returns are attributable to market power or are Ricardian rents. Ricardian rents are really returns to superior factors of production that provide a firm with an apparent cost advantage. They are not a result of the firm exercising market power.

130. An important source of long run fixed costs that must be covered by quasi-rents, are innovative activities. A firm might acquire high market share and a period of exceptional profitability because it has invested in innovative services and products, or made substantial investments in the network required to deliver these innovative services and products. In a dynamic market where technologies are frequently updated, it would be wrong to not allow such a firm to enjoy the fruits of its innovative efforts. If the firm expected that as a result of public policy, any exceptional profits that it realized as a result of its risk-taking and innovation were redistributed or appropriated in other ways, its incentives to continue investing and innovating would be seriously blunted.

131. In a dynamic environment, characterized by frequent upgrades to products, networks and consumer demand, providing appropriate incentives to innovate (by permitting firms to realize high returns from their innovations) would be a key underpinning of consumer and economic welfare. Any inferences about market power in a dynamic industry would need to take account of the durability of that market power in the face of rapid change. High market share and high accounting profitability in the short-term
may not suggest a reason for concern. This contrasts with the conventional technologically static environment, in which high market shares and exceptional profits might provide a more appropriate cue for policy concerns.

3.3. **Ricardian rents, quasi-rents, and the true profitability of Rogers Wireless**

132. This means that the recent strong financial performance of the wireless industry in Canada may be “payback” for years of painful early investments and uncertain and often negative cash flows, and dire warnings about the financial viability of investing in the wireless business. In a capital-intensive industry characterised by large lumpy investments made at periodic intervals (as well as continuous investments just to maintain existing capital assets), what one is interested in are the returns earned by investors over the life-time of an investment.

133. Since telecommunications assets typically have a useful economic life of around 11 years (this is the standard assumption made by the Bureau of Economic Analysis in the United States), it is worth evaluating the true underlying profitability of Rogers Wireless over the last decade or so. A priori, one would expect that these returns, observed as they for a firm that has managed to survive and even ultimately thrive, be rather high, as high returns would be expected for a risky investment. It is well to remember here that Rogers’ wireless arm was far from being a “sure bet” in the early 2000s. For instance, Moody’s credit rating service downgraded Rogers’ debt in July 2002 and noted at the time:

> Until this year RWI had been unable to increase operating cash flow for the previous five years. It has historically lagged industry growth which itself has been slowing recently, and Moody's is concerned about the ability of the company to quickly move beyond its current stage of cash consumption to a level of positive free cash flow which would bear a reasonable relationship to its level of debt. Moody's review will continue to focus on this fundamental issue.

134. In order to calculate Rogers’ life-cycle profitability, we treated the total assets of Rogers Wireless as the initial principal invested in the year 2000. **Table 3** then shows the cash outflows and inflows (including spectrum acquisition costs and including the costs paid to acquire Microcell in 2004) for Rogers Wireless. Assuming a 10 percent discount rate for these cash-flows we find that Rogers has not generated positive cash flow assuming this discount rate. Indeed, the discount rate that precisely equates Rogers’ cash flows to a net present value of zero (the so-called “internal rate of return”) is 9.75 percent. Since we used nominal values of cash-flows, this is a nominal rate of return. A nominal rate of return of under 10% does not represent excessive profitability. In fact, it is below the nominal Weighted Average Cost of Capital.
calculations submitted for European wireless operators in some regulatory proceedings. 50

135. By contrast, measured internal rates of return in innovative activities with high risks and long and variable payback periods are much higher than 10%. In fact, the internal rate of return for the U.S. market sector as a whole exceeded 13 percent in the 1977-2005 period. 51 Other studies such as Mansfield (1977) and Nadiri and Bernstein find private internal rates of return that are between 15% and 30% for innovative activities. 52 Of course, their data are based on returns to successful innovation, but that is precisely applicable to the situation with Rogers wireless: after all, Rogers is one of the surviving firms (unlike Microcell, for instance) and thus one would expect especially high returns for such a firm. Instead one finds returns of less than 10%. (Similar calculations cannot be performed for Bell Mobility or Telus Mobility, as the assets of the wireless business were not separately reported for most of this period).

136. This brings us to a crucial point: what one observes in the Canadian wireless (or at least in Rogers’ data) sector is a good illustration of the difference between genuine “scarcity” rents (or Ricardian rents) and quasi-rents. Quasi-rents are the difference between revenues and short run avoidable costs: they exclude sunk costs. 53 In order for a firm to break even in the long run, quasi-rents must at least equal sunk costs. Hence quasi-rents reflect a payback for a risk taken or an innovation or investment made. Absent the ability to earn these quasi-rents firms would cease to invest, innovate or take risks. By contrast, Ricardian rents are rents that are earned by controlling a factor that is in scarce supply. The innovator whose risk-taking pays off has worked to earn his or her quasi-rents. Allowing for these quasi-rents is absolutely essential to the functioning of a modern innovative economy, at least as much as is controlling firms’ ability to earn Ricardian rents. The evidence on Rogers’ IRR suggests not only the absence of monopoly rents created by the inefficient exercise of market power, but also the absence of Ricardian rents.

137. Thus if there are excessive profits to be earned in the wireless industry, it is not clear to us that these profits have thus far been earned. An A.T. Kearney study for the GSM Association claims that the return on capital employed (ROCE) for the European wireless sector was a mere 9% in 2006, well below the ROCE earned by other industrial sectors in Europe. 54 Thus the high concentration observed throughout the

50 See, for example, this document from the ITU available at :http://www.itu.int/ITU-D/finance/work-cost-tariffs/events/tariff-seminars/Bangkok-10/pdf/part_2_cost_accounting_model_wacc.pdf. In the examples presented, nominal pre-tax Weighted Average Cost of Capital is very often at least 10%.


world’s wireless markets does not mean that the remaining firms are able to inefficiently exercise market power. While circumstances probably vary from country to country, one suspects that there are few “monopoly profits” waiting to be competed away. The appropriate measure of market power in the case of the wireless industry does not indicate an inefficient exercise of market power. There is no indication that there is insufficient competition in the Canadian wireless sector. The evidence on industry entry and consolidation in the next section suggests a similar conclusion.

3.4. Cross-country evidence on recent entry and consolidation

3.4.1. Europe and Australia

138. In recent years, the most prominent entrant into wireless markets in Europe and Australia has been Hutchison, the wireless arm of the Hong Kong conglomerate, Hutchison Whampoa. Hutchison was successful in winning licenses at the 3G auctions in Europe in 2001/01. Hutchison offers services in Austria, Denmark, Italy, Ireland, Sweden and the United Kingdom under the “3” brand.

139. After nearly a decade of operations, Hutchison has market shares of 7% in Austria, 7.5% in Denmark, 6% in Ireland, 10.5% in Italy, 8.6% in Sweden and 7% in the United Kingdom. Detailed information about earnings and profitability was not usually available at the country level for Hutchison’s European operations. However, data on “EBIT” (Earnings Before Interest and Taxes) are sporadically reported by the Wireless Intelligence database. As best we can tell, Hutchison is still not profitable on an operating earnings basis in most of its European markets, and in the more relevant cash-flow terms, it has likely never generated a single quarter of positive cash flow. Were the data available to calculate the cumulative return that Hutchison’s investors have earned on the European operation, one would surely find that these investors have not even realised a positive return on their investment, leave alone one that covers the opportunity cost of the capital provided.

140. In the U.K., Hutchison’s performance has slowly improved, and its efforts are approvingly cited in a European Commission merger proceeding where it is described as something of a “maverick” firm that provides significant price and product innovation. However, this approving regulatory view co-exists with newspaper stories about a potential buyout of Hutchison’s U.K. operation, or at least a full network-sharing agreement (which would be easier to pass through antitrust scrutiny). Further, while Hutchison indeed can claim to be a price leader it is more questionable—given the generally lukewarm response to its products—that it is a substantial innovator.

141. Instead, the impact of Hutchison’s entry into a saturated U.K. market that already had four roughly equal competitors (although at the time O2-UK was significantly less profitable than its rivals) may well have been somewhat similar to the impact of an

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55 Source(s): Merrill Lynch Global Wireless Matrix Q3 2010, and Wireless Intelligence (for Ireland).
56 http://www.theregister.co.uk/2010/03/05/vodafone_3_uk_deal/
inefficient entrant that we hypothesised about in the previous discussion. Margins in the U.K. wireless market have dropped substantially since the early 2000s, and while this drop in profitability is unlikely to be the result of entry by Hutchison alone (given its modest market share), additional entry might have been a contributory factor. In 2004, Vodafone, Orange and T-Mobile all had EBITDA margins of over 35% and O2 had a margin of over 30%. By the late 2000s, these margins were down into the 25% to 29% range. As a response to this pressure on their profitability, the U.K. arms of T-Mobile and Orange have merged. The U.K. now has three networks with over 92% market share, and a fourth small and precariously placed network, whereas previously it had four roughly balanced networks. It should be remembered that Hutchison’s entry was aided by a substantial set-aside of spectrum in the 2000 auction.\textsuperscript{57}

142. In Australia, Hutchison entered the market with high hopes. There were only three players in the Australia market when it entered—Telstra, Optus and Vodafone. Australia was indeed one of Hutchison’s more successful foreign ventures. The operation generated some years of positive earnings (although never positive cashflow), and achieved a market share of 8.6% by early 2009. Despite this, Hutchison and Vodafone-Australia merged in 2009, as it appeared that both firms were not earning enough to fund future capital requirements. The Australian Competition and Consumer Commission considered that Hutchison was severely constrained in its ability to expand its network and make the investments required for it to remain an effective competitor in both the mobile broadband and mobile voice markets; it concluded that Vodafone was also constrained in its ability to compete. Thus it approved the merger on the basis that such a consolidation would allow the firms to expand network capacity and make needed investments.\textsuperscript{58}

143. In other countries too, there has been significant consolidation but little successful new entry. In the Netherlands, KPN purchased Telfort in 2005, and T-Mobile purchased the Dutch operations of Orange, leaving a market that had an improbable five players in 2004 with just three players in 2010. One of these players, KPN, had about half the market. The acquisitions by KPN and T-Mobile did not run into significant difficulties with antitrust regulators at either the national or European level.

144. Similarly, the European Commission eventually approved a “4-to-3” merger in Austria between T-Mobile and tele.ring. In that instance, it did require significant remedies in the form of divestiture of network infrastructure. Similarly, the T-Mobile and Orange merger in the U.K. did require the firms to divest some of the spectrum that they held in the 1800 MHz band and to provide undertakings regarding an existing network-sharing agreement between T-Mobile and Hutchison/3. In both these cases, it might be argued that regulators acted to safeguard the interests of the smallest competitor (Hutchison/3 in both the U.K. and Austria), but the more interesting detail is that they did so in the context of market consolidation. In blunter terms, the concern was not so

\textsuperscript{57} In all likelihood, a good chunk of this drop in margins was also the result of regulatory action to reduce mobile termination rates. These termination rates fell by over 50% over the course of the decade.

\textsuperscript{58} Australian Competition & Consumer Commission. 2009. \textit{Public Competition Assessment. Vodafone Group plc and Hutchison 3G Australia Pty Limited – proposed merger of Australian mobile operations.}
much about going from 4 operators to 3 operators, or 5 operators to 4 operators, but about going from 4 operators to 2 operators and 5 operators to 3 operators, given the perceived vulnerability of the marginal operator in each case. In other words, it was accepted that the previous market structure was not sustainable, but an effort (perhaps misguided) was being made to prevent further consolidation beyond what had already happened.

145. Also of interest here is the fate of those operators who purchased licenses in the European 3G auctions of 2000. In Germany, for example, MobilCom and Group 3G, which had financial backing or direct ownership from large multinational firms such as France Telecom and TeliaSonera, were unable to successfully launch services and had to return their licenses. Similarly, in Spain, Yoigo, which also had backing from large foreign firms, was only able to launch services in 2006, some three years after the intended launch date.

146. In short, the experience in Europe and Australia suggests strongly that many of these markets were at the “natural limit” of how many competitors they could sustain. They also suggest, however, that exit is costly and far from frictionless. Despite its substantial lack of success, Hutchison has been operating for seven to eight years in many markets. Of course, it is possible that Hutchison would have sold off its European interests had antitrust considerations not prevented it from doing so. If so, this suggests that antitrust analysis in Europe particularly fails to duly account for the possibility of inefficient entry and for the importance of scale-related economies.

3.4.2. Consolidation in the United States

147. The United States telecommunications industry offers an interesting glimpse into the power of economies of scale and scope in the telecommunications business, including the wireless sector. After the break-up of the Bell System in 1984, and the promotion of competition via a series of state-level measures and then the Telecommunications Act of 1996, the goal of American regulation was to promote competition and entry into (first) long-distance, then local and cellular markets. Indeed, until the PCS auctions of 1995, the U.S. cellular market consisted of what were essentially mandated duopolies in each major market. With the PCS auction, the U.S. cellular wireless market became a complex patchwork of largely un-inter-linked networks, some of them with ambitions to offer nationwide coverage, others with an intensely regional focus.

148. The past decade has seen substantial consolidation in both the fixed-line and wireless sectors in the U.S. Prominent examples of firms’ desire to seek economies and scale include:

- Mergers between Regional Bell Operating Companies (RBOCs), which operated in separate territories. One of the earliest prominent mergers included Bell Atlantic/Nynex (to form a new Bell Atlantic), which then merged with GTE (which had franchises in many states where Bell Atlantic was the main incumbent carrier, but which also had presence in states such as Washington and California where Bell Atlantic was not previously active).
This combined firm became known as Verizon Communications, and the wireless arms of the various original companies were also amalgamated;

- Subsequently, SBC Communications (formerly Southwestern Bell) merged with Ameritech. The combined firm then merged with AT&T in 2005. Between 1984 and 2005, AT&T had been first a long-distance-only firm, and then entered into some local markets for voice and Internet services, as well as providing wireless services.

- AT&T’s wireless offerings were bolstered significantly by a merger between itself and Cingular Wireless in 2004. Following the SBC/AT&T merger, the amalgamated firm then merged with BellSouth, and was rebranded as AT&T;

- Verizon Wireless merged with Alltel in 2007. Also, proposed mergers between smaller wireless players such as Leap Wireless and Metro PCS are often mooted in the financial press;

- T-Mobile USA began as the purchase of the assets of VoiceStream Wireless by Deutsche Telekom in 2004. VoiceStream itself had previously purchased the assets of Powertel, Omnipoint, and Aerial. Thus T-Mobile-USA does not represent a Greenfield entry by a new firm, but the result of several rounds of consolidation;

- Of especial note is the desire of cable operators to start offering wireless services to complement their cable TV, broadband and home phone services. The largest such cable operator, Comcast, is itself the product of massive consolidation (for instance, acquiring considerable cable assets from the-then AT&T in the late 1990s). Comcast has taken a stake in Clearwire, which runs a “4G” (fourth-generation) wireless network in many major American cities, using WiMax technology. Comcast currently offers wireless services via reselling Clear’s services. However other cable operators are building out their own networks: for instance, Cox Communications acquired spectrum with the intention of providing wireless services over its own 4G network utilizing the LTE technology.

149. It is far from certain that Clearwire will succeed in the U.S. market. However, it is probable that among all entrants, powerful cable system firms like Cox and Comcast will have the best chance of competing in the wireless space through their ability to bundle wireless and non-wireless offerings. But as with Europe, the history of the U.S wireless sector and the telecommunications sector more generally shows that even in a market of such size as the U.S., the market does not support more than a small handful of competitors.

3.4.3. Canada

150. Canada itself is no stranger to wireless consolidation. Telus’ purchase of Clearnet and Rogers’ purchase of Microcell are two instances that will be familiar to most.

151. However, it is worth reminding ourselves again of the Competition Bureau’s deliberations in the Rogers/Microcell proceeding. With respect to Microcell’s ability
to compete, the Bureau echoed its Australian counterpart’s logic in approving the Hutchison/Vodafone merger:

The Bureau undertook a detailed review of Microcell's financial situation in an effort to understand its current and future financial requirements. The company, which had recently emerged from court protection under the Companies' Creditors Arrangement Act (in May 2003), was not considered a "failing firm", as described in Section 93(b) of the Competition Act. It was recognized, however, that Microcell faced significant challenges in its efforts to implement its current business plan. In particular, Microcell's network required significant additional capital investments in order to support the increased load resulting from its City Fido product offering. This was reflected in its recent significant revisions to its projected capital expenditure budget. This in turn placed pressure on its ability to support funding for the next generation of product and service offerings, as well as other important company initiatives that were intended to allow it to compete on a more even basis with other competitors in the market. At the same time, its competitors are moving forward with significant capital investment in newer generations of technology and network enhancements and are preparing to launch new product offerings.  

Of course, the Bureau also recognised that the Canadian wireless market was vigorously competitive. It noted too that there was plentiful effective competition from resellers, and that the history of competition between Rogers, Bell and Telus not just in the wireless market but in all other markets in which they competed suggested that the main competitive constraint on pricing was not the alleged “maverick” Microcell but the reaction by the other large firms.

Evidence suggested that the majority of competitive price reactions by a competitor in the mobile telecommunications market were prompted by the actions taken by Rogers, Bell or Telus, as opposed to actions taken by Microcell. This conclusion is reinforced by the nature of competition between these competitors in other telecommunications and broadcast distribution markets.

Finally, the Bureau noted that further facilities-based competition was highly unlikely. While it acknowledged that spectrum and foreign ownership restrictions were barriers to entry, it also made the point that large capital investments required to set up the business was also a major barrier to entry. At the time of the Microcell merger at least, the Bureau did not seem to think that there was a lack of competition with just

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60 Ibid.
three players, and indeed did not expect that there would be further facilities-based entry.\(^{61}\)

154. It should, and indeed will, be pointed out that the decision of a competition authority to approve a merger is not in itself a finding to the effect that existing players do not possess market power, nor is it a finding that further entry is not feasible. However, the context in which most recent 4-to-3 mergers and 5-to-4 mergers have occurred is one in which at least one competitor faces immediate or even drastic financial stress, or at least concludes that at its current level of operation it cannot make sufficient investments to remain competitive in the medium-term. Thus these merger decisions do indeed offer valuable evidence regarding the natural order of things in the wireless industry. When margins are too low because of competition, then the level of competition in the market will not be sustainable. There will be consolidation and exit until competition is consistent with margins that allow recovery of sunk costs.

155. The behaviour of margins in the U.S. and the UK in Figure 8 make this clear. In the UK falling margins have created pressure for consolidation. In the U.S. margins start to rise after consolidation: importantly penetration and usage also grew substantially as the industry consolidated. For instance, in the United States, the wireless penetration rate increased (measured in the “SIM cards per 100 population” fashion) from just over 60 in 2004 to over 95 in 2010 (estimates). Over the same period, Minutes of Use per subscriber grew from 698 in 2004 to 838 in 2008 before falling off slightly (reflecting substitution between voice and data).\(^{62}\)

3.5. **Summary on market power in the Canadian wireless industry**

156. The cross-country evidence on market structure and market performance presented falls short of a full-blown “competition” analysis. However, in contrast to usual international comparisons, we have attempted to make linkages between market structure and market performance, while providing a more nuanced and analytically valid view of key market performance variables.

157. There are interesting differences in “performance” between countries that we have analysed, but these differences are driven predominantly by institutional factors such as the nature of interconnection charges and the share of prepaid subscribers in total subscribers. Overall, we find that looking at unique user penetration rates, most developed nations are at the point where the great majority of adults will have access to a wireless device. We do find that there are substantial differences in voice usage levels across countries. However, on our preferred measure of output (“minutes per capita”) we find that Canada performs reasonably well. We also find that the Canadian wireless market is less concentrated than wireless markets in many of the

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61 The Bureau states that “Further facilities-based entry is highly unlikely”, while noting that barriers to entry were very high, but it seemed then to think that some competition from resellers (MVNOs) and competition between incumbents propelled by new product and service offerings would ensure that there would be “vigorous and effective” competition after the transaction. The implication is that the competition between the three major networks would remain vigorous and effective in the foreseeable future. See Competition Bureau, *op.cit.*

other countries that we included in the analysis, and that Canadian operators’ recent margins have not been exceptional.

158. The most striking feature of our cross-country analysis is not the differences in performance between countries, but the similarities in market structure. Regardless of market size, most wireless markets seem only to be able to sustain three or four major competitors, and in most markets two operators have over 2/3rds and in many cases 3/4ths of the total subscriber base. This type of “empirical regularity” lends strong support to the idea that the technological characteristics of the industry—scale and scope economies, and high set-up costs—are the primary drivers of concentration. In this light, high market share and observed high margins need not imply that firms are earning Ricardian, let alone monopoly rents due to the exercise of market power and insufficient competition.

159. We looked at the true “life-cycle” profitability of Rogers Wireless and found that over the past decade, Rogers’ wireless division may not quite have compensated its investors for the opportunity cost of the capital that they provided. In any event, the recent high cash-flows and earnings profits generated by Rogers Wireless are payback for the substantial risks that investors in the wireless business agreed to take. These “quasi-rents” are the lifeblood of an economic system that encourages risk-taking and innovation, and should not be confused with Ricardian or monopoly rents.

160. Thus our analysis suggested to us that there are unlikely to be monopoly profits in the wireless sector that are waiting to be competed away. This seems to be confirmed by the difficulties that new entrants—even ones financed by powerful foreign parents—have had in most developed wireless markets in the past decade. Consolidation, rather than fragmentation, appears to be a strong trend in the wireless space and in telecommunications more generally.

161. This analysis is highly informative about the prospects for entrants in Canada, and thus for the wisdom of affirmative spectrum policies that might confer substantial amounts of a scarce resource upon these entrants. The evidence suggests that entrants will likely struggle to make inroads into the Canadian wireless market, and that there is a high probability that many will ultimately fail. As a result, it seems likely that their spectrum holdings will remain plentiful relative to their actual capacity needs. Further, as the experience of Hutchison shows, entrants may persist operating in a loss-making environment for many years, and that antitrust policy might actually be a barrier to exit for such entrants. In this case, any initial misallocation of spectrum will persist for many years, imposing significant social costs. The balance of risks suggests that policies such as a set-aside, especially one as large as that of 2008, are likely harmful to the wireless sector.

162. Fundamentally, without conclusive evidence regarding the inefficient exercise of market power in the wireless industry, there is no rationale for further set asides. A necessary condition for set asides that favour entrants is the inefficient exercise of market power. Our analysis indicates the exact opposite: the wireless sector is not characterized by insufficient competition. If anything the set asides in 2008 may have resulted in excessive competition that is not sustainable in the long run. That mistake
should not be repeated in 2012, when a limited amount of particularly valuable 700 MHz spectrum is up for auction, as we explain subsequently.

4. **RECONSIDERING SPECTRUM POLICY**

163. The previous two sections spell out respectively the conditions under which policies such as set-asides may make sense, and also provide an indication of whether those conditions apply in most developed country wireless markets (especially Canada).

164. We return, in this section, to a specific discussion of the merits of set-asides (the analytics for spectrum caps and other “affirmative” policies are similar, although the consequences of a spectrum cap warrant a separate discussion). In this section, then, the term “set-aside” is used, but the general principles regarding the applicability of a set-aside apply also to other measures that might be used to promote entry.

165. In Section I, we claimed that a set-aside policy might be valid under if all of the following conditions apply: (a) if absent such a policy, parties other than the incumbent could not acquire spectrum, (b) the market can sustain efficient new entrants whose entry enhances the market by increasing the availability and adoption of services or through substantial product and service innovation, (c) the benefits created by new entry outweigh potential costs of preventing the relevant spectrum from being acquired by incumbent operators. A necessary condition for set asides to be a solution to a competition problem is that there is competition problem. In Section 3 the evidence strongly suggests that in the wireless sector in Canada there is not insufficient competition or the inefficient exercise of market power.

166. In this section, we apply the theories developed in Section 2 to the Canadian wireless market. We begin by first evaluating the notion that absent a set-aside, entrants would not acquire spectrum.

4.1. **Foreclosure incentives**

167. From an economic perspective, the key consideration is whether or not incumbent firms will have a substantial incentive to bid over their “use value” for a tranche of spectrum, in an effort to pre-empt entry. In Section 2, we established that this could be the case, but whether or not it would be the case might depend on the prevalence of uncertainty regarding entrants’ eventual success, the competitive impact of entrants on the profits of incumbents, the number of incumbents and whether multiple entry would make the cost of foreclosure prohibitive.

168. In Canada, currently, there are three roughly equally balanced incumbent firms. The international evidence suggests that in most nations, almost regardless of market size, three firms have more than 90% of the market, and in some markets that are otherwise very successful (Japan and Korea), three firms have 100% of the market. Further, where there are four firms in the market, the fourth firm usually has a tenuous presence, as the experience of Hutchison testifies. Further, experience shows that not a few firms that purchase spectrum end up selling on their licenses or returning them.
Examples of this include MobilCom and Group 3G in the German case, and in the United States, several non-telecom firms such as Qualcomm have also relinquished spectrum that they originally purchased.

169. Further, because (rightly or wrongly, and perhaps as a result of government policy), spectrum is seen by many as a scarce resource, demand for which is bound to rise sharply in the coming five years, it may make sense to provide substantial financial backing for the purchase of spectrum while keeping open the options to either provide service using that spectrum or to sell on the spectrum at a higher price. For instance, Harbinger Capital is a private equity firm that owns around 50 MHz of Mobile Satellite System in the United States. While Harbinger has announced that it will deploy a national wholesale open access 4G network, it also has the option of being able to sell the spectrum on to a telecom firm such as AT&T or Verizon.

170. These factors would lead one to conclude the following: (a) there is substantial uncertainty about whether entrants will actually be able to threaten incumbent profits; (b) there is substantial uncertainty about whether and when the purchase of spectrum will translate into actual network deployments. In Canada, for instance, Shaw has yet to announce firm deployment plans using the spectrum that it purchased at the AWS auction.

171. This uncertainty would tend to mitigate against the payment of large foreclosure premiums by incumbent operators. Further, the ultimate viability of entrants is no clearer right now than it was in 2008, given the slow progress that entrants have made.

172. Second, Canadian incumbent operators would face a free-riding problem if they attempted to foreclose any new entry. The incumbent operators would have to coordinate their strategies for acquiring spectrum to do so, and there is no evidence that they have ever done so. The element that has been neglected in recent Canadian discussions is that the incumbents do not form a block. They can and do compete with each other for spectrum.

173. Third, Canadian incumbents would face a multiplicity of entrants competing for spectrum at the auction. This increases the complexity associated with any potential foreclosure strategy and raises its costs, as it requires incumbent firms to evaluate the threat posed by each entrant and (in the event that they decide to foreclose all and every entrant) raises the costs of foreclosure, potentially beyond the benefit to the incumbent. For instance, a monopolist faced with a new entrant might be well advised to attempt to foreclose entry. A duopoly faced with several new entrants might still be well advised to consider that even one successful entrant might significantly threaten duopoly profits, and if the free-rider problem could be overcome, they might well bid to keep out all entrants. But if there are three operators in the market, not only does the free-rider problem become more severe, but the threat to profits posed by a marginal entrant diminishes significantly. The costs of foreclosure increase relative to its benefits.

174. In the current situation in Canada, even if the incumbents were to act as a block (i.e., the free-rider problem didn’t exist), it would be clear to them that many or perhaps most of the entrants would not pose a threat to their profits. But they may not be able to establish which ones do and which ones do not, leaving them with the inefficient
option of foreclosing all entry. Given the costs of this relative to its benefits, they would not be rational to bid substantial pre-emption premiums to preclude entry altogether. It is also not quite apparent whether they would be able to identify and then devise strategies to handle particular entrants.

4.2. **Empirical evidence: do new bidders win spectrum?**

175. Evidence from the United States’ unrestricted auction of 700 MHz spectrum suggests that new entrants do not require set-asides in order to acquire spectrum. The list of firms acquiring spectrum in the 700 MHz (Auction 73) in 2008 included non-traditional players such as Qualcomm, and the third-largest nationwide licensee in the 2006 AWS auction (Auction 66) after Verizon and AT&T was a consortium of U.S cable companies. Indeed, when one looks at spectrum holdings in the United States, Clearwire argues that it has the best portfolio of spectrum in the United States. It argues that while other carriers face a “spectrum crisis” it does not because it has 150 MHz of contiguous spectrum.

176. Evidence from Europe also suggests that a set-aside is not necessary to promote new entry. The German auction of 2000 provides an example. The auction structure involved 12 licenses for offer, with bidders being required to purchase a minimum of two and a maximum of six licenses. There were four incumbent operators, so the auction rules certainly did not guarantee that there would be a new entrant. In reality, six firms won licenses. In fact, even absent any explicit set-aside provision, there were more acquirers of spectrum than there were eventual market participants, with the two “new” firms having to return their spectrum licenses.\(^{63}\)

177. Elsewhere in Europe, Hutchison benefitted from a set-aside in the U.K., but there was no set-aside in Italy, where it also entered, nor in Sweden, Denmark or Ireland. The U.K. policy might just have given a marginal boost to a player that was bent on entering the market anyway, but whose actual prospects were highly uncertain.\(^{64}\)

178. In any event, since 2000, firms, regulators and industry analysts have a better idea of what is feasible in the industry and what is not. Thus in the excitement generated by 3G technology at the dawn of the new millennium, all firms—incumbents and entrants—were over-optimistic about their prospects. However, given the willingness

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\(^{63}\) Austria followed a similar auction format to Germany, attracting six bidders (including new entrants) and ending up with six licensees. Further, there is some suggestion that these six bidders colluded among themselves to achieve a low auction price. See Klemperer, Paul, (2002) “How (Not) to Run Auctions: The European Telecom 3G Auctions”, available at http://www.nuff.ox.ac.uk/users/klemperer/hownot.pdf, at footnote 28. Collusion between entrants and incumbents is inconsistent with the pre-emption theories used to justify set-asides.

\(^{64}\) In Europe, a variety of licensing formats were used (including beauty contests, as in Sweden). In some cases, auction formats were designed so as to ensure a new entrant. But these auction formats do not equate with a set-aside, since equally sized blocks of spectrum are likely to be sold for very similar prices, whoever they are sold to. That said, in Denmark, Hutchison was able to win its license at the expense of one of the incumbent operators, a flat contradiction to the notion of pre-emption.
of several firms to try their hand at the wireless business, and given that the wireless industry was still relatively immature then, incumbent firms might have perceived a more substantial threat to their profits from new entry than they would presumably do today. In short, if incumbents did not foreclose entry back then, there is even less reason to think that they would do so today.

179. In this light, it is highly revealing that the latest German auctions for sub-1GHz spectrum involved participation by just the incumbent firms. After all the previous efforts at encouraging competition, it seems that wiser European regulators and wiser investors have taken note of the “natural limits” to entry in the wireless business and are instead focussing on spectrum availability instead of spectrum distribution as a tool to promote competition in an already saturated market.

180. In particular, when one considers the payments made per-MHz-POP in the 2008 Canadian AWS auction, it seems rather unbelievable that a consortium of Canadian cable telecom firms, including Shaw and Videotron, would not have been able to match the performance of their U.S. counterparts in Auction 66.

181. Finally, it is notable that the G-Block spectrum in the 2008 Canadian AWS auction was not set-aside, but was acquired by an entrant firm, Public Mobile. Even though firms such as Rogers, Bell and Telus could have acquired such spectrum for very little money, it had little use value to them, and so they did not acquire it. Instead, they permitted the entry of a new firm. This example demonstrates that incumbent firms simply do not acquire all the spectrum they can, at least not if that spectrum is not useful to them, and even if not acquiring that spectrum results in entry into the market.

182. In summary, it is unlikely that a set-aside was required in 2008, and at least equally unlikely that a parallel set-aside will be required in 2012 in order for firms other than Bell, Telus and Rogers to acquire spectrum.

4.3. Feasible and viable entry

183. As we have discussed previously, the empirical evidence from around the world suggests that it would be surprising to expect more than four national competitors. In the Canadian case, there may be important regional variations, but it still seems that in each regional or provincial market, it would be difficult to anticipate more than four competitors. It is possible that in Toronto, one might see five firms seeking to provide service, but the fourth and fifth firms might be relatively marginal. In fact, while Globalive seeks to be the fourth “national” competitor, it is unclear whether that firm will be able to compete in markets such as Calgary and Vancouver where it will be arrayed against not just Bell, Rogers and Telus, but also against a well-heeled regional cable firm in the shape of Shaw. Firms like Shaw would be able to offer bundles of wireless service with other services, which will give them a significant advantage relative to Globalive. It is unclear whether there is room for both Globalive and the regional cable champion.

184. Given the ever-accumulating evidence from around the world, we think that there is a high risk of unviable entry into the Canadian wireless sector.
4.4. **Costly entry**

185. Finally, what are the costs to society (additional to the costs of failed entry which are borne by private investors) of a spectrum set-aside that promotes entry that is either unviable or merely duplicative? The first cost that is imposed arises from the **higher expenditures required to acquire spectrum**. The second cost is the **opportunity cost** of placing large amounts of spectrum in the hands of a firm that through its failure to achieve sufficient scale ends up under-utilising the spectrum. The third cost is the **impact of the entrant on aggregate industry outcomes**.

186. In the 2008 AWS auction, one author estimates that the overpayments relative to what would be predicted by a regression model of bid amounts against the quantity of spectrum won in other similar auctions in the United States, Norway and Sweden suggests that the overpayment in the Canadian AWS auction was at least $2 billion (Dippon 2009). It is difficult to estimate precisely what portion of this overpayment was due to the set-aside, but it was likely significant.

187. These overpayments do not have trivial consequences. While these payments are sunk and should not directly affect pricing and subsequent behaviour, they do affect the financial condition of wireless operators and hence the costs, quality and roll out of service. Specifically, they impinge upon these operators’ ability to raise capital and to invest in their networks. Although the huge over-valuations of spectrum in the European 3G auctions were not the result of set-aside policies, the impact of these very large payments upon the financial condition of the operators and their ability to invest shows that overpayments for spectrum, however they arise, have substantial consequences for the industry.

188. The European wireless industry exhibits significantly lower capital intensity for almost the entire decade than the North American one, and while this doubtless reflects differences in deployment costs, it also reflects the fact that European operators were scarred by their experiences in the early 2000s. Among other things, France Telecom had a near-brush with bankruptcy in 2002, while BT sold off its wireless division after it found itself saddled with debt. Where Europe was the frontrunner in 2G wireless deployment, it was behind the Far East (at least) in 3G deployment (although some of this reflects the benefits of the CDMA technology that was being deployed in Asia). Currently, many European countries are well behind Asia and North America in the deployment of 3.5G and 4G technologies. For instance, it is very unlikely that the U.K. will have an LTE network before the middle of the coming decade.

189. The second type of entry cost is the **opportunity cost** associated with allocating spectrum to those who may not be able to productively use it, whilst simultaneously keeping it out of the hands of those who might be best placed to use it.

190. An extreme example of how this opportunity cost might arise manifested itself in the set-aside schemes used in conjunction with the auction of PCS spectrum in the United States in the mid-1990s. The FCC chose to restrict the C-Block and F-Block licenses in the PCS auction to small bidders, resulting in more than half the licenses being returned (unused) to the FCC eventually. Hazlett and Boliek (1999) estimate that the delay in returning the licenses to a viable operator that was able to put the spectrum to
use cost consumers in the U.S $5.4 billion between 1996 and 1998, and that each individual year of delay cost consumers $1.4 billion.

191. As discussed above, Telus and Bell may well have entered into their joint venture even without the set asides in the AWS auction: but the presence of the set asides meant that they had little choice. Given the likelihood of there being substantially less 700 MHz spectrum on offer than there was AWS, there is even the possibility that a substantial set-aside will only allow for one incumbent network to deploy LTE in the 700 MHz band. Access to the 700 MHz band appears to be important for the quality and coverage of an LTE network, as well as a vibrant ecosystem. Hence a significant cost of set asides in the 700 MHz auction could be less vibrant intra-incumbent network competition, a concern that is particularly important if the set asides do not result in an equally effective entrant network.

192. These types of costs are highly significant in the Canadian context. Industry Canada had itself asked whether there were costs associated with setting aside spectrum for a firm that ultimately proves unviable. This is how they answered that question:

Creating an opportunity for new entry at the time of auction is, in many respects, the only time to introduce further competition in the wireless market. That is, once market power is obtained through the aggregation of spectrum, the simple exercise of that market power in the absence of any abusive conduct (i.e. conduct that is disciplinary, predatory or exclusionary) would not raise an issue under the Competition Act. Reducing barriers to entry may assist new licensees in providing services in competition with existing services as described in the competition principles. Potential adverse impact (i.e. unviable entry) can be corrected by market forces should a new entrant fail. The risk of having the spectrum bought by all the incumbents is that the opportunity of having further competitive entry into the market would be prevented. (Emphasis added)\(^\text{65}\)

193. Industry Canada’s analysis ignores the fact that there are frictions in markets and it takes time for mistakes to be corrected. For instance, “market forces” are indeed correcting the enormous bubble in some asset prices and the enormous growth of leverage in some economies, but the corrective mechanism has involved many years of economic pain in Europe and the United States. It would have been better to avoid the policy errors that created property bubbles and debt traps in the first place. Likewise, even in the case of the European firms that returned the licenses that they acquired in the 3G auctions, this usually happened after a period of three years or so. Thus it took MobilCom and Group 3G about three years before they returned their spectrum licenses to the German government, and about three years for Group 3 to return the spectrum license that it won in Austria.\(^\text{66}\)

\(^{65}\) Industry Canada, “Consultation on a Framework to Auction Spectrum in the 2 GHz Range, Including Advanced Wireless Services: Part II”, see Section 2.7.

The third type of entry cost is the cost of duplicative entry. A set-aside is actually particularly prone to inducing an excess of such entry. Those firms for whom the existence of a set-aside is the vital factor governing their entry decision are likely to be precisely those firms with the least probability of offering well-differentiated products, expanding output or meaningfully expanding consumer choice. Even if entry by such firms persists—as it may do if a government agency or an indulgent parent company is prepared to continue directly or indirectly subsidizing the entrant—the entry is likely to raise the costs of incumbent firms and potentially increase the prices that such firms charge to their own customers. For example, entry by operators that specialise in targeting the pre-paid market might result in price reductions in the pre-paid segment, but incumbent firms facing higher costs might then respond by raising prices in the Smartphone segment where they do not compete with the entrant. In a scale-driven industry, unless entry expands market output, it is likely to increase industry-wide average costs and thus ultimately drive up prices and/or reduce margins. Firms might respond to reduced margins by choosing to merge, thus restoring the market structure that existed prior to entry. Such has indeed been the case in the U.K. and Australia, following the entry of Hutchison into those markets. In fact, profitable and sustained entry might only occur if accompanied by some compensating consolidation among existing firms.

4.5. Benefits of entry

It does appear to be the case that recent entry into the Canadian wireless marketplace has resulted in lower prices as the new entrants buy market share. This appears to be particularly true for lower cost pre-paid plans. However it is not clear that the deep discounting is sustainable in the long run. Moreover, the extent of the discounts appears to be more consistent with business stealing rather than market expansion. If there were large numbers of consumers outside the market—legions of Canadians who have been deprived of the opportunity to avail of mobile services by excessive incumbent pricing—then the extent of the discounts would likely be less as the entrants attracted subscribers both from the incumbents and (especially) induced those previously without wireless services to enter the market. Another important indication of “business stealing” rather than market expansion is that these entrants are concentrating on urban markets, which are surely closer to saturation than rural markets.

The market share of the new entrants is relatively small at 2%. Entry does not seem to have been associated by a large increase in the number of subscribers to wireless services. The lack of a significant response is consistent with our analysis that there is not a competition problem in the Canadian wireless industry. Merrill Lynch estimated a change of around 4.3 percentage points in the wireless penetration rate between end-2009 and end-2010. However the actual growth rate of penetration was around 6%, compared to an average growth rate in 2004-2009 of nearly 8%. This seems largely consistent with a standard “s-shaped” diffusion pattern in which growth rates slow down as penetration increases, and inconsistent with the idea that entrant operators are exploiting vast untapped “room to grow” in Canada. These considerations also suggest that duplicative rather than market-expanding entry is the greater likelihood.
Finally, it is important to make note of the distinction between the short-run benefits of this entry and its wider consequences. Not only are the short-run benefits unlikely to persist, but the entry that generates these benefits might result in higher costs and ultimately lead to higher prices. Further, because such entry involves a potential misallocation of the spectrum resource, one has to take into account the consequences of that in terms of reduced network coverage and quality, and the resultant reduced consumer choice.

4.6. Further discussion and summary

There is a final consideration at work here, and that is the coming of age of mobile data services. The last three years have seen spectacular growth in mobile data services and this growth has strained network capacity and increased short-term and medium-term spectrum demand. Cisco System’s VNI “widget” predicts 32-fold growth in Canadian mobile data traffic between 2009 and 2014.

A report by PA Consulting for the U.K. government concludes that the supply of spectrum will be especially tight in the medium-term (until about 2015). The ITU predicted in 2007 that under its “medium growth” scenario, some 760 MHz of spectrum would be required by 2010, 1300 MHz by 2015, and 1720 MHz by 2020. The alternative is for wireless operators to inefficiently substitute capital expenditure for spectrum in order to manage strains on the network.

We are not engineers or technologists, and thus are unable to offer additional insight into the accuracy of these forecasts. However, it seems to us that unlike the early 2000s, this time around the forecasts for data services growth are likely to prove correct. Deployments in some countries are moving at a rapid clip, perhaps more rapid than anticipated a few years ago. Verizon Wireless in the United States and Telia in Sweden are already offering commercial LTE services for instance, and AT&T has recently announced plans to accelerate the deployment of LTE services relative to its earlier plans. These developments show that the demand for data services that are comparable to fixed-line services in terms of latency and speed characteristics is real.

Given this backdrop, it is reasonable to assume that relative to total licensed spectrum available for mobile services today—which is only around 680 MHz in the United States—there will be significant additional spectrum required in coming years. Indeed, finding 500 MHz of additional spectrum is one of the key goals of the FCC’s National Broadband Plan.

In this light, it is especially concerning that Canada’s regulators are considering auctioning off only a limited amount of 700 MHz spectrum, and doing so in 2012, a full four years after the United States did so. It would be even more concerning if it

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then implemented policies that ensured that the likely most productive users of the spectrum would be the ones that would be most disadvantaged in acquiring it.

203. In summary, it is not necessary to have a set-aside, and nor are the consequences of a spectrum set-aside (especially not one that puts such a large amount of spectrum outside the realm of unrestricted bidding) likely to be benign in Canada.

5. SPECTRUM CAPS AND AUCTION CAPS

204. Finally, we turn to a discussion of “caps” or limits on spectrum holdings. There are two types of caps that we will discuss: (a) caps on the aggregate spectrum holdings—across all bands—of a particular operator, which we call “spectrum caps” and (b) caps on the amount of spectrum that any given operator can purchase at an auction, which we call “auction caps.”

5.1. Spectrum caps

205. Spectrum caps were originally used in the United States and Canada, and their purpose was to give assurance to high bidders in auctions that they would indeed be able to win spectrum. By capping (at 45 MHz and then 55 MHz) the amount of aggregate spectrum that any one player could hold, the spectrum cap gave assurance that a player with ample existing spectrum would only be allowed to win a limited amount of additional spectrum, and thus encouraged bidding on spectrum by newcomers. The context in which this happened is relevant too: at the time these caps were first used (in the mid-1990s), most U.S. cellular markets were licensed duopolies. Further, auctions and behaviour in auctions, were new and unfamiliar territory for many firms. As described by former FCC Chief Economist, Professor Katz:

>A spectrum cap had a useful role to play when the [U.S. Federal Communications] Commission first began to assign Spectrum through auctions. That role was to allow potential bidders to determine with a high degree of certainty whether they would be allowed to purchase licenses for which they were the high bidders in the first auctions of CMRS spectrum in 1994 and 1995.70

206. Post-1996 (after the PCS auction and the advent of second-generation cellular wireless technology) the cap stood at 45 MHz of spectrum in any given geographic market in the United States. The cap was increased to 55 MHz in rural areas only in the late 1990s, but by 2001 the FCC had made the decision to remove the cap altogether. The FCC’s rationale at the time was that competition had developed strongly and that consumer choice and network coverage had expanded significantly.71

70 Katz, op.cit., at ¶ 11.
207. In Canada too, the early days of the wireless industry were characterised by a spectrum cap, set at 40 MHz in 1995. This cap was accompanied by a number of other measures that were designed to promote network deployment and competition, such as roaming and resale requirements. In 1999, the cap was increased to 55 MHz, and then in 2004, it was abolished altogether. At the time, Industry Canada stated:

*The mobile spectrum cap policy was introduced in 1995 to encourage innovation and help new entrants become established in the wireless industry. Canada now has close to 14 million cell phone subscribers and a modern wireless infrastructure capable of delivering a wide range of voice, data and media services. The Canadian Radio-television and Telecommunications Commission (CRTC) provides an overview of the telecommunications market in its report to the government, Status of Competition in Canadian Telecommunications Markets, 2003. The CRTC report depicts a mobile market with strong growth relative to other telecommunications markets.*

208. Despite the abolition of these caps, there has been significant concern voiced about concentration in spectrum holdings. Further, at least in the United States, the FCC has a screen of 95 MHz of spectrum in any given area beyond which the acquisition of further spectrum (for example, through a secondary market sale or a merger) might be subjected to further (case-by-case) scrutiny. Such was the case when Verizon and Alltel merged in 2008. Some petitioners in the United States—such as the Rural Telecommunications Group—have continued to argue for the imposition of spectrum caps, pointing out that concentration in the wireless industry has been increasing since the early 2000s, when the cap was abolished.

209. However, the case against a hard cap on aggregate spectrum holdings remains a substantial one. For one thing, caps are inherently arbitrary and they cannot easily be adjusted to respond to actual demand conditions. Thus, once a cap is set, it would typically be a difficult thing for a firm to change that cap to respond to changes in its needs for spectrum. Since the cap would be set by a body such as Industry Canada or the Federal Communications Commission, this would typically involve a lengthy and contentious procedure, subject to much lobbying by all sides. Although periodic reviews might be an alternative, this would all seem to go against the goal of creating something of a market in spectrum trading.

210. It is true that some transactions would anyway be subject to scrutiny (e.g. in the United States, transactions that catch the FCC’s 95 MHz screen), but this happens on a case-by-case basis and the dynamics are quite different than when there is a hard-and-fast rule about how much spectrum one firm can have. As an analogy, consider the current essentially case-by-case regime in most countries for assessing mergers between wireless operators and compare it to a rule that impose a strict numerical ceiling for market concentration. Some or all mergers would be subject to scrutiny, but a merger

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that is pro-competitive and economically efficient but violates the strict numerical rule would be far harder to pass than it would be under a case-by-case regime if the rule itself has to be overturned. In short, having a “bright line” rule always runs the risk of creating unnecessary rigidity.

211. Further, a cap invites particular problems when the underlying forces that are driving demand for spectrum are so dynamic. Consider, for instance, that in testimony before the FCC in 2001, it was implied that 45 MHz of spectrum would be sufficient to meet the needs of most of the then-foreseeable data applications (WAP, SMS, and streaming content).\(^ {73} \) One would wonder at what level the adherents of a cap would wish to see it set today. Given that we can expect very high but also uncertain\(^ {74} \) rates of growth in mobile data traffic, it may not be realistic to set a “bright line” such as a cap when market realities are evolving so quickly and also quite unpredictably.

212. A hard cap might also prevent a “capped” firm from bidding on certain bands of spectrum altogether. For instance, if Industry Canada decided to implement a hard cap of 95 MHz based on the FCC’s screening threshold, then firms such as Rogers would not be able to bid on some tranches of spectrum altogether, such as the 700 MHz. From an institutional perspective, then, a cap seems like an undesirable instrument given its rigidity and given the technical and economic backdrop against which it is being implemented.

213. Turning to the economics of a cap, the standard claims for a cap and the standard analysis of these claims are similar to the analysis that we just provided for a set-aside. As with the set-aside, the main “benefit” of the cap is that it prevents the warehousing of spectrum by incumbent firms. It could also be claimed that by doing so, the cap encourages the efficient use of spectrum by incumbent operators. In the specific instance of the U.S. cap of the late 1990s, the cap was set at 45 MHz out of a total of 180 MHz of CMRS spectrum that was available in most areas in the U.S. This ensured that there would be at least four competitors in each market. However, the same objective can be achieved by a combination of (a) making substantially more spectrum available via the auction process, while (b) using softer instruments such as auction-specific caps that could ensure a minimal number of competitors in each market.

214. In any case, we think that the threat of warehousing is substantially over-stated. We also think that the benefits from consciously encouraging new entry by (at the margins) reducing the supply of spectrum available to productive incumbent firms might be very limited. Moreover, as our international explorations of Section 3 demonstrated it might not even be possible to encourage viable new entrants. There simply are no examples of developed country wireless markets in which there are more than four healthy operators (and usually one might have three healthy operators and a tenuous fourth operator). We think that this “tyranny” of concentration which is observed with such regularity across the world is the result of the (exogenous) set-up

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\(^ {74} \) We can be reasonably confident that mobile broadband data traffic will grow very rapidly in coming years, but there is significant uncertainty about the precise growth rate.
costs in the industry being rather high relative to market size. The inefficient exercise of market power that some observers might detect by looking at short-term EBITDA margins does not, on closer examination, seem to exist.

215. Then there is the danger that a cap might entirely eliminate the participation of certain firms in a spectrum auction. For instance, a cap based on the FCC’s screening criteria would, if implemented in Canada, prevent Rogers from acquiring any 700 MHz spectrum. As we stated in the introduction to this paper, there are good reasons for why firms and consumers can benefit from a diversity of spectrum holdings. Thus 700 MHz can be used to provide service in rural areas or can be used as supplemental downlink capacity even if Rogers’ ultimate plan is to deploy LTE in urban areas using the AWS or other spectrum. Preventing Rogers from participating in the auction and from utilizing the spectrum might conceivably weaken competition and offer competitors a “pricing umbrella.”

216. Our point is not so much whether spectrum caps are good or bad, but whether they are appropriate to apply to a mature and saturated wireless market where the industry has consolidated into a relatively normal number of major competitors (three). As with set-asides, the pro-competitive entry-promoting benefits of a cap seem somewhat improbable. On the other hand, while we cannot be definitive about whether or not there is a spectrum shortage, it does appear as if there is an elevated risk (relative to what pertained in the past) of constraining the successful expansion of an incumbent operator if it cannot acquire the spectrum. Thus the costs of implementing the cap would appear to loom larger than ever before.

217. This is particularly the case since caps that are likely to be set close to the current aggregate spectrum holdings of major incumbent firms are highly likely to create significant waste. For instance, if the application of a cap either negated or severely restrained Rogers’ ability to participate in the 700 MHz auction, it could result in the acquisition of substantial amounts of 700 MHz spectrum by firms that are unable to then use that spectrum. However, the cap would prevent these firms from selling that spectrum to Rogers in the secondary market, thus preventing a timely reallocation of the resource to the highest bidder.

218. An important additional point should be made regarding warehousing. It has been claimed (for instance in Professor Cramton’s 2001 testimony on caps before the FCC) that incumbents are warehousing spectrum because they own spectrum in areas that they do not actually offer service (this is “proof” of warehousing). This seems like an improbable “proof” of warehousing or even spectrum under-utilisation. In fact, what is happening is that incumbent firms are buying licenses that include areas in which it is not profitable to provide services because the licensing process is insufficiently disaggregated to allow otherwise.

219. Further, as we explained at the very outset of this report, the fact that firms are not currently using spectrum is not in itself evidence of anti-competitive behaviour or even intent. For instance, Rogers and Bell are partners in Inukshuk Wireless, which has a substantial amount of 2.5 GHz spectrum. It is possible that Rogers can access some of

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75 See Katz, op. cit. for a similar argument.
this spectrum and use it to offer LTE services. There is nothing wrong or even inefficient in Rogers wanting to hold an option to use this spectrum for LTE. In the parlance of the discussion on pre-emption in Sections 1 and 2, this is all part of the “use value” of the spectrum to Rogers. If another firm could be using this spectrum in a more optimal way, it would presumably have paid more money than Inukshuk did for the same spectrum. The small sums of money that Inukshuk paid to acquire this spectrum do not reflect “pre-emption” premiums: indeed, other firms including the many new entrants who availed of an Industry Canada set-aside could have purchased 2.5 GHz spectrum from firms such as Look Communications and Craig Wireless that were trying to dispose of it. However, they did not do so.

220. Another claim that is sometimes made is that small rural telephone cooperatives might be able to offer service, but they cannot acquire the spectrum to do so. This seems like a questionable claim to us. Even if incumbents acquired this spectrum by bidding above their use value, they would offer service if it were profitable to them to do so. The fact that they do not means that it is probably not profitable or viable to offer services in that area. But this in turn implies that there is no rational reason for incumbents to want to foreclose entrants in these areas as there are no profits that incumbents can earn and then protect via a foreclosure strategy.76 Thus, absent any set-asides or caps, rural telephone companies should be able to acquire this spectrum on the secondary market if they can use it more productively than the incumbent firms, if indeed licenses were available in small enough blocks to make this realistic. Thus the issue of “unused licenses in rural areas” does not seem like it requires spectrum caps or set-asides to resolve it. If anything, revisions to the band plan used by IC would be more helpful in this case.

221. In summary, then, we cannot find a set of circumstances in Canada today that would warrant the imposition of caps. We wonder what has changed since 2004, the year when the Competition Bureau concluded that the market was vigorously competitive and when IC removed the cap that had hitherto applied to the wireless industry in Canada. Competition since then has intensified or at least stayed equally effective, wireless penetration has increased, and Canada has seen a remarkable deployment of new wireless broadband networks.

5.2. “Auction caps” or “soft caps”

222. There are other variants on caps that have been used by regulators in Europe (particularly). Under these regimes, the cap is auction-specific and puts a restriction

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76 A foreclosure-type theory might explain unused licenses in rural areas if and only if it were the case that an incumbent operator purchased certain bands of spectrum whose use value was zero in order to protect profits from other bands of spectrum that it was using to provide service in other areas. This seems to be unlikely since entry is more likely to be profitable in those other urban areas than in the rural area, i.e. keeping the entrant out of the rural area is unlikely to result in deterrence of entry in urban areas that would have otherwise been profitable. Even in this case, in order for the foreclosure argument to apply, there would have to be an entrant that was more efficient than the incumbent in providing service in these areas using the band of spectrum that is currently unutilised. We are not aware of any circumstances in which this is actually the case.
on the amount of spectrum that any one operator can purchase. For instance, if 90 MHz of spectrum is up for auction, an auction-specific cap might be designed such that no one party wins more than 20 MHz. This would guarantee at least five winners, but it would not involve a set-aside of particular blocks of spectrum for new entrants, and it would ensure that there is fully competitive bidding for all blocks of spectrum. While such a cap might represent a departure from pure efficiency considerations in the award of spectrum, these caps offer a more flexible way of ensuring a minimal amount of participation in the auction.

223. Unlike an aggregate spectrum cap, an auction-specific cap could be designed so that it takes account of relative supply and demand at the time of the auction. Further, unlike an aggregate spectrum cap, an auction-specific cap may not require putting needless restraints on secondary market activity. Thus if a new entrant wins a license that is unable to use, it may sell that license to an incumbent firm in the secondary market. Under some circumstances, an aggregate cap might prevent this from happening, or at least it may only happen after a contentious proceeding in which the merits of relaxing the cap or raising the cap are debated.

224. An auction-specific cap might also be designed so that it responds flexibly to real spectrum demand in the market. For instance, if 90 MHz of spectrum is put up for auction, then an initial cap of 20 MHz per bidder could be imposed, with no other restrictions. If, in this relatively unrestricted bidding process, there are not sufficiently many bidders — a situation that we deem unlikely, given that there is an option value to simply acquiring spectrum, which makes it an attractive commodity not just to telecom firms but to financial firms too — the unclaimed spectrum can be re-auctioned thus preventing the waste of such spectrum.

225. Since it offers more flexibility, this type of “soft cap” approach might be a workable alternative to an aggregate spectrum cap. We see this “soft cap” approach as a way to ensure a minimum number of licensees. Such an approach might make some sense if there is only a very limited amount of spectrum available, such that even viable and efficient incumbent operators face the real prospect of not being able to obtain sufficient spectrum at auction. Thus such a cap might be used in circumstances other than to promote or sustain new entry. However, we note that in general, a combination of making more spectrum available and allowing unrestricted bidding on the more abundantly available spectrum, would represent the best economic policy.

226. Finally, concerns about warehousing and spectrum waste can be better handled by imposing non-negotiable (but reasonable) rollout obligations on firms that win licenses. Such rollout obligations might obviate the need for set-asides, since they would presumably make it too costly for incumbents to acquire spectrum for purely pre-emptive purposes, but they would also prevent speculators from acquiring spectrum in order to exploit spectrum scarcities.

6. **CONCLUSIONS: MORE SPECTRUM OR MORE INTERVENTION**

227. Spectrum auctions and spectrum allocation policy can be used to promote useful competition in the wireless market. Set-asides and perhaps even spectrum caps are
two policy instruments that can be used to address the consequences of inefficient market power in the wireless market. These are not costless instruments, however, and if the conditions that are used to justify them do not apply, they can impose substantial social costs.

228. Throughout the developed world, wireless markets are concentrated. Three or four firms often account for the entire market, and two firms frequently serve more than 75% of subscribers. But this regularity of concentration suggests that there are intrinsic limits to profitable and socially efficient entry in the wireless market. There is no evidence to suggest that most wireless firms in most developed wireless markets (all of which are highly concentrated) are earning monopoly rents or even necessarily earning much above their cost of capital, at least not if their profits and cash-flows are evaluated over the lifecycle of investments.

229. In short, there is no indication of “insufficient competition”, and because there is no indication of such, it seems very unlikely that there is much room for further entry into markets such as Canada. For this reason alone, a set-aside runs the risk of lavishing a resource on firms that have rather high probabilities of failure or exit. Further, given high penetration rates and high levels of market development, it is difficult to see how new firms—firms whose ability to effectively raise and deploy capital, to develop a brand and to develop supplier and customer relationships is largely unproven—are going to meaningfully expand output or increase product variety and innovation. Indeed in Canada, what one has seen so far is that entrants are concentrating on urban markets, and on winning customers through aggressive pricing.

230. Aggressive pricing suggests that these firms are doing all they can to cover some proportion of their fixed cost in the short-run, but have done nothing to establish their long-run viability. Playing for customers in the same pond as incumbent operators suggests that these firms are “business stealers” rather than market expanding firms. Industry Canada’s set-aside has attracted too much entry, much of which is either unviable or even undesirable (i.e., the same amount of output that could have been provided by three firms is now being provided by four or five or even six). Worse, this has come with substantial costs attached. First, there is the cost of misallocating the spectrum resource, and second, there is the constraint that has been imposed upon the ability of Bell Mobility and Telus in terms of future separate network developments.

231. 700 MHz spectrum is especially valuable for LTE deployments and it is likely to be made available in only rather limited quantities. This means that the costs of misallocating the resource are very high. There would be very serious consequences from using a set-aside or applying spectrum caps in an effort to “sustain” the entry that has already occurred. The reality is that incumbent incentives to foreclose such entrants from acquiring spectrum are limited, and equally spectrum is not going to be the crucial factor determining whether entry can be sustained. In fact, spectrum (or lack of it) is more likely to be a crucial factor in determining how fast and how far incumbent firms can go with rollouts of 4G technology.

232. With only a limited amount of 700 MHz spectrum available, a set-aside or cap policy might keep a valuable and essential resource out of the hands of those who can best
use it. In particular, given its uses in rural and low-density areas (areas where mobile broadband might be especially valuable because of the prohibitively high costs of deploying fixed broadband service), a policy that ensures that entrants get a “fair share” of 700 MHz spectrum might reduce meaningful competition and choice for Canadians living in such areas, particularly given that thus far the deployments by new entrants have concentrated on the markets (big cities) with the lowest deployment costs and most favourable economics.

233. There is a further grave danger that a substantial set-aside of 700 MHz spectrum will produce an even worse constraint on competition than the set-aside of AWS spectrum did. With substantially less 700 MHz spectrum available, a set-aside of even 20 MHz (barely enough to satisfy all the entrant firms that require to be “sustained) could ensure that there is only one incumbent with enough 700 MHz spectrum to substantially use that band in its LTE deployments.

234. A better policy would define a “fair share” in terms of those with the best prospects for using the spectrum, and thus generating consumer surplus. However, we have seen no evidence that justifies a departure from the “highest bidder is the most productive user” rule that ought to be the de facto assumption in any auction process. Instead we have seen evidence that the costs of departing from this rule are potentially very high.

235. Instead, we would suggest that the most useful policy focus for Industry Canada is on increasing the availability of spectrum to the wireless industry. This might involve conducting a comprehensive audit of spectrum use and a comprehensive process of gathering information about future spectrum demand. A side benefit of a policy that frees up spectrum is that it enables further entry without depriving current market participants of spectrum that they can put to good use.
Figures and Tables

Figure 1: SIM Cards per 100 Population

Source: Yankee Group
Figure 2: ARPU (nominal US$) per month

Figure 3: Correlation between ARPU($, x-axis) and Penetration

\[ R^2 = 0.71286 \]
Figure 4: Unique users and “penetration”

Source: Yankee Group
Figure 5: Affordability of subscriptions and usage relative to Canada (=100)

Source: Merrill Lynch GW Matrix Q3 2010. Note that “affordability” is the ratio of ARPU (subscription) or ARPM (usage) to GDP per capita (all quantities in nominal US$, converted at current market exchange rates).
Figure 6: Annual Minutes of use per capita

Source: (Annual MoU per subscriber) x (Subscribers per capita) based on Yankee and Merrill Lynch data. Note that MoU are unadjusted for potential bias towards RPP countries.
Figure 7: Average fixed line penetration (1991-2004) relative to prediction

Source: BRG analysis based on regression of fixed-line penetration on per capita GDP. The bars show that the average difference between fixed penetration and predicted fixed penetration over the 1991-2004. This indicates that Canada’s fixed penetration rate was substantially higher than predicted by its income level.
Figure 8: Cash-flow margins 2004-2009 (weighted average of leading operators)

Source: BRG analysis based on Merrill Lynch GW Matrix Q3 2010.
Table 1: Concentration and Earnings Profitability (2010)

<table>
<thead>
<tr>
<th>Country</th>
<th>HHI</th>
<th>Top 2 Share</th>
<th>EBITDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>3400</td>
<td>72%</td>
<td>32%</td>
</tr>
<tr>
<td>Canada</td>
<td>3060</td>
<td>66%</td>
<td>46%</td>
</tr>
<tr>
<td>France</td>
<td>3310</td>
<td>77%</td>
<td>38%</td>
</tr>
<tr>
<td>Germany</td>
<td>2790</td>
<td>67%</td>
<td>47%</td>
</tr>
<tr>
<td>Greece</td>
<td>3630</td>
<td>72%</td>
<td>34%</td>
</tr>
<tr>
<td>Italy</td>
<td>2900</td>
<td>69%</td>
<td>47%</td>
</tr>
<tr>
<td>Japan</td>
<td>3590</td>
<td>77%</td>
<td>46%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>3830</td>
<td>77%</td>
<td>38%</td>
</tr>
<tr>
<td>South Korea</td>
<td>3880</td>
<td>82%</td>
<td>36%</td>
</tr>
<tr>
<td>Spain</td>
<td>3340</td>
<td>74%</td>
<td>38%</td>
</tr>
<tr>
<td>Sweden</td>
<td>3280</td>
<td>75%</td>
<td>38%</td>
</tr>
<tr>
<td>UK</td>
<td>2210</td>
<td>51%</td>
<td>20%</td>
</tr>
<tr>
<td>USA</td>
<td>2380</td>
<td>62%</td>
<td>39%</td>
</tr>
</tbody>
</table>

*Source: Merrill Lynch GW Matrix, Q3 2010.*
Table 2: Cash-flow margins, capital intensity and market share (2004-09 averages)

<table>
<thead>
<tr>
<th>Country</th>
<th>Average &quot;cash&quot; margin</th>
<th>Average Capital Intensity</th>
<th>Largest firms' share</th>
<th>Top two share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>32%</td>
<td>11%</td>
<td>43%</td>
<td>76%</td>
</tr>
<tr>
<td>Canada</td>
<td>30%</td>
<td>15%</td>
<td>37%</td>
<td>68%</td>
</tr>
<tr>
<td>France</td>
<td>27%</td>
<td>12%</td>
<td>45%</td>
<td>80%</td>
</tr>
<tr>
<td>Germany</td>
<td>38%</td>
<td>8%</td>
<td>37%</td>
<td>72%</td>
</tr>
<tr>
<td>Italy</td>
<td>40%</td>
<td>11%</td>
<td>39%</td>
<td>73%</td>
</tr>
<tr>
<td>Japan</td>
<td>21%</td>
<td>18%</td>
<td>51%</td>
<td>77%</td>
</tr>
<tr>
<td>Korea</td>
<td>18%</td>
<td>16%</td>
<td>51%</td>
<td>82%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>24%</td>
<td>10%</td>
<td>49%</td>
<td>72%</td>
</tr>
<tr>
<td>Spain</td>
<td>32%</td>
<td>10%</td>
<td>46%</td>
<td>76%</td>
</tr>
<tr>
<td>Sweden</td>
<td>28%</td>
<td>10%</td>
<td>46%</td>
<td>76%</td>
</tr>
<tr>
<td>UK</td>
<td>18%</td>
<td>10%</td>
<td>24%</td>
<td>49%</td>
</tr>
<tr>
<td>USA</td>
<td>22%</td>
<td>17%</td>
<td>27%</td>
<td>55%</td>
</tr>
</tbody>
</table>

Source: BRG analysis based on Merrill Lynch data. Weighted averages of top 2 or top 3 operators' key financials over the period 2004-2009.
Table 3: Cash-flow calculations for Rogers Wireless

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating Free Cash Flow</th>
<th>Non-Operating Cash Outflows</th>
<th>Actual Free Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>(98,030,000)</td>
<td>(2,364,343,000)</td>
<td>(2,462,373,000)</td>
</tr>
<tr>
<td>2001</td>
<td>(253,233,000)</td>
<td>(393,520,000)</td>
<td>(646,753,000)</td>
</tr>
<tr>
<td>2002</td>
<td>(47,961,000)</td>
<td>(47,961,000)</td>
<td>(47,961,000)</td>
</tr>
<tr>
<td>2003</td>
<td>304,303,000</td>
<td>304,303,000</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>502,479,160</td>
<td>(1,318,400,000)</td>
<td>(815,920,840)</td>
</tr>
<tr>
<td>2005</td>
<td>740,122,000</td>
<td>740,122,000</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>1,272,867,000</td>
<td>1,272,867,000</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>1,712,000,000</td>
<td>1,712,000,000</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>1,868,000,000</td>
<td>(999,367,000)</td>
<td>868,633,000</td>
</tr>
<tr>
<td>2009</td>
<td>2,141,000,000</td>
<td>2,141,000,000</td>
<td></td>
</tr>
</tbody>
</table>

NPV (@10%) $(44,385,321.14)$

Notes: The $2.364 billion outflow in 2000 represents the book value of total assets of Rogers Wireless as of Q1 2000. It is treated as the initial investment principal.

Other non-operating cash outflows include spectrum payments and payments for acquisition of Microcell.

Source: BRG analysis based upon Rogers Wireless annual reports, Wireless Intelligence database.
Jeffrey Robert Church
February 2011

_______________________________________
Contact Information
Department of Economics
University of Calgary
2500 University Drive, N.W.
Calgary, Alberta
T2N 1N4
Phone: (403) 220 6106
Fax: (403) 282-5262
e-mail: jrchurch@ucalgary.ca

_______________________________________
Citizenship
Canadian

_______________________________________
Education and Professional Qualifications


• B.A. First Class Honours (Economics), University of Calgary 1984.

• Qualified as an expert witness before the National Energy Board, the Alberta Energy Utilities Board, the Canadian Radio-Television and Telecommunications Commission, the Federal Court of Canada, and Supreme Court of British Columbia.

_______________________________________
Positions Held

Academic Appointments

• Professor, Department of Economics, University of Calgary (since July 1, 2001).

• IAPR Professor, Institute for Advanced Policy Research, University of Calgary, Coordinator of the Markets, Institutions, and Regulation Working Group (July 1, 2006 to June 30, 2009).
• Associate Professor, Department of Economics, University of Calgary (1994-2001).
• Assistant Professor, Department of Economics, University of Calgary (1989-1994).

Other Appointments
• Chairperson, Terra Nova Reference Price Committee, Newfoundland (2007 and 2010-).
• Fellow, Economics Network for Competition and Regulation (ENCORE), Netherlands, (since 2007).
• Founding Academic Director, Centre for Regulatory Affairs in the Van Horne Institute for International Transportation and Regulatory Affairs, University of Calgary (1998-2001).
• President, Church Economic Consultants Ltd. (1992-).
• Director, Berkeley Research Group (2010-).

Academic Awards and Distinctions

Teaching Awards
• Faculty of Social Science Distinguished Teacher Award, University of Calgary 1994 and 2004.
• Students' Union Teaching Excellence Award, University of Calgary 1994-95.

Major Academic Distinctions
• Faculty of Social Sciences Gold Medal, University of Calgary 1984.

Research Interests
• Industrial Organization
• Economics of Regulation
• Competition Policy
Publications

Refereed Journal Articles


Invited Papers

Books and Monographs


Chapters in Books


Papers and Proceedings

- “The Interface Between Competition Law and Intellectual Property in Canada: An


Public Reports


• *An Evaluation of Traditional and Incentive Regulation for Canadian Natural Gas Pipelines*. (with Robert Mansell) Study submitted to, and available from, the National Energy Board of Canada, 1992.


Public Regulatory Interventions

• Submission of The Director of Investigation and Research to Industry Canada re: Canada Gazette Notice No. DGTP-008-95 Review of Canadian Overseas Telecommunications and Specifically Teleglobe Canada's Role October 27, 1995 (with David Smith).

• Reply Comments of The Director of Investigation and Research to Industry Canada re: Canada Gazette Notice No. DGTP-008-95 Review of Canadian Overseas Telecommunications and Specifically Teleglobe Canada's Role December 11, 1995 (with David Smith).
• Submission of The Director of Investigation and Research to The Canadian Radio-Television and Telecommunications Commissions re: Telecom Notice CRTC 95-36 Implementation of Regulatory Framework, Local Interconnection and Network Component Unbundling January 26, 1996 (with Cal Gundy and Patrick Hughes).
• Final Argument of The Director of Investigation and Research to The Canadian Radio-Television and Telecommunications Commissions re: Telecom Notice CRTC 95-36 Implementation of Regulatory Framework, Local Interconnection and Network Component Unbundling October, 1996 (with Cal Gundy and Patrick Hughes).
• Final Oral Argument of The Director of Investigation and Research to The National Energy Board in PanCanadian Petroleum Limited application dated 26 July 1996 for an order requiring Interprovincial Pipe Line Inc. to transport natural gas liquids for PanCanadian Petroleum Limited from Kerrobert, Saskatchewan (MH-4-96) November 1996 (co-author).
• Opening Statement to the Alberta Utilities and Energy Board in Federated Pipe Lines Ltd. Application to Construct and Operate a Crude Oil Pipeline from Valhalla to Doe Creek, Alberta Energy and Utilities Board March (Decision 98-12) March 1998.
• Final Argument of The Director of Investigation and Research to The Canadian Radio-Television and Telecommunications Commissions re: Telecom Notice CRTC 98-10 Local Competition Start-Up Proceeding November, 1998 (with Cal Gundy).
• Written Comments of the Competition Bureau to the Alberta Electricity Industry Structure Review February 2002 (with David Krause and Mark Ronayne).
• Final Submission of the Commissioner of Competition to the Ontario Energy Board’s Natural Gas Forum Consultation on the Ontario Natural Gas Market November 2004 (with Mark Ronayne).


**Book Reviews**


**Websites**


**Research In Progress**


• “Asymmetries, Simulation and the Assessment of Input Foreclosure in Vertical Mergers.” (with A. Majumdar and M. Baldauf) Mimeo, Department of Economics, University of Calgary 2010.


Presentations


• “The Competition Act and the Fair Efficient and Open Competition Regulation.” Workshop for the Alberta Utilities Commission, Calgary, April 2010 (with Barry Zalmanowitz).


• “Forbearance of Local Telecommunications in Canada: One Back, Two Forward?” Telecommunications and Broadcasting Current Regulatory Issues and Policy Insight
Communications Conference, Ottawa, April 2007.

- “Stumbling Around in No Man’s Land is Dangerous: Competition Policy, the CRTC, and Deregulation of Local Telecom in Canada.” Competition Policy in Regulated Industries: Principles and Exceptions, C.D. Howe Institute Policy Conference, Toronto, November 2006.
- “Competition in Local Telecommunications in Canada: Grading the CRTC.” Delta Marsh Annual Conference, Department of Economics, University of Manitoba, Winnipeg, October 2006.
- “The Interface Between Competition Law and Intellectual Property in Canada: An Uneasy Alliance or Holy War?” Presented at the Canadian Bar Association Annual Fall Conference on Competition Law, Gatineau, November 2005.
- “The Economics of Exclusionary Contracts and Abuse of Dominance in Canada” Presented at the Canadian Bar Association Annual Fall Conference on Competition Law, Hull, October 2003.
- “Network Externalities, Technological Progress, and Competitive Upgrades” Presented at
• Panelist, Efficiencies in Mergers Under the Competition Act, Annual Meeting of the Canadian Economics Association, Calgary, June 2002.
• "The Economics of Coordinated Effects and Merger Analysis." Presented at the Canadian Bar Association Annual Fall Conference on Competition Law, Ottawa, September 2000.
• "Applying Antitrust Concepts in IT Industries." Presented at Roundtable on Reassessing the Role of Antitrust in Mega-Mergers and IT Industries Faculty of Law, University of Toronto, June 2000.


Panelist, Symposium on Barriers to Entry, Bureau of Competition Policy, Ottawa, March 1995.


Invited Seminars

- Faculty of Commerce and Business Administration, University of British Columbia, April 2002
- Department of Economics, University of Toronto, March 2002
- School of Business & Economics, Wilfred Laurier University March 2002
- Competition Bureau, January 2002
• Department of Economics, University of Laval, April 1996
• Department of Economics, Carleton University, Ottawa, January 1996
• Stern School of Business, New York University, December 1995
• Bureau of Competition Policy, Industry Canada, Ottawa, March 1994
• Department of Economics, Simon Fraser University, November 1992
• Department of Economics, University of Victoria, November 1992
• Department of Economics, University of Toronto, October 1991
• Department of Economics, Queen's University, Kingston, October 1991
• Department of Economics, University of Alberta, February 1990

Refereeing

• American Economic Review
• Canadian Journal of Agricultural Economics
• Canadian Journal of Economics
• Canadian Journal of Political Science
• Canadian Public Policy
• C.D. Howe Institute
• Energy Journal
• European Economic Review
• FCAR
• Information Economics and Policy
• International Economics and Economic Policy
• International Economic Review
• International Journal of the Economics of Business
• International Journal of Industrial Organization
• Journal of Econometrics
• Journal of Economic Behavior and Organization
• Journal of Economic Education
• Journal of Economic Psychology
• Journal of Economics
• Journal of Economics and Business
• Journal of Economics and Management Strategy
• Journal of Industrial Economics
• Journal of International Economics
• Journal of Law, Economics, & Organization
• Management Science
• Marketing Science
• National Science Foundation
• RAND Journal of Economics
• Journal of Economic Surveys
• Review of Industrial Organization
• Review of Network Economics
• Routledge
• SSHRC
• University of Cambridge Press

Professional Service

• Chair Canadian Bar Association National Competition Law Section Economics and Law Committee, 2005-2007.
• Vice-Chair Canadian Bar Association National Competition Law Section Economics and Law Committee, 2004-2005.
• External Examiner for E. Croft Ph.D, Policy Programme, Faculty of Commerce and Business Administration, University of British Columbia, April 1999, B. Isaacs Ph.D, Department of Economics, Simon Fraser University, May 2000, and J. Landa Ph. D, Department of Economics Carleton University May 2001
• House of Commons Standing Committee on Industry, Science and Technology Roundtable Participant on Competition Policy, December 2001.

Teaching Experience

Graduate

• Ph.D. Micro Theory
• Industrial Organization
• Regulatory Economics

Undergraduate

• Regulatory Economics
• Competition Policy
• Honours Micro Theory
• Industrial Organization
• Intermediate Microeconomics

Professional

• Regulatory economics through the Centre for Regulatory Affairs.
• Principles of Microeconomics, Industrial Organization and Competition Policy for the Competition Bureau.

Graduate Student Supervision/Examination

Completed

• Supervisor, M.A. Programme, Alex Harris, "Optimal Multiproduct Tolling on an Oil Pipeline," Department of Economics, University of Calgary, 2000.
• Examination Committee Member, M. Ec. Programme, Murray Sondergard, "An Examination of the Efficient Markets Hypothesis for the Toronto Stock Exchange," Department of Economics, University of Calgary, 1992.
• Examination Committee Member, M.A. Programme, Denise Froese, "Auctioning Private Use of Public Land," Department of Economics, University of Calgary, 1993.
• Examination Committee Member, M.Ec. Programme, Merrill Whitney, " Economic
Espionage as a Form of Strategic Trade Policy" Department of Economics, University of Calgary, 1994.

- Examination Committee Member, M.Ec. Programme, Robert Richardson, "North-South Disputes Over IPRs" Department of Economics, University of Calgary, 1994.
- Examination Committee Member, M. Ec. Programme, Eva Cudmore, "The Viability of New Entry into the Alberta Electrical Generation Industry," Department of Economics, University of Calgary, 1997.
- Examination Committee Member, M. A.. Programme, Geok (Suzy) Tan, Course Based M.A, Department of Economics, University of Calgary, 1997.
- Examination Committee Member, M.A. Programme, Kris Aksomitis, "Strategic Behaviour in the Alberta Electricity Market," Department of Economics, University of Calgary, 2002.

Current
- Supervisor, M.A. Programme, Susan Baker, Jecielle Alonso, and Michael Ata, Department of Economics, University of Calgary.

University Service

- University Research Grants Committee 1994/95
- Dean's Academic Appointment Committee, Department of Mathematics and Statistics 2001
- ISEEE Tier II Chair in Energy and Climate Change Search Committee 2005/06
- Faculty of Social Sciences Academic Program Review Committee 2000/01
- Faculty of Social Sciences Executive Council 2002/03
- Department of Economics, Ad Hoc Outreach Committee 2001/02
- Curriculum Fellow, Department of Economics, 2001
- Department of Economics Representative on Van Horne Institute Sub-Committee on Centre for Regulatory Affairs 1997/98
- Department of Economics Advisory Committee 1997/98
- Department of Economics Honours Advisor 1992/93, 1993/94, 1994/95, 2006/07
- Department of Economics Ph.D. Ad Hoc Committee 1990/91 and 1992/93
- Department of Economics Ad Hoc Committee on the Status of Women 1991/92
Consulting Experience

President of Church Economic Consultants Ltd., for whom I have written consulting reports and provided advice on issues in regulatory and antitrust economics for Alberta Beef Producers, Apotex, Bayer CropScience, BC Ferries, the Canadian Association of Petroleum Producers, the Canadian Cattlemen’s Association, the Canadian Competition Bureau, The Coca-Cola Company, The Conference Board of Canada, Enbridge Pipelines, EPCOR, European Commission, Foothills Pipelines, Google Inc., James Richardson International Limited, Mackenzie Explorers Group, Maple Leaf Foods, Microcell, Nokia, Nova Gas Transmission, OECD Competition Division, Pacific Gas & Electric, Pan Alberta Gas, PanCanadian Petroleum, Peace Pipe Line, Perimeter Transportation, Rogers Communications, Superior Propane, TransAlta, TransCanada Pipelines, Williams Energy, and eight major motion picture film studios.

Other

- 3M National Coaching Certification Program Level 1 Softball January 2002
- 3M National Coaching Certification Program Coach Level Hockey November 2002
- 3M National Coaching Certification Program Level 1 Baseball September 2003