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The Adverse Economic Effects of Spectrum Set-Asides

Robert W. Crandall and Allan T. Ingraham†

Abstract

In February 2007, Industry Canada released a consultation that outlined a proposed auction design for spectrum for Advanced Wireless Services. As part of its consultation, Industry Canada contemplated a spectrum set-aside in the AWS auction to facilitate the entry of a new wireless service provider in Canada; however, it noted that a potential drawback of a spectrum set-aside is that it can induce uneconomic entry into the market. In this paper, we show that a set-aside for AWS spectrum in Canada is more likely to result in uneconomic entry than in a viable domestic entrant into the Canadian wireless industry. Furthermore, if Industry Canada desires another wireless service provider, there are far more constructive ways than a set-aside to promote viable entry into the Canadian wireless industry.

Introduction

In February 2007, Industry Canada released a consultation that outlines its auction design for spectrum for Advanced Wireless Services (AWS) in the 1.7 GHz and 2.1 GHz bands.¹ Industry Canada proposed to auction 90 MHz of spectrum (45 MHz paired) in five separate licence blocks.² The A and B blocks would each contain 5 MHz of paired spectrum and would cover 172 licence areas.³ The C and D blocks, which would each include 10 MHz paired, would each be divided into 59 geographic licence areas.⁴ Finally, the E block would contain 14 licence areas and have 15 MHz paired of spectrum.⁵ These blocks would be sold using a simultaneous multi-round auction (SMR) design, which has been used in worldwide spectrum auctions for more than a decade.⁶

As part of its consultation, Industry Canada has contemplated the value of a spectrum set-aside in the AWS auction to facilitate the entry of a new wireless service provider in Canada.⁷ Industry Canada stated that “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”.⁸ By contrast, Industry Canada noted that “not taking explicit action to enable entry may therefore have the consequence of preventing entry while taking explicit action runs the risk of potentially enabling uneconomic entry”.⁹ In this paper, we show that a set-aside for AWS spectrum in Canada will result in the uneconomic entry that Industry Canada refers to, and that there are far more constructive ways than set-aside auctions to promote viable entry into the Canadian wireless industry.

The implementation of the designated entity program in the United States illustrates the many problems

encountered in set-aside auctions for spectrum. The U.S. C block auction was a set-aside auction for spectrum, the consequences of which tied up valuable spectrum in bankruptcy litigation for nearly a decade. As a result, network congestion reduced the quality of service that carriers were able to offer in major metropolitan areas, forcing the wireless carriers to engage in costly cell-splitting. Furthermore, the continued use of spectrum set-asides in the United States has significantly distorted auction prices and has resulted in the costly creation of bidding fronts that incumbent carriers have used to circumvent set-aside rules.

European auctions have also demonstrated that spectrum set-asides are inconsistent with the efficient allocation of radio spectrum. For example, the auction for spectrum for universal mobile telecommunications service (UMTS) in the United Kingdom included a spectrum set-aside for a new entrant. However, the United Kingdom placed no restrictions on the size or foreign ownership of that entrant. As a result, the set-aside merely served to subsidize Hutchinson, a large multinational firm that would not require regulatory protection to enable its entry into the U.K. market. Despite receiving a £1.4 billion break on the price of the largest piece of bandwidth let at auction, Hutchinson, which began service under the company name “3” in 2003, has experienced significant difficulty in the U.K. market and is not projected to turn a profit until 2008. Therefore, the spectrum set-aside in the U.K. UMTS auction not only revealed that set-asides can encourage entry that is not viable, but also revealed that set-asides can subsidize the purchase of the most valuable asset let at auction by the firm that values that asset the least — an outcome that is at odds with the maximization of consumer welfare.

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In addition to the examples in other countries that illustrate the problems with set-aside auctions, there is a more general reason why a set-aside for spectrum will facilitate uneconomic entry in Canada's AWS auction. Canada's foreign ownership restriction limits entry to domestic firms only. However, the purpose of a spectrum auction is to allocate spectrum to the most efficient carrier — that is, the carrier that can use the spectrum to provide the service most valued by the end user. Given that a foreign entrant with experience in the provision of wireless services is more likely than a newly formed domestic entrant to be a viable wireless carrier, a spectrum set-aside for a domestic entrant risks allocating a valuable public resource to the third-best entity.

Even though Canada's foreign ownership restrictions on wireless carriers are inefficient, a relaxation of these restrictions appears unnecessary to achieve a competitive wireless industry. Market forces have recently led to some consolidation in the industry for wireless services in Canada, but the industry's performance since that time has provided no convincing evidence that the industry is not competitive.¹⁰ Therefore, it is far from apparent that Canada requires a fourth facilities-based wireless carrier, and the recent consolidation would indicate that the Canadian marketplace cannot support one. That said, if Industry Canada truly believes that another wireless service provider is necessary to effect competition, it would be far more productive to encourage entry through a relaxation of the foreign ownership restrictions than through a spectrum set-aside. By allowing *all* potential entrants to compete with incumbent providers, Canada would know whether or not a fourth facilities-based wireless carrier is viable.

I. The Effects of Set-Aside Allocations for Broadband Spectrum in the United States

The Federal Communications Commission (FCC) began to auction spectrum for mobile wireless services in 1994 in response to a 1993 mandate from Congress. The main frequency allocation to commercial wireless carriers was the so-called PCS spectrum, which included five different chunks of bandwidth, or "blocks."¹¹ Two of those blocks, the C block and the F block, were originally sold as set-asides for small bidders under the FCC's "designated entity" program.¹²

The C block was first let at auction in 1996,¹³ and was the only block of spectrum up for bid in that auction. The end result of the C block auction was that a number of the designated entities with winning bids could finance neither these purchases nor the subsequent costs of building out their networks. They subsequently declared bankruptcy, and tied up valuable spectrum without using it while bankruptcy litigation continued for nearly a decade. As a result, consumers were harmed by the regulators' inability to deliver valu-

able spectrum to the wireless carriers that were best suited to deploy that spectrum.

In a subsequent auction for C block and F block licences that were either returned to the FCC or unsold in the original auctions for that spectrum, the FCC again used a set-aside auction for designated entities. In this auction the FCC's designated entity program induced the creation of "bidding fronts", which were designated "small" entities controlled by large wireless firms. As a result, the set-aside program simply did not work in the manner that the FCC had originally intended because the FCC was unable to prevent valuable spectrum licences from winding up in the hands of the economic agents that valued them the most, namely, the large wireless companies. The overall effect of the set-aside program, however, was to increase greatly the transaction costs of wireless service providers and to delay the deployment of valuable spectrum assets, which increased the cost of wireless services and harmed the quality of those services.

A. The C Block PCS Spectrum

The FCC's first C block auction was FCC Auction 5. That auction sold 30 MHz C block licences that were disaggregated into 493 Basic Trading Areas (BTAs). The auction began in December 1995 and ended in May 1996 after 184 rounds of bidding. Net winning bids in the auction exceeded \$10 billion for 30 MHz of spectrum, compared to the \$7 billion raised in the A and B block auction (FCC Auction 4), which accounted for 60 MHz of spectrum. The prices in the C block auction were much higher than in the earlier A block and B block auctions, in part, because of the subsidies that were granted to designated entities in this auction.¹⁴ These subsidies encouraged the designated entities to elevate their bids to artificially high levels that could not be justified by subsequent market conditions. As a result, many of the designated entities defaulted, inducing the FCC to offer further subsidies in the form of generous restructuring options so that they could retain the spectrum that they won at auction.¹⁵ Those options were (1) disaggregation, (2) amnesty, and (3) prepayment.

First, the FCC allowed any C block licensee to disaggregate 15 MHz of its spectrum for any particular licence or group of licences and surrender that spectrum to the FCC for re-auction.¹⁶ For example, if a bidder won a 30 MHz licence covering New York City and a 30 MHz licence covering Boston, that bidder would have several disaggregation options. It could choose to disaggregate one licence (either Boston or New York) from 30 MHz into 15 MHz. Alternatively, it could choose to disaggregate both licences from 30 MHz into 15 MHz licences and pay to the FCC only one-half of its bid commitments from the auction.

Second, the FCC provided designated entities with the option of surrendering an entire C block licence in exchange for full relief of outstanding debt and any

applicable default payments. This amnesty option allowed designated entities to return the licence for the full amount of the winning bid, minus the initial down payment.¹⁷

Third, the FCC provided designated entities a prepayment option, which would allow them to prepay the debt on a licence with the down payments of another licence, thus granting the benefit of avoiding the payment of additional interest on the principal amount owed. Under the prepayment plan, a designated entity could “apply 70 percent of the total of all down payments it made on the licences that it elects to surrender to the Commission (‘Available Down Payments’), to a prepayment of the Notes for as many of its licences as it wishes to keep”.¹⁸

Despite its efforts to support winning bidders in the first C block auction, the FCC’s efforts to sustain the entry of these uneconomic designated entities were unsuccessful. NextWave, the bidder that won the largest share of licences in Auction 5, as measured in MHz-Pop¹⁹ of spectrum, declared bankruptcy in June 1998. NextWave’s bankruptcy tied up substantial amounts of valuable C block spectrum in litigation for six years. The FCC re-auctioned the NextWave spectrum as part of FCC Auction 35, which included both C and F block spectrum licences. Bidding in Auction 35 concluded in January 2001. In June 2001, however, before the FCC delivered the licences to the carriers that had submitted the winning bids in the re-auction, the U.S. Court of Appeals for the D.C. Circuit ruled that bankruptcy law precluded the FCC’s re-auction of the spectrum, sending the spectrum back to NextWave, and the Supreme Court subsequently upheld the D.C. Circuit’s decision.²⁰

The spectrum that NextWave initially won in Auction 5 in 1996 was finally sold in secondary market transactions to Cingular Wireless and Verizon Wireless. In August 2003, Cingular agreed to purchase NextWave’s PCS licences covering 34 markets.²¹ The total price of the transaction was \$1.4 billion,²² which equated to a unit price of \$1.69 per MHz-Pop.²³ In April 2005, Verizon and NextWave completed a \$3 billion transaction for spectrum licences that covered 23 markets, including Boston and New York City.²⁴ Verizon paid \$2.85 per MHz-Pop for the spectrum rights it purchased in that transaction.²⁵ Given that NextWave had originally bid \$1.49 per MHz-Pop for its spectrum, NextWave’s investors realized a large return without ever offering a wireless service. Therefore, the FCC’s set-aside program kept increasingly valuable spectrum unused for up to a decade, but it did not promote entry of new carriers.²⁶ As we show below, this delay in the provision of spectrum to nationwide wireless carriers resulted in substantial consumer harm.

B. The Cost to Consumers from the C Block Auction

The FCC’s designated entity program has had no long-term benefits to the wireless industry in the United States. Despite the FCC’s efforts to effect competition in the wireless industry through subsidized entry, the U.S. wireless industry has evolved into a dynamically competitive industry of large nationwide carriers. These carriers acquired nearly all of their spectrum either by competing in auctions that were open to all bidders or through secondary market transactions, which are negotiated at market prices. Therefore, the FCC’s auction set-aside program was unable to positively contribute to consumer welfare through the creation of sustainable wireless carriers that provide service to a significant portion of U.S. subscribers.

Not only did the FCC’s spectrum set-asides not improve competition in the U.S. wireless industry and, therefore, not benefit U.S. consumers, but spectrum set-asides also imposed costs on the industry, which resulted in consumer harm. Because the FCC chose to initially lease the rights to the C block and F block spectrum to small bidders in small fragmented BTA licences, consumers were harmed by the delay that occurred in allocating this spectrum to the bidder that valued it most. Professor Thomas Hazlett of George Mason University and Babette Boliek measured the rate of inefficiency of the C block auction relative to the A and B block auctions by the ratio of licences returned or resold in those particular auctions.²⁷ The authors found that within a year of the first C block auction, 53 per cent of the 493 licences let at auction had been returned to the FCC.²⁸ By comparison, only twelve of the 102 licences sold in the A and B block PCS auction were resold within one year after the auction ended.²⁹ Consequently, Hazlett and Boliek concluded that the allocation of the A and B block spectrum was relatively more efficient than the allocation of the C block spectrum.

Hazlett and Boliek also calculated the social welfare costs of the delay in the deployment of the C block PCS licences.³⁰ The authors concluded that by allocating spectrum to inefficient wireless carriers, the delay in the C block spectrum set-aside prevented the sale of that spectrum to a *viable* wireless carrier.³¹ The authors found that the delay in the deployment of the C block spectrum cost consumers \$5.4 billion between 1996 and 1998 and that each individual year of delay in the deployment of the C block spectrum cost consumers \$1.4 billion.³² Therefore, by attempting to subsidize the entry of *inefficient* wireless carriers, the FCC neglected to allocate the spectrum in a timely fashion to the firm that valued it the most, which resulted in significant consumer harm.

C. The Emergence of Bidding Fronts in Set-Aside Auctions

A secondary effect of the set-aside program used in the United States was the emergence of bidding fronts and speculators. Bidding fronts are designated entities that are controlled by large wireless service providers. The two best examples of bidding fronts are Alaska Native (a front used by AT&T) and Salmon PCS (a front used by Cingular Wireless).

One must stress that these fronts were not illegal. Rather, they emerged as a natural mechanism for large, incumbent wireless providers to circumvent the FCC's set-aside program and to control a designated entity, even if the large carriers did not own a majority of the bidding entity's equity, thereby negating the FCC's attempt to allocate a valuable economic resource in an inefficient manner. Specifically, the FCC adopted a standard for a firm's eligibility in the designated entity program that was based on both *de facto* and *de jure* control. Ownership of at least 50.1 per cent of an entity's voting stock was evidence of *de jure* control.³³ *De facto* control was determined on a case-by-case basis and was related to a variety of factors such as management decisions and board seats.³⁴ Because the FCC's standard was unrelated to a large firm's ability subsequently to effect economic control of any spectrum won at auction by the bidding front, these large companies were able to use the closed spectrum won at auction by the front without causing the front company to pay "unjust enrichment penalties" to the FCC.³⁵

Both Alaska Native (AT&T) and Salmon PCS (Cingular) were active bidding fronts in FCC Auction 35, the re-auction of C block and F block spectrum that was triggered by the bankruptcies that resulted from providing bidding preferences in the original auctions. These auctions included the NextWave spectrum, which was later sent back to NextWave as a result of the Supreme Court's ruling. However, Auction 35 also included hundreds of spectrum licences unaffiliated with NextWave.³⁶ Of the 422 licences let at Auction 35, 170 of those licences were closed to large bidders. These 170 licences accounted for 1,707 million MHz-Pop. Of these 170 licences, either AT&T or Cingular won 64 of them, which accounted for 893 million MHz-Pop, through their "designated entity" bidding fronts. Therefore, bidding fronts won 52.3 per cent of spectrum designated only for small bidders in FCC Auction 35.

Academic research on the effects of bidding on the Auction 35 outcome reveals that those fronts had a significant effect on prices paid for spectrum. Peter Cramton, Allan Ingraham, and Hal Singer analyzed the effects of bidding fronts on prices in FCC Auction 35.³⁷ The authors found that bidding fronts significantly altered prices in both the closed and open segments of the auction; Alaska Native, by itself, inflated prices in the closed segment of the auction by 58 per cent.³⁸ Furthermore, the authors found that the creation of the bidding

front by Alaska Native was financially prudent, as AT&T would have paid \$5.24 per MHz-Pop for the spectrum it won had it bid in the open segment of the auction, whereas Alaska Native paid only \$4.46 per MHz-Pop by bidding in the closed segment of the auction.³⁹

Thus, by giving rise first to NextWave and then to Alaska Native, the FCC's spectrum set-aside program twice created unsustainable wireless carriers (Alaska Native was designed to be unsustainable).⁴⁰ The FCC's spectrum set-asides were ultimately unable to prevent large wireless service providers from leasing or purchasing spectrum allocated to designated entities. However, the set-aside program simply delayed the sale of that spectrum to the firms that eventually found use for it and thereby reduced the value of services available to consumers in the interim.

II. European Spectrum Auctions and New Wireless Entrants

Spectrum auctions in Europe also prove that set-asides are not a productive way to encourage efficient entry into a wireless market. Specifically, the auction for UMTS spectrum in the United Kingdom served only to subsidize Hutchinson, a large firm that would not require a subsidy were it efficient for it to enter the U.K. wireless market. Furthermore, entrants throughout Europe have exhibited a high rate of failure. This fact leads one to believe that entry into the wireless markets is often uneconomical, and that a spectrum set-aside would only serve to attract entrants that are not viable.

A. The United Kingdom's UMTS Spectrum Auction

The United Kingdom's auction for UMTS spectrum began on March 6, 2000 and ended on April 27, 2000.⁴¹ The auction raised £22.5 billion, which amounted to \$35.7 billion on the day that the auction was completed. Five blocks of spectrum, each with nationwide coverage, were let at auction. The A block, which was spectrum designated only for a new entrant, consisted of 15 MHz of paired spectrum and 5 MHz unpaired. The B block could be won by any bidder — entrant or incumbent — and consisted of 15 MHz of paired spectrum and no unpaired spectrum. Finally, the C, D, and E blocks included 10 MHz of paired spectrum and 5 MHz unpaired. These blocks were open to any interested bidder.

1. The United Kingdom's Set-Aside Led to an Inefficient Allocation of Spectrum

The A block sold for £4.4 billion to TIW, which was a joint venture between Telesystem International Wireless and Hutchinson Whampoa.⁴² Hutchinson Whampoa is a leading international telecommunications firm that reported \$4.8 billion in profits during

2000.⁴³ The B block sold for £5.9 billion.⁴⁴ The C, D, and E blocks, which were all nearly identical, all sold for between £4.0 billion and £4.1 billion to Orange, One2One, and BT3G.⁴⁵ The following table expresses these bids in terms of pounds per MHz-Pop and pounds per MHz-Pop of paired spectrum.

Table of Prices per MHz-Pop for Paired Spectrum and All Spectrum in the U.K. UMTS Auction

Block	Winning Bidder	£ (billion)	£/MHz-Pop	£/Paired MHz-Pop
A	TIW (Hutchinson)	4.4	2.1	4.9
B	Vodafone	5.9	3.3	6.7
C	BT	4.0	2.7	6.7
D	One2One	4.0	2.7	6.7
E	Orange	4.1	2.7	6.8

The data in the above table show that the set-aside licence for a new entrant afforded Hutchinson⁴⁶ a price discount for all spectrum and paired spectrum. Hutchinson paid £2.1 per MHz-Pop for the 35 MHz of spectrum it won at auction, whereas Vodafone paid £3.3 per MHz-Pop for 30 MHz. For paired spectrum, Hutchinson paid £4.9 per MHz-Pop for 15 MHz paired, while all other bidders at auction paid between £6.7 per MHz-Pop and £6.8 per MHz-Pop. Therefore, the United Kingdom's set-aside to a new entrant simply subsidized the price of spectrum for a large international firm that arguably did not need a subsidy.

The size of Hutchinson's subsidy serves as an estimate of the amount of the inefficiency caused by the set-aside in the U.K. auction. To determine the amount of that subsidy, one must know the allocation and prices of spectrum but for the set-aside. Such a calculation is impossible to determine with perfect accuracy, but an estimate of it can be determined as follows.

Because Hutchinson bid in excess of £4 billion for the licence it won, it would have won a licence in an auction even without a set-aside. The marginal bidder in the open auction would have been NTL, which dropped out in round 150 when the price reached £4 billion for 10 MHz paired.⁴⁷ Therefore, the price of a C, D, or E block (10 MHz paired) licence still would have been £4 billion plus one bid increment, or £4.06 billion. Furthermore, Hutchinson valued a licence with 15 MHz of paired spectrum by approximately £700 million more than a licence with only 10 MHz paired.⁴⁸ Adding one bid increment to £4.7 billion yields a price for the A and B licences of £4.83 billion — a price that Vodafone and BT likely would have been willing to pay for the spectrum.⁴⁹ Consequently, an estimate of the size of Hutchinson's subsidy, and an estimate of the size of the inefficiency of the United Kingdom's set-aside, is £4.83 billion - £4.38 billion = £450 million.⁵⁰

2. TIW Is Struggling Despite Its Large Subsidy

In addition to the cost of the spectrum, Hutchinson built out its mobile network at a cost of £13 billion.⁵¹ However, due to its late entry into the U.K. market — Hutchinson first offered service under the brand name “3” in 2003 — it is currently the smallest provider of wireless service in the United Kingdom.⁵²

Because its late entry into the mobile marketplace put 3 at a disadvantage relative to its competitors, 3 has attempted to add subscribers and increase service revenues by providing additional services such as mobile Internet access on both wireless handsets and laptop computers.⁵³ Furthermore, there is good reason to believe that the U.K. wireless market was competitive even before 3 began to provide service. Were the market uncompetitive, then one would expect that 3's entry would result in significant price decreases for wireless communications services. However, wireless voice prices declined significantly *before* 3 entered the market, and decreases in voice prices after 3 entered were due to regulated reductions in mobile termination charges.⁵⁴

There is a substantial possibility that one of the other wireless service providers may acquire 3, which is not expected to become profitable until 2008 at the earliest, eight years after it first acquired its spectrum licence.⁵⁵ Therefore, although regulators in the United Kingdom were successful in facilitating entry into the wireless services market by allowing an entrant to obtain spectrum in the UMTS auction at a lower price than those paid by incumbents, the new entrant is currently struggling despite the fact that it is a large company with vast financial assets.

B. Germany's UMTS Spectrum Auction

Germany's auction for UMTS spectrum began on July 31, 2000⁵⁶ and ended on August 17, 2000.⁵⁷ That auction included 12 spectrum blocks that were each 5 MHz paired (120 MHz of spectrum in total).⁵⁸ Eligible bidders were required to be active on at least two blocks of spectrum in any given round and were allowed to be active on no more than three blocks of spectrum.⁵⁹ Put simply, winning bidders were required by rule to win at least 10 MHz paired, but could win no more than 15 MHz paired. For this reason, at least four bidders were guaranteed to win spectrum at auction. With four incumbent providers at the time of the auction, and with no spectrum set-aside for a new entrant, the auction rules did not guarantee that a new entrant would be born from the auction.

Winning bidders included four incumbent wireless carriers and two new entrants. The two new entrants were MobilCom and Group 3G.⁶⁰ The entrants were not small domestic carriers, however. MobilCom was a

reseller of wireless service in Germany that had financial backing from France Telecom,⁶¹ and Group3G was a consortium of Sonera and Telefonica. Telefonica is a leading worldwide telecommunication provider with revenues of €31 billion in 2001.⁶² Sonera, a leading provider of telecommunications services in Finland, had net income equal to €284 million in 2001.⁶³ Therefore, although Germany introduced two new wireless providers to its market through its sale of 3G spectrum licences, those two new entrants were large companies with telecommunications expertise in other countries, and they were not provided with subsidized entry by the auction.

Despite the financial strength of the parent companies of the wireless entrants in the German market, both MobilCom and Group 3G experienced difficulty soon after entry. Investors criticized bidders for bidding so aggressively for the spectrum and stated that the German market could not support six 3G service providers.⁶⁴ Ultimately, Sonera and Telefonica abandoned their joint venture, Group 3G,⁶⁵ as both companies wrote off the debt they incurred by bidding in the 3G Auction in Germany and attempting to deploy the spectrum after the auction.⁶⁶ Ultimately, Group 3G returned its spectrum won at auction back to the German government.⁶⁷ Soon after Group 3G's demise, MobilCom returned its spectrum won at auction to the German regulator⁶⁸ as France Telecom and MobilCom reached agreements with one of MobilCom's creditors, Nokia, on a restructuring of MobilCom's loans.⁶⁹ Hence, the German UMTS auction also serves as an example of the inability of regulators to induce new entry into a wireless industry that is already competitive.

C. Other UMTS Spectrum Auctions

Several other European countries have seen new service providers enter their wireless markets by first winning spectrum at auction. As in the United Kingdom and Germany, however, those entrants have been large companies that provide telecommunications services in other countries. Furthermore, some of these entrants have proven unsuccessful and have exited the industry, while other entrants have, thus far, proven to be viable. The successful entrants, however, did not require a spectrum set-aside or other subsidies to enter the market successfully.

For example, 3G Mobile, a unit of Spain's Telefonica SA, and Hutchinson 3G, a unit of Hong Kong's Hutchinson Whampoa Ltd., were both new entrants that won licences in the Austrian spectrum auction that took place in November 2000.⁷⁰ 3G Mobile proved unsuccessful and exited the Austrian market in late 2003, selling its spectrum licences to T-Mobile, an incumbent service provider in Austria.⁷¹ Hutchinson 3G, however, deployed the spectrum it won at auction and is continuing to provide service in Austria.

A similar situation occurred in the Swiss UMTS auction that took place in 2000. In that auction, four spectrum licences of equal size (15 MHz paired and 5 MHz unpaired) were awarded.⁷² Because there were only three incumbents, the auction effectively guaranteed at least one new entrant. However, that entrant would receive identical spectrum to any other winning bidders. Furthermore, that entrant would, by design, pay the same price as other bidders at auction.⁷³

The three incumbent providers, Swisscom, Orange, and dSpeed, each won a licence.⁷⁴ The other licence was awarded to Team3G, which was a division of Telefonica.⁷⁵ Telefonica, however, never built out the network necessary to deploy the spectrum it won at auction. As a result, the licence was rescinded in April 2006.⁷⁶ Therefore, auctions for spectrum in Austria and Switzerland both serve as examples that new entrants into wireless markets are often prone to failure.

These auctions should not be viewed by policy-makers as providing a justification for *precluding* new entrants from establishing wireless service in already competitive markets. However, they should serve as a warning to regulators that *subsidizing or attempting to facilitate* entry into the wireless industry runs the risk of allocating spectrum in an inefficient manner. As a result, the spectrum would go unused by the firm most qualified to deploy it.

III. An Analysis of the AWS Spectrum Auction Reveals That a Set-Aside for a Domestic Entrant Is Unnecessary

A spectrum set-aside for a domestic entrant would likely result in an inefficient allocation of the AWS spectrum. The Canadian wireless market, which is already competitive, has shown that it is unable to support four domestic carriers under current ownership rules. Were Industry Canada to decide that some form of market intervention is required, removing the foreign ownership restriction and rejecting a spectrum set-aside for *any* entrant would be a far more productive way to encourage entry into the Canadian wireless market. Specifically, such an auction would first determine whether or not entry is viable, and second, regardless of whether or not entry occurs, the auction would be more likely to result in an efficient allocation of spectrum. Furthermore, the AWS spectrum is new bandwidth that will need to be built out by all winning bidders. An incumbent wireless carrier would not have a substantial cost-based advantage over a new entrant in deploying the spectrum.

A. A Set-Aside for a Domestic Entrant Would Result in an Inefficient Allocation of Valuable Spectrum

As stated above, Industry Canada has acknowledged that a spectrum set-aside runs the risk of subsidizing entry of inefficient carriers. However, Industry Canada does not acknowledge that because of Canada's restriction on foreign entry into the Canadian wireless industry, a spectrum set-aside would likely amount to an allocation of spectrum to the third-best carrier. Specifically, for a spectrum allocation to a new *domestic* entrant to be efficient, that domestic firm must value the spectrum more, at the margin, than both the incumbent wireless carriers and a foreign entrant. For this reason, and regardless of whether foreign ownership restrictions are lifted, it makes more sense for Canada to use an efficient and open auction to (1) determine if entry is viable, and (2) allocate spectrum to the best-suited entrant if competitive bidding reveals that an entrant is justified.

1. A Domestic Entrant Is Viable Only if That Entrant Values the Spectrum More Than a Foreign Entrant with Expertise in Wireless Services

Any new entrant will be viable only if that entrant is able to provide a service that is valued sufficiently by the market so as to allow the entrant to cover its recurring costs.⁷⁷ The value of spectrum is determined by the net present value of the services that can be provided through the use of that spectrum. A viable entrant would need to value the first blocks of spectrum purchased at a higher rate than incumbent wireless carriers in Canada. Although it is conceivable that a domestic entrant fitting this criterion already exists, it is more likely that such an entrant would be a firm already equipped with expertise in the provision of wireless communications services. Therefore, a necessary (but not sufficient)⁷⁸ condition for a domestic entrant to be viable is that the entrant must either (1) provide a wireless service to Canadian consumers that is more valuable than one provided by a foreign entrant, or (2) provide a service of similar value to consumers as the foreign entrant but at a lower cost. For this reason, a spectrum set-aside for a domestic entrant risks allocating the spectrum in a "third-best" manner.

2. A Removal of the Foreign Ownership Restriction Would Be Economically Superior to a Spectrum Set-Aside for a Domestic Entrant Were Industry Canada To Decide That Intervention Is Required

Because it is not apparent that there exists a domestic entrant that values the AWS spectrum more than both a foreign entrant and/or domestic incumbents, a set-aside for a domestic entrant would likely result in a third-best allocation of spectrum. Although competitive forces eventually correct an inefficient spec-

trum allocation — either the entrant would fail and return the spectrum for re-auction or it would sell the spectrum to a competitor — costs would be imposed on consumers by delaying the consumption of the services provided through that spectrum. Therefore, consumers would benefit if the auction results in an efficient spectrum allocation *ab initio* and avoids the need for the efficient allocation to be determined years hence on the secondary market.

Furthermore, we note that the first-best outcome can only be achieved without a set-aside for *any* new entrant. That is, even if the foreign ownership restriction is lifted, Industry Canada might be tempted to provide a set-aside for a new entrant, regardless of whether that entrant is domestic or foreign. Although such an auction would be more efficient than one that only allowed domestic entrants to compete for a spectrum set-aside, it would still run the risk of allocating spectrum to an entrant when that spectrum would be most efficiently used by an existing incumbent. Simply put, a spectrum set-aside for *any* entrant would potentially allocate spectrum in a second-best manner.

Although there is no convincing evidence that the Canadian wireless market is not competitive, if Industry Canada is truly interested in determining whether or not a fourth facilities-based wireless firm is viable, the best environment in which to determine this viability would be one that eliminated the foreign ownership restriction and allowed all wireless carriers to compete on equal terms at auction. Such an auction would increase the likelihood that an efficient allocation of spectrum would occur, since all interested parties would be allowed to express, through competitive bidding, their values for the spectrum. By comparison, a spectrum set-aside for a new entrant would greatly increase the likelihood of an inefficient allocation of a valuable public resource — an action that is adverse to the welfare of Canadian consumers. Put differently, it is not apparent that any market intervention is necessary, but if Industry Canada seeks to determine the value of a fourth facilities-based wireless service provider, it should conduct a fair market-based test of the viability of such a provider rather than force the entrance of an inefficient provider that is very likely to fail.

B. Because the AWS Spectrum Is New Bandwidth, All Winning Bidders Will Incur Large Build-Out Costs after the Auction

As stated above, the value of spectrum is determined by the net present value of profits that can be achieved through the services provided on that spectrum. Because the costs of network equipment necessary to build out the spectrum are large, those build-out costs directly influence the price that a carrier is willing to pay for the spectrum in a competitive wireless market. Conse-

quently, an incumbent carrier is willing to pay a premium for spectrum that it can easily patch into its existing network. By contrast, an incumbent carrier will discount its willingness to pay for new spectrum which must be built out with new network equipment, by the price of that equipment.⁷⁹

The majority of spectrum used to provide commercial wireless services is Canada's PCS spectrum, which is in the 1.9 GHz band. Because the AWS spectrum is located in a different band, new wireless equipment will be required to deploy that spectrum. Furthermore, new handsets that operate on both the AWS band and the PCS band will be needed. Therefore, incumbent bidders will be unable to integrate this new spectrum into their existing wireless operations without incurring significant levels of investment. As a result, incumbent carriers' build-out costs after the auction will be similar to the build-out costs of a large entrant. For this reason, it makes little sense to subsidize a new entrant since that entrant is at no cost disadvantage relative to the incumbent in deploying the spectrum.

Conclusion

A spectrum set-aside for a domestic entrant in Canada's forthcoming auction for Advanced Wireless Services spectrum in the 2 GHz band would likely result in an inefficient allocation of a valuable public resource. Industry Canada should carefully reflect upon the disastrous outcome of the FCC's set-aside auctions. Those auctions resulted in nearly a decade-long delay in

the provision of PCS spectrum to the marketplace, and resulted in the creation of bidding fronts that both distorted auction prices and were costly to create. Furthermore, the spectrum set-aside in the United Kingdom merely provided a subsidy to a large multi-national firm that (1) did not need the subsidy to begin with, and (2) is teetering on the brink of failure even after having received that subsidy. Finally, other spectrum auctions in Europe have shown that subsidies are not required for entry to be successful, so long as all potential entrants are allowed to bid.

Although there is no evidence that the wireless industry in Canada is less than competitive, Industry Canada should still reject a spectrum set-aside for a domestic entrant if it wants to determine whether a fourth wireless carrier is indeed needed. Specifically, a set-aside for a domestic entrant would amount to a *determination* on the part of Industry Canada that (1) a new entrant is needed to increase competition, and that (2) the most efficient entrant resides within Canada. Instead, Industry Canada could use an auction without a spectrum set-aside to *test for* the viability of a new facilities-based entrant. That is, if competition and innovation in the Canadian wireless industry are truly lacking, a new entrant would emerge from an auction for bandwidth that must be built out by *any* winning bidder (either entrant or incumbent). Therefore, Industry Canada should reject a spectrum set-aside, which could, with reasonable likelihood, *force* the allocation of spectrum to an inferior carrier and reduce the economic welfare of end-users.

Notes:

¹ Industry Canada, Telecommunications Policy Branch, *Consultation on a Framework to Auction Spectrum in the 2 GHz Range Including Advanced Wireless Services* (Ottawa: Industry Canada, Feb. 2007), Reference Number: DGTP-002-07, online: <[http://strategis.ic.gc.ca/epic/site/smt-gst.nsf/vwapj/aws-consultation-e.pdf/\\$FILE/aws-consultation-e.pdf](http://strategis.ic.gc.ca/epic/site/smt-gst.nsf/vwapj/aws-consultation-e.pdf/$FILE/aws-consultation-e.pdf)>.

² *Ibid.* at 26-27.

³ *Ibid.* at 29.

⁴ *Ibid.*

⁵ *Ibid.*

⁶ *Ibid.* at 33.

⁷ *Ibid.* at 21.

⁸ *Ibid.*

⁹ *Ibid.*

¹⁰ Indeed, there is ample evidence that the industry is competitive: See, e.g., Wall Communications Inc., "An Examination of Issues Raised in the Telecommunications Policy Review Panel's March 2006 Report Regarding the Canadian Mobile Wireless Services Industry" (19 September, 2006), at 17-20 (discussing how statistics on minutes of use, average revenue per user, and data usage in Canada compare favourably to both the United States and Europe).

¹¹ The first two blocks auctioned were the "A" and "B" blocks, which were divided into 51 separate geographic areas called "Major Trading Areas". In auctioning these blocks, the FCC provided no bidding preferences to any entities. For information on the A and B blocks auction, see U.S., Federal Communications Commission, "FCC Auctions: Summary: Auction 4", online: Federal Communications Commission <http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=4>.

¹² In mandating that the wireless industry be free from price regulation, the United States Congress instructed the FCC to "ensure that small businesses, rural telephone companies, and businesses owned by members of minority groups and women are given the opportunity to participate in the provision of spectrum-based services, and, for such purposes, consider the use of tax certificates, bidding preferences, and other procedures". See 47 U.S.C. § 309(j)(4)(D). The designated entity program was the FCC's response to that mandate. In its original form, the designated entity program allowed specific provisions for women- and minority-owned business. See Implementation of Section 309(j) of the Communications Act — Competitive Bidding, *Fifth Report & Order*, 9 F.C.C.R. 5532, ¶ 174, 75 Rad. Reg. 2d (P & F) 859 (1994). However, the Supreme Court's decision in *Adarand Constructors, Inc. v. Peña*, (see *Adarand*, 515 U.S. 200, 227 (1995)) forced the FCC to impose a strict standard for favouring race in its designated entity program. Ultimately, the FCC used business size only as a qualification for a firm to achieve designated entity status.

¹³ The F block was let at auction in 1996 (soon after the sale of C block spectrum) and was sold simultaneously with two other blocks of PCS spectrum that were open to large firms.

¹⁴ One subsidy given to bidders in the C block auction was favourable loans that delayed payment on winning bids to the government at an interest rate below the competitive market rate. In addition, the FCC allowed winning bidders to restructure their winning bids after the auction. The ability to restructure, however, was granted after the auction once the FCC recognized that designated entities were having financial difficulty as a result of strong bidding in the C block auction.

¹⁵ U.S., Federal Communications Commission, *Amendment of the Commission's Rules Regarding Installment Payment Financing For Personal Communications Services (PCS) Licensees, Second Report and Order*

and *Further Notice of Proposed Rule Making* (September 25, 1997) at 4 ¶6.

¹⁶ *Ibid.* at 21 ¶38.

¹⁷ *Ibid.* at 28 ¶55.

¹⁸ *Ibid.* at 32 ¶64.

¹⁹ MHz-Pop, which is the product of bandwidth and population under-neath the licencing area, is commonly used to define the “quantity” of spectrum won.

²⁰ *NextWave Personal Communications, Inc. v. FCC*, 254 F.3d 130 (D.C. Cir. 2001). The FCC eventually allowed bidders to opt out of bids on licences sold in Auction 35 that the FCC was unable to deliver in a timely manner.

²¹ Cingular Wireless, News Release, “Cingular Wireless and NextWave Telecom Agree to Terms for Spectrum Licenses” (5 August, 2003) online: Cingular Wireless <http://cingular.mediaroom.com/index.php?s=press_releases&item=523>.

²² *Ibid.*

²³ *Ibid.* (stating that \$1.4 billion in spectrum covered 83 million persons with 10 MHz of bandwidth).

²⁴ Verizon Wireless, News Release, “Verizon Wireless Completes Purchase of NextWave Spectrum Licenses in 23 Markets” (3 April, 2005) online: Verizon Wireless <<http://news.vzw.com/news/2005/04/pr2005-04-13.html>>.

²⁵ *Ibid.*

²⁶ The FCC also designated the F block spectrum as a set-aside to small bidders. The F block was originally sold simultaneously with the D and E PCS blocks. However, only designated entities were allowed to bid on the F block, which was closed to large bidders. Because prices in this particular auction were far lower than those in the C block auction, the rate of default was much lower. Nevertheless, many of the F block licences were re-auctioned with the NextWave spectrum in FCC Auction 35.

²⁷ Thomas W. Hazlett & Babette E.L. Boliek, “Use of Designated Entity Spectrum Preferences in Assigning Wireless Licenses” (May 1999) 51 Fed. Comm. L. J. 639 at 648-49.

²⁸ *Ibid.* at 649. The 53 per cent figure does not include the 63 licences won by NextWave, which had yet to declare bankruptcy. Were one to include those licences one would conclude that 62 per cent of the C block licences were allocated in an inefficient manner. Finally, one must note that Hazlett’s measure of efficiency understates the *inefficiency* of the C block auction because it does not capture what would have happened had large wireless carriers been allowed to compete at auction for the C block spectrum.

²⁹ *Ibid.* at 649-50.

³⁰ *Ibid.* at 655-58.

³¹ *Ibid.* at 656-57.

³² *Ibid.* at 657.

³³ U.S., Federal Communications Commission, *Report: Amendment of Part 1 of the Commission’s Rules — Competitive Bidding Procedures*, WT Docket No. 97-82, Order on Reconsideration of the Third Report and Order, Fifth Report and Order, and Fourth Further Notice of Proposed Rule Making (FCC 00-274) (14 August, 2000).

³⁴ For a detailed explanation of the *de facto* standard, see the Commission’s affiliation rule at 47 C.F.R. §1.2110(b)(4); see also *Ellis Thompson Corp.*, 10 FCC Rcd. 12,554, 12,555-56 (1994), in which the Commission identified the following factors used to determine control of a business: (1) use of facilities and equipment; (2) control of day-to-day operations; (3) control of policy decisions; (4) personnel responsibilities; (5) control of financial obligations; and (6) receipt of monies and profits; *Intermountain Microwave*, 12 FCC 2d. 559 (1963), and *Application of Baker Creek Communications, LP, For Authority to Construct and Operate Local Multipoint Distribution Services in Multiple Basic Trading Areas, Memorandum Opinion and Order*, 13 FCC Rcd. 18,709 (23 September, 1998).

³⁵ Peter C. Cramton, Allan T. Ingraham, and Hal J. Singer, “The Impact of Incumbent Bidding in Set-Aside Auctions: An Analysis of Prices in the Closed and Open Segments of FCC Auction 35”, (Dec. 2002), online: Social Science Research Network <<http://ssrn.com/abstract=387300>> at 28-30 [“Incumbent Bidding”].

³⁶ For the salient data on FCC Auction 35, see U.S., Federal Communications Commission, “FCC Auctions: Summary: Auction 35,” online: Fed-

eral Communications Commission <http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=35>.

³⁷ Cramton, Ingraham & Singer, “Incumbent Bidding”, *supra* note 35.

³⁸ *Ibid.* at 31.

³⁹ *Ibid.*

⁴⁰ *Ibid.*

⁴¹ Auction details are available at the Radiocommunications Authority’s legacy Web site: U.K., Radiocommunications Authority, “Spectrum Auctions: 3G Mobile Spectrum Auction”, online: Office of Communications <http://www.ofcom.org.uk/static/archive/spectrumbauctions/auction/auction_index.htm>.

⁴² See, e.g., Hutchinson Whampoa, News Release, “TIW Wins UMTS License in the United Kingdom” (April 27, 2000) online: <http://www.hutchinson-whampoa.com/upload_docs/2000/04/Corporate/81/81_eng.htm>.

⁴³ See Hutchinson Whampoa, “Consolidated Profit and Loss Account for the Year Ended December 2000” online: <<http://202.66.146.82/listco/hk/hutchison/annual/2000/cpnl.pdf>>.

⁴⁴ *Ibid.*

⁴⁵ *Ibid.*

⁴⁶ For the remainder of this paper we refer to the bidding entity TIW as Hutchinson, since it was Hutchinson that eventually deployed the spectrum under the brand name “3”.

⁴⁷ See U.K., Radiocommunications Authority, “3G Mobile Spectrum Auction: Round By Round Reports”, online: Office of Communications <http://www.ofcom.org.uk/static/archive/spectrumbauctions/auction/auction_index.htm>.

⁴⁸ In round 129, TIW was standing high bidder on the D block (10 MHz paired) at a price of £3.59 billion. It was bumped from this block by One2One in round 130. TIW then switched to the A block (15 MHz paired) in round 131 at a price of £4.38 billion. The price of a C, D, or E block in round 131 was approximately £3.68 billion, which indicates that TIW’s marginal value of 5 MHz paired was approximately £700 million. Consequently, if, in an auction with no set-aside, the minimum price of 10 MHz is £4 billion, TIW would have bid up to £4.7 billion for the A or B licence. Note, however, that this calculation assumes that TIW was not subject to a budget constraint between £4.3 billion and £4.7 billion.

⁴⁹ Since it bid £5.8 billion in the actual auction, Vodafone obviously would have bid £4.83 billion in an auction without a set-aside. BT likely would have bid £4.83 billion too, considering that it has been revealed after the auction that a primary concern for BT was ensuring that it did not pay for more spectrum, in £/MHz terms, than other bidders at auction. See Dan Maldoom, “A Comment on ‘Strange Bids: Bidding Behavior in the United Kingdom’s Third Generation Spectrum Auction’ by Tilman Borges and Christian Dustman” (2005) 115 Econ. J., 579 at 581-82. At £4.83 billion, the price of the A or B block would be cheaper, in paired MHz terms, than the price of the C, D, or E blocks at £4.06 billion. Therefore, it is reasonable to conclude that BT would have opted for the A or B blocks. Also, while bidding up Vodafone on the B block, BT was the temporary high bidder on that block at a price of £5.8 billion in round 142 of the auction.

⁵⁰ One might argue that this inefficiency was beneficial so long as wireless prices declined as a result of TIW’s entry into the U.K. wireless industry. This, however, did not occur. In particular, the most significant reductions in per minute wireless revenues in the United Kingdom occurred between 2001 and 2003, before 3UK had even begun to offer service. See U.K., Ofcom, *The Communications Market 2006* (Aug. 10, 2006) at 151 [“Ofcom 2006 Report”]. Furthermore, per minute price decreases since 2003 are mostly due to decreases in off-network price from reductions in mobile call termination charges. See *Ibid.* Therefore, the U.K. market was sufficiently competitive without the addition of 3UK.

⁵¹ Nic Fildes, “Hutchinson Scraps Plan to Float UK Mobile Arm” *The Independent* (Nov. 17, 2006) [“Hutchinson Scraps Plan”].

⁵² *Ibid.*

⁵³ Tim Richardson, “3UK Confirms Mobile Web” *The Register* (Sept. 12, 2005).

⁵⁴ See “Ofcom 2006 Report”, *supra* note 50 at 151. Furthermore, 3 has average prices that are *higher* than those of other competitors, which is a further indicator that 3’s entry did not put downward pressure on prices for voice services. *Ibid.*

- ⁵⁵ "Hutchinson Scraps Plan", *supra* note 51.
- ⁵⁶ "Dutch Auction Ends, French 3G Decision Delayed" 18 *Wireless Insider* 30 (31 July 2000).
- ⁵⁷ "Telecommunications — World Record Bidding for UMTS In Germany" *Tech Europe* (Sept. 1, 2000).
- ⁵⁸ Bundesnetzagentur, Ruling of 18 February 2000 by the President's Chamber on the Rules for Conduct of the Auction for the Award of Licences for the Universal Mobile Telecommunications System (UMTS)/International Mobile Telecommunications-2000 (IMT-2000); Third Generation (3G) Mobile Communications, online: <<http://www.bundesnetzagentur.de/media/archive/2165.pdf>>.
- ⁵⁹ *Ibid.*
- ⁶⁰ Kristin Ridley, "Germany UMTS bids top \$4.5 bln, Mannesmann in lead" *Reuters News* (Aug. 4, 2000) ["Germany UMTS"]. (The six firms to win licences in the German spectrum auction were T-Mobil, Mannesmann, E-Plus, Viag, MobilCom, and Group 3G. Ridley lists T-Mobil, Mannesmann, E-Plus, and Viag as German cellphone groups and lists MobilCom as a France Telecom-backed reseller and Group 3G as a consortium of Sonera of Finland and Telefonica of Spain.)
- ⁶¹ "Germany UMTS", *supra* note 60.
- ⁶² Telefonica, "2002 Annual Report", online: Telefonica <<http://www.telefonica.es/accionistaseinversores/ing/html/financyreg/informesanuales.shtml>>.
- ⁶³ Sonera "2001 Annual Report," online: Sonera <http://www.teliasonera.se/GetImages/GetImages_GetImage_pdf/0,1168,62467,00.pdf>.
- ⁶⁴ See e.g., Ray Le Maistre, "Dead End for German 3G Dodos" *Unstrung* (Nov. 9, 2002).
- ⁶⁵ See e.g., "Sonera and Telefonica Switch Off in Germany" *3G Newsroom* (July 25, 2002).
- ⁶⁶ *Ibid.*
- ⁶⁷ "Telefonica Moviles Fights to Keep Italian License" *3G Newsroom* (July 25, 2004), online: www.3gnewsroom.com/3g_news/jul_04/news_4684.shtml.
- ⁶⁸ Ouida Taaffe, "The 3G Waiting Game" *Telecommunications International* (Feb. 2004), online: Looksmart <http://findarticles.com/p/articles/mi_m0IUL/is_2_38/ai_n6354537>.
- ⁶⁹ See e.g., Mark Berniker, "Nokia Backs France Telecom Bailout Plan of MobilCom" *InternetNews.com*, (November 25, 2002).
- ⁷⁰ Rhea Wessel, "Austria 3G Auction Phase 1 Ends with Total Bids EUR 704 Million" *Dow Jones Int'l News* (Nov. 3, 2000).
- ⁷¹ T-Mobile, News Release, "T-Mobile Austria Takes over UMTS Block of Frequencies" (March 30, 2004), online: T-Mobile <http://www.t-mobile.at/unternehmen/presse/pressreleases/pressreleases_2004/2004_03_30/index.html>
- ⁷² Elmar Wolfstetter, "The Swiss UMTS Spectrum Auction Flop: Bad Luck or Bad Design?" *CESifo Working Paper No. 534* (Aug. 2001) at 3 ["Swiss UMT Spectrum"].
- ⁷³ Without a spectrum set-aside, any bidder (entrant or incumbent) would be allowed to bid on any licence. With identical licences, it would be the case that any eligible bidder that was not, in any given round, a "standing high" bidder, would choose to bid on the lowest priced licence. As a result, the licence prices would rise together and the auction would end with near identical prices across licences.
- ⁷⁴ "Swiss UMT Spectrum", *supra* note 72.
- ⁷⁵ *Ibid.*
- ⁷⁶ Timo Poropudas, "Telefonica Loses Swiss 3G License" *Mobile Monday* (April 16, 2006).
- ⁷⁷ See e.g., Robert S. Pindyck and Daniel L. Rubinfeld, *Microeconomics*, 6th ed. (Upper Saddle River, NJ: Pearson Prentice Hall, 2005) at 269.
- ⁷⁸ This condition does not guarantee that the domestic entrant is viable, as it could be the case that the Canadian wireless industry can only support the three wireless carriers that currently exist. Put differently, a sufficient condition is one where the domestic entrant can provide either (1) a more valuable service than either an incumbent or a foreign entrant, or (2) it can provide a lower-cost service than either an incumbent or a foreign entrant.
- ⁷⁹ See e.g., Peter Cramton, "Estimating Auction Revenues for the Proposed FCC Sale of 3G Spectrum for Broadband and Advanced Wireless Services" *Criterion Auctions Working Paper* (Dec. 2003) at 12, online: <<http://www.cramton.umd.edu/papers2000-2004/cramton-us-3g-spectrum-valuation.pdf>>.