ON A COMMON WAVELENGTH: CONVERGENT CANADIAN AND AMERICAN SPECTRUM ALLOCATION POLICY

by

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B.A., University of British Columbia, 1994

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS

in the Department of Political Science

SIMON FRASER UNIVERSITY

June 1997

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DEGREE: Master of Arts

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On a Common Wavelength: Convergent Canadian and American Spectrum Allocation Policy

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On a Common Wavelength: Convergent Canadian and American Spectrum Allocation Policy

Interest in the convergence thesis has been rekindled since the end of the Cold War. National policy systems face pressures of conformity, especially within integrative regimes such as the European Union or the North American Free Trade Agreement. These cases of regional integration provoke questions about the relationship between international systems and national policy development.

A systemic focus, utilizing aggregate information, obscures the variety of processes below the 'surface' of a given sector and often fails to reveal any useful evidence of policy convergence. Instead, a focus on a particular policy problem at the meso, or sectoral level has the potential to avoid the artificial delineation of system and shed light upon interactions that cross organizational and territorial boundaries to define the problem facing policy-makers.

This investigation isolates a policy field in Canada, specifically, radio spectrum allocation, and examines the development of policy over the last decade. A comparison between the Canadian regulatory regime and that of the United States is made, with the intention of establishing the existence or absence of policy convergence within the last decade, or in the foreseeable future. A series of comparative case studies in cellular radio, personal communications services, and local multipoint communications provide

evidence that Canadian spectrum allocation policy indeed is becoming similar to that of the United States. However, while Canadian policy instruments increasingly resemble those of the Americans, policy convergence is primarily observable in a shift of Canadian policy style. Furthermore, there is conclusive evidence that this policy convergence is a deliberate outcome of decisions made by domestic actors, and not the consequence of societal homogenization imposed upon industrial states by globalization or a deterministic technological imperative.

Acknowledgments

This project is my first serious foray into academic writing and as such, constitutes my first tentative steps on the "road to Rome". I would like to extend my thanks to the individuals that contributed their time and energies to helping me realize this thesis, namely my supervising committee, Professor Michael Howlett, Department of Political Science, Simon Fraser University and Professor Catherine Murray, School of Communications, Simon Fraser University. Professor Laurent Dobuzinskis, Department of Political Science, Simon Fraser University, provided important guidance as an external reader. Thanks to Professor Colin Bennett, Department of Political Science, University of Victoria, for accepting the role of external examiner.

I would like to acknowledge the help of several Industry Canada officials, consenting to interviews and responding to my e-mailed inquiries: Bob Fedoruk, David Warnes, and Darius Breau. I would also like to express my appreciation to the legion of nameless Industry Canada staff who tracked down many of the more obscure policy documents from departments and libraries across Canada. Further thanks are to be extended to Steven Delaney at the Telecommunications Directorate of the CRTC, and Harminder Gill, PCS Marketing Manager at BC Tel Mobility, for their time, and to Bonnie Lynn Baillie for proofreading this document. Finally, thanks go to Marty Allen, Budgets and Results Manager at the BC Tel Call Centre and Su Ann Lim, Sales Planning Manager, BC Tel, for their help. For any omissions or oversights in these acknowledgments (or in the material that follows) I claim sole responsibility.

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Chapter I: Introduction

Despite being criticized as an overly deterministic theoretical framework, convergence theory nevertheless has demonstrated considerable longevity and relevance as an attempt to explain the increasing homogenization of industrial societies. Yet such system-level concepts often obscure, rather than reveal, the varied and complex processes that operate at the societal and sectoral levels. Social scientists must rely on precise meso-level policy analyses to craft arguments that support or assail the convergence thesis. Unfortunately, a mire of causal complexity becomes even more apparent as one descends into the policy systems that typify any public activity. In particular, the isolation of cause-effect relations of convergence is quite problematic when sought within the context of telecommunications policy.

The homogenization of standards and technologies through digitalization is often cited as the driving force of convergence between broadcasting and telecommunications.[1] Convergence can also refer to the merging of specific technologies, apparent at the consumer appliance level as televisions, personal computers, and telephony devices assume complimentary or similar functions, or at the sectoral level, i.e. the reintegration of telecommunications common carrier and broadcast content provider. Alternately, convergence can describe the observed shift of regulatory regimes toward similar regulatory policy. These three levels of process are intimately interrelated. Technological developments alter the positions of firms and consumers and conceivably, as a reaction

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[1]Organization of Economic Cooperation and Development, Convergence Between Communications Technologies (Paris: OECD, 1992), 13.

to market realignment initiated by the introduction of potentially revolutionary new technologies, the pressures for policy changes intensify as well. The opposite view argues public and commercial policy is the initiator of technological change, instead of being subordinated to it.[2] Debates rage over what compels policy transformation, rife with theoretical divisions between technological determinists and those that accord a greater role to human agency.

Nowhere is the rapid transformation of national telecommunications policy more evident than in the field of wireless telecommunications. The burgeoning growth of personal communications services (PCS), video on-demand services, wireless local area (LAN), wide area (WAN), and metropolitan area networks (MAN), satellite services, and digital audio broadcasting (DAB) demands an active management role of the radio spectrum on a scale unimaginable only a decade ago.[3] The importance of the radio spectrum in telecommunications systems is reflected in an estimate claiming the share of spectrum used by total voice traffic and all major information technology applications to be 30% by 2000.[4] Wireless services will account for a substantial (20 - 25%) portion of telecom industry revenues. The latter are expected to grow from $US 600 billion in 1997 to nearly $US 1.2 trillion in 2000, in light of the February 1997 World Trade Organization (WTO) telecom pact.[5] A premium has been placed upon a resource that has the potential to support services such as global roaming, number portability,[6] and the

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[2]Robert Babe, Telecommunications in Canada (Toronto: University of Toronto Press, 1990), 12

[3]Laurent Benzoni, and Eva Kalman, The Economics of Radio Frequency Allocation (Paris: OECD, 1993), 36.

[4]Simon Forge, "The Radio Spectrum and the Organization of the Future," Telecommunications Policy 20 (1996): 55.

[5]"Telecom Trade Deal Struck", Reuters February 15, 1997.

[6]Once the hardware, software, and support infrastructure are in place, mobile communications users will

ubiquitous access to information, as well representing more prosaic interests for developing countries, presented with an opportunity to establish telecommunications infrastructures cheaply, hurdling the developed world's slow movement from analogue to digital networks. Additionally, wireless telecommunications are regarded as a crucial industrial asset in the evolving information economies of North and South America, Europe, and Asia. Increasing demands are being made of a physically limited resource. While the currently exploitable spectrum, restricted to the range of 3 kHz (kilohertz) to 3000 GHz (gigahertz),[7] is expanding at the rate of 6 - 8% per year, demand for wireless services facilitated by technological innovations is leading to a congestion of existing spectral capacity *and* outstripping the growth of the spectrum. The physical characteristics of certain frequencies determine their suitability for various applications: 30 MHz (megahertz) to 1 GHz is the most exploited region of the spectrum for mobile communications because of these bands' unique properties including a range of 32 - 64 km and near line-of-sight propagation.[8] With the number of users of services concentrated in such narrow bands of spectrum increasing, the potential for signal interference becomes evident. The latter externality is the primary reason for the existence of spectrum regulatory regimes at the international, regional, and national level and is the source of a major policy problem currently faced by national and international regulators of the radio spectrum.

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be accessible theoretically anywhere on the globe (global roaming) and will have a telephone number independent of their geographical location (number portability).

[7]Laurent Benzoni, and Eva Kalman, 25.

[8]Michael Paetsch, Mobile Communications in the US and Europe: Regulation, Technology and Markets (Boston: Artech House, 1993), 55.

The term "spectrum allocation" refers to the apportionment of wireless communications frequencies by public regulatory agencies to commercial service providers (broadcasters, cellular companies, dispatch services), information technology and telecommunications equipment manufacturers, and public and private agencies. A distinction must be made between spectrum allocation and the policies of *spectrum utilization* which is concerned with the use to which a particular frequency band is put.[9] Furthermore, there exists a distinction between domestic and international spectrum allocation regimes. Each national regulator is granted considerable latitude to employ whatever regulatory scheme it deems most effective to allot frequencies to domestic users, as long as it does so within the spectrum assignment framework established by the International Telecommunications Union (ITU). Empowered by its mandate to "effect allocation of the radio frequency spectrum and registration of radio frequency assignments in order to avoid harmful interference between radio stations of different countries." (Article IV 18 (a)) [10] the ITU assigns spectrum to regions on the basis of *primary service designations*[11] which in turn, are subdivided by the national regulator of each respective state.

The most common techniques used by national agencies to apportion spectrum are some manner of administrative allotment such as comparative review or "first come, first served" distributions; lotteries; auctions; or a hybrid of these approaches. The choice of

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[9]Hereafter, we shall use spectrum or license allotment and allocation interchangeably.

[10]International Telecommunications Union, International Telecommunications Union Convention: Final Protocol, Additional Protocols, Optional Additional Protocols, Resolutions, Recommendations, and Opinions (Nairobi, 1982) (Geneva: General Secretariat of the ITU, 1982), 3.

[11]Differentiation is made between categories such as fixed, mobile, satellite, amateur, aeronautical, or radiolocation services.

policy instrument is influenced by a multiplicity of factors: the degree of the interventionism of the host state, the extent of liberalization of the national telecommunications market, the scope of commercial penetration into the policy process, and the physical properties of the spectrum that is being allotted. Two examples of regulatory systems typical of those found throughout the global telecommunications regulatory system can be viewed in the North American context.

Canadian and American goals in the field of radio spectrum currently differ. The American emphasis is on the facilitation of an efficient, free-market oriented allocation regime under the broad mandate given to the Federal Communications Commission (FCC) by the 1934 *Communications Act*, whereas Canadian policy presently stresses the orderly division of frequencies with a salient social welfare component. These policy goals are reflected in the manner in which spectrum is allocated by each state. In the U.S., the spectrum management role is primarily the purview of the FCC, an independent agency responsible for the management of spectrum for nonfederal uses. In a less public, but no less significant role, the National Telecommunications and Information Administration (NTIA) administers frequency usage by federal (typically military) entities. These two agencies jointly manage the national table of frequency allocation, and are subject to judicial review.[12] Traditionally, the FCC has facilitated the division of spectrum either through comparative hearings or license lotteries. Since 1994, large scale spectrum distribution in the United States is conducted via license auctions. Radio frequencies are granted to the highest bidder in a group of applicants who have made prior demonstration of their intent and capability to introduce new

[12]Laurent Benzoni, and Eva Kalman, 59.

products or services to the public. Arguably, this method is considered to be the most efficient and responsive to market demands -- while still according the state considerable policy discretion[13] -- with the added benefit of generating considerable revenue for the federal treasury.[14]

Canadian spectrum management is implemented by the minister responsible for Industry Canada, as defined by the *Radiocommunication* and *Telecommunications* acts. The spectrum management branch (DGSE) of Industry Canada has an important technical advisory role, and in cultural (usually broadcast related) issues or the regulation of common carriers, Heritage Canada and the Canadian Radio-Television Commission (CRTC) respectively, have jurisdiction as well. In contrast to the American process, Canadian spectrum policy focuses on ensuring the orderly development and efficient operation of the wireless communications industry with the intent of providing effective and affordable communications services to all Canadians, while at the same time promoting domestic control and ownership of carriers. A multistage comparative review process is the presently preferred mechanism for spectrum allotment encompassing procedures to solicit client interest, select service providers, allot spectrum, and issue licenses.[15] However, interest in American-style allocation policies of radio spectrum recently has been expressed by Industry Canada in the form of a February 1996 report. In autumn 1996, Industry Minister John Manley announced future local multipoint communications services (LMCS) licenses would be allotted via auctions. The Canadian

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[13]John McMillan, "Why Auction the Spectrum?" Telecommunications Policy 19 (1995): 199.

[14]$17 billion as of March, 1996. FCC Auctions Fact Sheet [http://www.fcc.gov/wtd/aucfct.html]

[15]Industry Canada, Industry Canada's Three-Phase Selection and Radio Licensing Process (Ottawa, 1994).

government is under considerable pressure from the telecommunications and broadcast industries to "rationalize" spectrum allocation. Furthermore, in an era of fiscal restraint, coupled with the reduced administrative capacity of federal departments there is a powerful incentive to seek more efficient means of executing their regulatory duties. Without exception, the alternative system sought has been some form of competitive bidding. Allegedly, radio license auctions would permit Industry Canada to set minimum entry criteria for applicant eligibility with less effort and at less cost than with the present process of administrative review. It is also debatable whether the Canadian government can resist the potential revenues generated by such a process, even taking into account Canada's considerably smaller telecommunications market.

Upon closer inspection of these two agency systems the question is whether, why, and how two different regulatory regimes can give rise to similar policies of radio spectrum management. Other questions materialize as well: to what extent does the requirement to adhere to technical standards influence spectrum policy? What influence do international organizations, such as the ITU have in encouraging the *Gleichschaltung* of policy instruments at the national level? To address these concerns adequately, one must further consider contemporary theories of convergence. An often cited definition of convergence as "the tendency of societies to grow more alike, to develop similarities in structures, processes, and performances."[16] summarizes the thesis pursued by many fields of social science.[17] According to early exponents of the convergence thesis, the

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[16]Clark Kerr, The Future of Industrial Societies (Harvard: Harvard University Press, 1983), 3.

[17]Brigitte Unger, and Frans van Waarden, "Introduction", 2 in Brigitte Unger and Frans van Waarden eds., Convergence or Diversity: Internationalization and Economic Policy Response (Brookfield: Avebury Ashgate Publishing Ltd., 1992)

shared problems faced by industrialized and industrializing states compel them to seek common solutions using instruments similar in function and form. Over time, these societies assume similar qualities in their drive toward modernization. Complementing this theory was the observation that actors become homogenous through the effects of the "technological imperative" that eventually subordinates all activity to the common dynamic of instrumental planning. Yet these systemic explanations smack of determinism and imprecision: broad generalizations and the reliance upon aggregate data that such arguments make blur the variation of sub-societal interactions.[18] These theories discourage the examination of underlying causal relationships. Alternative arguments have been advanced that emphasis intermediate or meso-level examinations of *sectoral convergence*. These can be further subdivided into categories of economic and policy convergence. The former is primarily the product of outcomes, measured by macroeconomic indicators such as interest or unemployment rates, or GDP.[19] However, there is some agreement between social scientists that economic convergence is observable in only a few fields (such as international trade) and that similar outcomes in other areas are often the product of policy decisions.[20] So it is to the latter that we turn our attention. In political science, theories of policy convergence are an outgrowth of comparative politics. State systems have long been subjected to cross national comparison, and the policy convergence literature has attempted to explain the observed similarities and differences in policy content, instruments, and style across state systems. A number of theorists have risen to the challenge, responding with

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[18]Colin J. Bennett, Regulating Privacy: Data Protection and Public Policy in Europe and the United States (Ithaca: Cornell University Press, 1992), 4. and Harold Wilensky et. al., Comparative Social Policy: Theories, Methods, Findings (Berkeley: University of Berkeley, 1985), 11.

[19]Brigitte Unger, and Frans van Waarden, 6.

[20]Brigitte Unger, and Frans van Waarden, 6.

typologies that emphasize the multivariate nature of policy convergence. One such classification, espoused by Colin Bennett, suggests four domains of policy convergence: policy transfer through *emulation*;[21] *elite networking* and epistemic communities;[22] *harmonization* and *penetration*.[23]

The imitation of innovative (requiring a 'policy exemplar' to originate new policy), or merely decisive policy by other actors is cited as a prevalent but often understated explanation for policy convergence.[24] Especially evident in instances where policy problems are novel or demand unconventional solutions, or where there are constraints upon time or information, imitation alleviates uncertainty.[25] Innovative policies pioneered by an actor are often diffused throughout the state system by means of elite networks. Epistemic communities, originating in international organizations, bilateral institutions, or developing out of professional or technical fraternization (such as the Institute of Electrical and Electronics Engineers), assist in the spread of knowledge, and even generate actual policy solutions outside of a state's domestic environment. These informal, non-hierachical and issue-specific policy networks often cut across state boundaries.[26] A cross-fertilization of 'modes of address' of common policy problems is facilitated by these 'expert systems'. Thirdly, harmonization of policy and regimes can

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[21]D. Dolowitz, and D. March, "Who Learns What from Whom: A Review of the Policy Transfer Literature," Political Studies 44 (1996).

[22]Peter Haas, "Introduction: Epistemic Communities and International Policy Coordination," International Organization 46 (1992).

[23] Colin J. Bennett, "What is Policy Convergence and What Causes It?" British Journal of Political Science 21 (1991).

[24]Colin J. Bennett, "Policy Convergence."

[25]Colin J. Bennett, Regulating Privacy, 5.

[26]Patrick Kenis, and Volker Scheider, "Policy Networks and Policy Analysis: Scrutinizing a New Analytical Toolbox," 32 in Bernd Marin and Renate Mayntz eds., Policy Networks: Empirical Evidence and Theoretical Considerations (Boulder: Westview Press, 1991).

occur as a consequence of increasing interdependence between and integration of states. Although interdependence by itself does not ensure convergence, the presence of international conventions, norms, and regimes shared and commonly accepted by state actors in combination with a general consensus as to the nature of the policy problem are necessary criteria for convergence under this concept. Finally, a more coercive element (one also evident in some considerations of harmonization) is introduced into policy convergence by penetration, which assumes the participation of external actors in a state's policy environment.[27] Typically, these actors are foreign administrations or international organizations, however, foreign firms are also potential 'intruders'. Convergence is evident in the assumption of similar policy instruments, content, style, outcomes, or goals *over a period of time*. This temporal component is strongly emphasized in the writings of a number of theorists, including Colin Bennett[28] and Robert Seeliger.[29] Convergence cannot be determined without reference to discrete changes in policy over a range of time. Secondly, establishing the necessary criteria of convergence requires a focus on dynamic systems: one examines *processes*. Symptoms of convergence are evident in the harmonization of process and structure across policy sectors: it is to these that we turn our attention in an investigation of spectrum allocation policy.

What follows is a comparative study of Canadian and American public policy in the field of radio spectrum allocation, with an explicit goal of explaining the evolving similarities in

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[27]Colin J. Bennett, Regulating Privacy, 5.

[28]Colin J. Bennett, "Policy Convergence."

[29]Robert Seeliger, "Conceptualizing and Researching Policy Convergence," Policy Studies Journal 24 (1996).

policy content, or the visible components of government policy such as acts, statutues, or regulation; policy instruments, or the tools selected to apply policy; or policy style, the underlying 'theme' of policy formulation (for example, anticipatory versus reactive, incremental versus rational, corporatist versus pluralist).[30] We do so for several reasons, subordinated to particular conditions: first, such an examination will be cross sectoral, with relevant elements in economic, political, industrial, and social concerns. Secondly, the policy problem is relatively novel: spectrum allocation has been a policy issue since the 1920s, but not on the scale we are presented with today. Third, an investigation of such policy may reveal intriguing relations between technology and policy challenging the absolutism of the diametrically opposed views of the primacy of public policy and technological determinism. We also wish partially to address the disparate focus that is lavished on policy outcomes in Canadian public telecommunications policy: consequently, the policy process and policy content are subjected to insufficient scrutiny. The examination of this particular policy sector should also yield greater insights into the policy capacity of the Canadian state. As Atkinson and Coleman argue, a telling indication of a state's governmental effectiveness is evident in the different (in their words, 'uneven') impact its policy has across policy sectors.[31] This examination shall provide another analogous case study of the 'policy landscape' against which other 'policy peaks' or 'troughs' can be arrayed. We shall test the hypothesis that there is a distinctive convergence of Canadian policy with that of the United States, and furthermore, that this convergence is a consequence of the pursuit of

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[30]Colin J. Bennett, "Policy Convergence", 218.

[31]William D. Coleman, and Grace Skogstad, "Policy Communities and Policy Networks: A Structural Approach," 17 in William D. Coleman and Grace Skogstad eds., Policy Communities and Public Policy in Canada: A Structural Approach (Mississauga: Copp Clark Pitman, 1990).

domestic political and commercial goals. Canadian spectrum allocation policy in the last decade shall be examined against the policy template fashioned by parallel American cases. An affirmation of our hypothesis will be attained when there is sufficient evidence of the movement of Canadian policy towards functionally equivalent policy instruments, content, and style. We can only do so once we have conclusively established there was a sufficient difference between the two regimes at some point in the past. This observation may appear pedantic, but without such a qualification an investigation of this nature would be flawed from the outset.[32] As we alluded to above, such convergence may be abetted by a lack of policy capacity within the Canadian regulatory system, but could also be a process propagated by the requirement to manage radio spectrum on international and regional scales, thus ensuring integration between the technical (telecommunications systems) and the political (policy schemes). Commensurate with such a system-level analysis is an effort to establish, via induction, the existence of some relationship at the sectoral, or meso-level.[33] We rely upon the important distinction made between three levels of policy often made by political economists and in theories of the 'disaggregated state'.[34] Macro-level analysis concerns itself with broadly applied industrial or social policy; sectoral or meso-level policy is sectorally applied and specific to a social issue or market. The lowest level of analysis is at the micro level and focuses upon individual firms or social agencies. This investigation shall rely upon a comparative analysis of the system's components: the relevant state policy subsystems and their

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[32]Harold Wilensky et. al., Comparative Social Policy: Theories, Methods, Findings (Berkeley: University of Berkeley, 1985), 12.

[33]Adam Przeworski, and Henry Teune, The Logic of Comparative Social Inquiry (New York: John Wiley and Sons, 1970), 50.
More accurately, we shall conduct analysis at multiple levels as suggested by Przeworksi and Teune.

[34]Michael M. Atkinson, and William D. Coleman, The State, Business, and Industrial Change in Canada. (Toronto: University of Toronto Press, 1989), 25.

policy instruments, networks of commercial actors and international agencies. As a consequence, we shall engage in analysis that encompasses various aspects of the international system while remaining firmly situated in the meso or sectoral level. The two domestic policy systems are appropriate for comparison, sharing similar socioeconomic systems and an historical legacy of telecommunications activity. These shared characteristics permit, at the very least, some factors in this study to be held constant, mitigating some of the methodological inadequacies associated with a qualitative approach.

Our methodology will be that of similar case comparison. It would be excessively difficult to subject our hypothesis to rigorous qualitative tests because of the multiplicity of causal relationships involved. Only by examining spectrum allocation policy in context is it possible to establish why certain conditions constitute sufficient and necessary cause for convergent systems. Convergence is a *process of processes*. Isolating a single variable for examination alters the nature of the process under investigation. Our causal arguments are concerned with the intersection of variables.[35] Therefore, convergence toward functionally equivalent policy instruments or content is difficult to quantify; policy style even more so. Furthermore, the number of cases under investigation is too few to constitute a representative sample, thereby limiting the number of relevant observations that can be gleaned. We shall rely upon three case studies to buttress our argument: spectrum assignments to cellular telephony; recently developed personal communications services (PCS), also known as "digital cellular";

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[35]Charles C. Ragin, The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies (Berkeley: Berkeley University Press, 1987), 26.

and local multipoint communications services (LMCS) in the United States and Canada shall be examined. We limit our investigation to these cases on several grounds: first, these services are the 'bleeding edge' examples of new regulatory techniques because of their economic and social importance. Also, many of the traditional applications requiring radio licenses are in decline. AM/FM radio and conventional broadcast television are stagnating services because of their low channel capacity, a lack of interactivity and inferior programming and signal quality to many cable alternatives.[36] Other wireless applications such as short-wave radio or microwave links were important in the past, but now are obsolete, or of fading relevance to most of the developed world as technology and markets drive frequency assignments up the electromagnetic spectrum.[37]

Bennett's four criteria for policy convergence will be applied to each case study in an attempt to extract the relevant threads from causally complex relationships. In the words of Ragin we seek to "unravel the empirically relevant causal combinations".[38] Additionally, we shall focus the temporal dimension of this investigation upon the last ten years, focusing on the evolution of spectrum allocation policy in the post deregulation period in the United States (post 1984) and in Canada, the semi-competitive era after 1992.[39] Briefly turning our attention to policy outcomes, there is evidence that contemporary radio spectrum management policies in these selected cases have not

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[36]Joseph Pelton, Wireless and Satellite Telecommunications: the Technology, the Markets, and the Regulations (Englewood Cliffs, N.J.: 1995), 83.

[37]Or replace many of the former with cheaper and higher capacity wireline alternatives such as fibre optic or coax cable.

[38]Charles C. Ragin, 26.

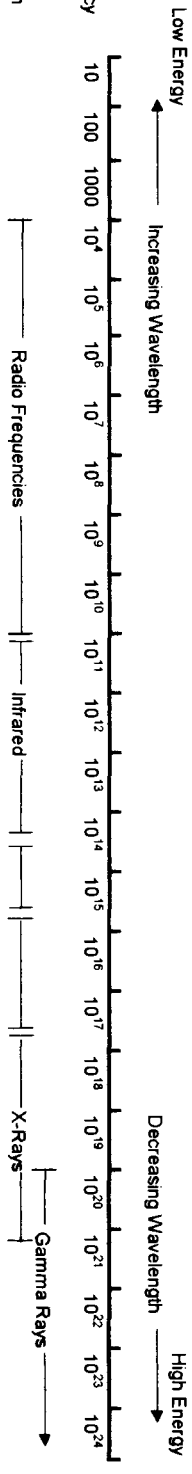
[39]However, we shall still make reference to various historical examples of spectrum management in the US and Canada that are deemed relevant to radio frequency policies being pursued today.

been implemented long enough for a satisfactory assessment of their consequences. As was already mentioned, spectrum allocation has existed since the 1920s, but not on the scale that is presently under consideration: previous instances have been limited to the low power, and narrow bandwidth of radio or broadcast frequencies, not the profuse bandwidth and higher frequencies personal communications services, satellite, and the information technology industries require. Finally, the policy problem under investigation is contemporaneous to both policy systems: the burgeoning demand for wireless services has occurred in the United States and Canada more or less at the same time. The above considerations lead us to attach a preference to analyzing functionally equivalent policy content and instruments, rather than outcomes, which at present still remain indeterminate.

With methodological and procedural concerns addressed, we now first turn to a brief discussion of the technical aspects of radio spectrum allocation. The policy implications of wireless technology are bereft of meaning without a better understanding of the intimate relationship between frequency properties and the demand these create for them and what this means for instrument choice in public policy. We still need to first answer the questions, "Why regulate?" and, "With which tools does one regulate?" before proceeding any further.

Figure 1

The Electromagnetic Spectrum



Sources: Michael Patesch, Mobile Communications in the US and Europe, (Boston: Artech House, 1992), 50.
Jack L. Kraushaar and Robert A. Ristinen, Energy and Problems of a Technical Society (Toronto: John Wiley and Sons, 1993), 14.

Figure 2

Frequency Range Chart

Frequency Range	Designation	Wavelength	Common Usage
< 30 kHz	VLF (very low frequency)	miriametric	maritime navigation
30 - 300 kHZ	LF (low frequency)	kilometric	radionavigation
300 - 3000 kHz	MF (medium frequency)	hectometric	AM radio, marine radio telephone, amateur band
3 - 30 MHz	HF (high frequency)	decametric	ISM, shortwave radio, NRC time signal
30 - 300 MHz	VHF (very high frequency)	metric	VHF television broadcasts, FM radio, cordless phones
300 - 3000 MHz	UHF (ultra high frequency)	decimetric	UHF television, broadcasts, microwave ovens, PCS, DBS, MSAT, cellular telephones
3 - 30 GHz	SHF (super high frequency)	centimetric	satellite communications, LMCS, radio astronomy
30 - 300 GHz	EHF (extremely high frequency)	millimetric	microwave links, radar, space

Data sources: Industry Canada, Radio Spectrum Allocations in Canada, chart (Ottawa, 1995) and Laurent Benzoni, and Eva Kalman, The Economics of Radio Frequency Allocation (OECD: Paris, 1993), 194.

Figure 3

Spectrum Allocation Instrument Matrix

	Range of Variation Low Average High
administrative discretion	1.....3.....5
reliance upon market	1.....3.....5
instrument cost	1.....3.....5
administrative complexity	1.....3.....5
coerciveness	1.....3.....5

	administrative discretion	**reliance upon market**	**instrument cost**	**administrative complexity**	**coerciveness**
auction	2*	3	2	2*	5
comparative process	5	1	4	4	5
lottery	2	1	2	1	5
'first come, first served'	2	1	2	1	5

*varies with instrument design.

Figure 4

Policy Variables Relationships

Aspect of Policy	Process Input	Process Output
Δpolicy style	Internalization of new norms and values (i.e 'paradigm shift'). Lesson drawing from other regimes; information transfer via epistemic community?	Change of policy focus from social welfare concerns and orderly development to liberalized, competitive, industry and consumer-centric policy. Promotion of environment conducive to market-based instruments. Harmonization of policy with international or regional trade regime.
Δpolicy content	Policy content manifestations of change in policy style, or barriers to be overcome by proponents of new policies.	Policy content necessary condition for new policy instruments. *Telecommunications Act* (1993), *Radiocommunication Act* (1989)
Δpolicy instrument	Emulation of American policy instruments.	From comparative process, 'first come, first served' to streamlined comparative process and spectrum auctions Further evidence of shift in policy style.

Causal Relationship

Δpolicy style → Δpolicy content → Δpolicy instrument

Chapter II: The Policy Problem and Modes of Address

The *crux* of the policy problem faced by regulators originates in the physical characteristics of the electromagnetic spectrum. Regulators are challenged by the problem of how to allocate spectrum in a manner that best serves policy goals, established by national executive, legislative, or judicial bodies, or international standards agencies. Policy goals are a myriad of often mutually exclusive intentions, encompassing the need to foster competition; the introduction of new products and services; the efficient usage of the spectrum; universality of service; and public welfare concerns. The selection of instruments to achieve these goals is undertaken in a no less complex framework of political culture, market dynamics, and technological standards. The economics of spectrum regulation are largely a derivative of the physical and technical requirements of the resource. However, there is no simple causal relationship between spectrum scarcity and market value, for example. Regulators must grapple with complex relationships of frequency characteristics and functionality and the positive feedback effect technological innovation seems to have upon demand, and other externalities generated by commercial, personal, and governmental[40] use of the radio spectrum. Finally, the *nature* of the spectrum plays a substantial role in the choice of policy instruments available to national regulators. This assertion will be substantiated in the following section.

The spectrum is a naturally occurring resource, with a heterogeneity that lends itself to specialized usage at different frequencies. The electromagnetic spectrum (Figure 1) is

[40]Historically the user of the largest portion of the spectrum.

defined as "a form of oscillating electrical and magnetic energy capable of traversing space without the benefits of physical interconnections,"[41] encompassing radio transmissions, infrared and visible light, and gamma rays. Such emissions travel via waves in cycles/second, or hertz (Hz). The wave form frequency and amplitude (the height of the frequency wave, or more accurately, the distance between positive and negative wave peaks or troughs) determine the characteristics of particular radio wave. Within this grouping of frequencies there are subdivisions (Figure 2) which are dedicated to various applications on the basis of their unique physical properties such as propagation or "the movement of radio waves throughout the atmosphere and the transfer, by wave mechanism, of radiant energy from a transmitting antenna to a receiving antenna."[42] For example, very low to medium frequency waves travel along the nape of the earth, as ground waves, and have a low signal capacity and a stable, long distance configuration[43] making them ideal for maritime radio applications. On the other hand, high frequency (HF) waves propagate through refraction off the ionosphere, a characteristic that makes this band ideal for broadcasting. As transmissions of greater distance with smaller emitter power requirements become possible, however, these transmissions degrade in atmospheric disturbances such as lightning storms or hurricanes.[44] Above 1 GHz, radio waves take on some of the properties of visible light, and are unable to circumvent obstacles such as artificial structures, or mountains[45] and unlike lower frequencies, these waves pass through the ionosphere. This limits their

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[41]Harvey J. Levin, The Invisible Resource: Use and Regulation of the Radio Spectrum (Baltimore: John Hopkins Press, 1970), 15.

[42]Michael Paetsch, 53.

[43]Michael Paetsch, 53.

[44]One can 'see' such interference, for example, as bursts of static on a television set during an electrical storm.

[45]Michael Paetsch, 53.

usage primarily to LOS (line-of-sight) applications such as microwave links, and satellite up- and downlinks. In the ultra-high frequency (UHF) band and above, the limitations of propagation are compensated for by the greater bandwidth[46] of these frequencies. The transmission of high bandwidth information such as video or multiple voice/text streams is often done at this frequency: nearly 6,000 voice signals can be accommodated within 30 MHz of microwave.[47]

The frequencies of the radio spectrum command scarcity rents[48] on the basis of demand for them. When the demand for a given frequency block exceeds supply, additional economic rents are claimed by the occupants of that block. Unlike the absolute limits placed on the radio spectrum, the suitability of a frequency for a particular application, as demonstrated above, is not entirely addressable by technological innovation.[49] Frequencies exploitable at least capital cost by service providers will be in greater demand. This is the source of the differential rent often ascribed to the fecundity of natural resources such as land and minerals, a concept applicable to the radio spectrum as well.[50] Scarcity is evident in particular bands, for example, the 800 - 900 MHz mainly utilized by cellular radio services is heavily congested in most metropolitan areas.

Secondly, and perhaps most importantly, there are externalities associated with the usage of this resource. Two transmitters operating at the same frequency and

[46]defined as "...the difference between the highest and the lowest frequency of a channel." Michael Paetsch, 53. Generally, the more information one wants to transmit, the larger the bandwidth requirements are.

[47]Regis Bates, Wireless Networked Communications (New York: McGraw-Hill, Inc., 1994), 27.

[48]Laurent Benzoni, and Eva Kalman, 39.

[49]Laurent Benzoni, and Eva Kalman, 27.

[50]David M. Leive, International Telecommunications and International Law: The Regulation of the Radio Spectrum (New York: Oceanea Publications Ltd., 1970), 15.

amplitude, over the same period, can cause signal interference. When two identical signals in the same geographic region interfere, both transmitting and receiving parties suffer disutility. Frequency interference can extend over national boundaries: decametic waves have an extensive range of hundreds or even thousands of kilometers. As was previously indicated, regulation at the international level operates to prevent incursions upon national sovereignty by such transmissions, but primarily functions to mitigate interference by allocating geographically and temporally exclusive frequency blocks to nations on the basis of frequency application. National regulators duplicate this function at the state level, assigning specific frequencies to users, as they are able to enforce compliance and constitute (at least for the time being) the sole and most effective recourse for arbitration in case of a conflict between parties.[51]

In addition to co-channel interference (which has been implicit in discussions of interference thus far), there is a phenomena that prohibits a frequency band from being fully occupied: the absolute bandwidth that constitutes the difference between the upper and lower frequency of a channel is subject to *adjacent channel* interference[52] that ultimately limits channel capacity to a necessary bandwidth. A third source of interference that is a concern for regulators is that of *multipath propagation*[53], where widely scattered signals arrive at the receiver at different intervals out of phase, or at a different frequency, garbling the signal. This type of interference appears in systems that use *simulcasting*[54] such as paging networks. For pagers, reliable communications on the

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[51]Laurent Benzoni, and Eva Kalman, 27.

[52]Michael Paetsch, 51.

[53]Adel Turkmaini, "Spread Spectrum Systems" in John Gardiner, and Barry West eds., Personal Communications Systems and Technologies (Boston: Artech House, 1995)

[54]"...the same message is broadcast simultaneously over multiple transmitters with overlapping

first attempt are paramount. Multiple transmissions of the same message increase the probability a signal will get to the receiver. However, signal attenuation and delay (because of geographical obstacles or atmospheric conditions) may produce multiple signal paths. The resulting signals may be entirely out of phase with another, creating two sine waves with opposite amplitude (nullifying both), or two superimposed, slightly out of sync, and unintelligible signals.[55]

Like many other natural resources, the spectrum is finite. Theoretically, the transfer of information is limited to the range between 3 kHZ and 3,000 MHz. However, the exploitable range of the radio spectrum is constantly being increased by various innovations in spectrum optimization and existing frequencies are reclaimed by management techniques. Among the latter are the transfer of government frequencies to the private sector; regulators reassigning previously allotted frequencies; and frequency reuse. Among the former are new techniques of digital transmission and signal compression. The Canadian and American governments periodically release blocks of frequency to civilian users. 200 MHz of spectrum was released to the public sector from American governmental usage in 1991, as part of the *Emerging Telecommunications Technology Act* of 1989.[56] Frequency reassignments are another means to release spectrum tied up in older, perhaps less lucrative applications to expanding services, or which the industry regulators believe have potential for future growth.[57] The FCC

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coverage." Ira Brodsky, Wireless: The Revolution in Personal Communications (Norwood: Artech House, 1995), 9.

[55]Ira Brodsky, 9.

[56]Michael Paetsch, 137.

[57]Frequencies are reclaimed for growing services or to create contiguous bands. The frequencies supporting UHF channels 73 - 80 (806 - 890 MHz) were reassigned to cellular services by the FCC, requiring relocation of broadcasting services. Bennett Z. Kobb, Spectrum Guide: Radio Frequency Allocations in the United States, 30 MHz - 300GHz (Falls Church: New Signals Press, 1996), 99.

decision to reallocate UHF-TV channels to land mobile radio is credited with igniting the spectacular growth of the cellular telephone market. Recently, the United States and Canada have reallocated a 200 MHz block between 1.8 and 2.2 Ghz to accommodate demand for the broadband personal communications services.

Frequency reuse is a technique usually applied to mobile radio systems (cellular radio, PCS/PCN, or other specialized mobile radio) to reduce total bandwidth consumption. Instead of assigning channels to each user, frequencies are divided geographically.[58] The service area is split into cells, each covered by a low power transmitter operating on a discrete channel. Adjacent cells do not share channels, so interference is largely eliminated. Mobile users are switched to the adjacent transmitter as they cross into the other cell.

Compression technologies are often employed to optimize spectral efficiency. The most common forms of compression are applied to digital transmissions. Signals can be characterized as either analogue or digital, depending on the modulation scheme that is being used. Analogue signals use either amplitude modulation (AM) or analogue frequency modulation (FM) to transmit information. Amplitude modulation implies information upon a carrier wave by varying the wave's *amplitude*, whereas analogue frequency modulation requires a waveform *frequency* change to transmit a signal. The majority of wireless installations utilize analogue transmission techniques, however, digital modulation is becoming prevalent, for the advantages it affords over its older

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[58]Ira Brodsky, 7.

counterpart. Digital transmissions discretely sample the information signal at fixed intervals (the 'sampling rate') and encode that amplitude onto the carrier wave as binary ('on' or 'off') pulses.[59] Wireless communications systems are increasingly digital because the latter permits higher signal fidelity and error correction, among other benefits. Digital transmissions do require more bandwidth than analogue. However, redundant portions of the signal can be removed. Consequently, less spectrum is needed to support a digital signal than a comparably loaded analogue transmission. This technique is referred to as compression. Popular digital compression standards used today include frequency-division multiple access (FDMA), time-division multiple access (TDMA) and code-division multiple access (CDMA). CDMA originates in a compression technique called *spread spectrum*. Often cited as a definitive future standard for digital radio systems and with the greatest potential to alleviate today's frequency scarcity, spread spectrum distributes carrier signals over a wide frequency band at a lower power than conventional radio transmission systems, modulated by a pseudo-random signal that accompanies the transmission. Only a receiver capable of demodulating the original pseudorandom signal can read the transmission. Spread spectrum is seen as a panacea to spectrum scarcity because of its capacity to share a continuous range of frequency with other signals (DS-SS) or to 'hop' from one channel to another (FH-SS) according to instructions stored in the accompanying pseduorandom signal.[60]

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[59]Michael Paetsch, 67.

[60]Ira Brodsky, 38. According to Brodsky, the problems associated with spectrum 'scarcity' become less derivatives of the absolute limits placed upon existing spectrum, and more about managing interference, which imposes wasteful divisions upon the resource.

Despite the general optimism that technological fixes will be found for the problem of spectrum scarcity, there are still a number of developments combining to mitigate the beneficial effects innovation has upon it. Even wireless' most enthusiastic proponents concede the current complexity and cost of spectrally efficient equipment inhibits its usage by service providers and manufacturers. Arguably, technologies such as CDMA do hold long term prospects to mitigate spectrum shortages. However, there are high capital costs associated with such equipment. Without a commitment by service providers to upgrade to more efficient transmitters and receivers, manufacturers are loathe to convert their existing productive capacity to its production.[61] So, service providers will seek out the frequencies that will 'naturally' support the applications they plan to offer, further exacerbating sprectrum shortages. National regulators must then reassign or reallocate spectrum to the expanding services. Bates summarizes this problem quite clearly in the case of microwave:

> "The competition for this limited bandwidth is intense. Looking at the spectrum and its limitations, one can see reality setting in. The industry is running out of the radio frequency spectrum (RF). An example is the move by the FCC to reallocate some of the RF spectrum in the 1.7 - 2.3 GHz range for the newer offerings of personal communications services."[62]

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[61]James G. Savage, The Politics of International Telecommunications Regulation (Boulder: Westview Press, 1989), 63. Savage mentions the example of SSB (single sideband broadcasting), a technology that would have considerably enhanced the transmission capabilities of the HF band. However, it remained unused because broadcasters would not invest in the necessary equipment.
[62]Regis Bates, 27.

Whatever spectrum is recovered by more efficient techniques quickly is consumed by the demand for more spectrum. The revolution in microelectronics has reduced the cost of transmission and terminal equipment, with commensurate improvements in performance and reliability over the last four decades, further fueling demand for wireless services.[63] Embedding wireless telecommunications 'solutions' in silicon (such as a signal compression algorithm, or the ability to hop frequencies as needed) holds out the promise of solving some of the problems of spectrum scarcity,[64] while at the same time exacerbating the shortage of spectrum, as this permits the proliferation of low cost cellular transmission facilities, wireless LANs, and consumer items such as cellular phones and personal data assistants (PDA). Flexible communications, ubiquitous access to information, and real-time networking are marketing points that appear to translate into real demand for wireless equipment and services.[65] Several commentators invoke the evolution and proliferation of business structures composed of individual mobile workers and distributed workgroups, within 'flattened' management structures, in which wireless networks and cellular radio play a pivotal role.[66] Additionally, the demand for wireless services such as DAB, high definition television (HDTV) and PCS, is expected to increase, abetted by processes of convergence between the telecommunications, broadcast, and information technology sectors.[67]

A *prima facie* argument can be made that a common delineation between instrument choice (means) and policy goal (ends) is established by the type of the spectrum that is

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[63]Laurent Benzoni, and Eva Kalman, 33.
[64]Ira Brodsky, 37.
[65]Laurent Benzoni, and Eva Kalman, 35.
[66]Simon Forge, 57.
[67]This writer feels this division has long been obsolete.

to be allocated. The nature of the application may provide the necessary conditions for the existence of the type of policy instrument selected to allot spectrum. Market-based tools for spectrum allotment, under the aegis of fostering market competition or achieving procedural efficiency, are of little use when the necessary elements of a market, namely a disparity between supply and demand, is lacking. For private sector applications, such as land mobile radio (cellular telephony, PCS/PCN, and SMR) there is enough demand in both the United States and Canada to justify the economic arguments in favour of a market-based licensing regime. This also raises the possibility of scenarios where policy instruments are technically nonsubstitutable.[68] However, controversy still exists over what type of licensing regime should be used for public wireless services, such as public broadcasting, emergency dispatch and disaster relief. As was demonstrated above, the characteristics of frequencies determine their suitability for a particular function: it is on this basis that these bands command the kind of premium that can underpin a market-based system of spectrum allocation. The lower frequencies are in great demand because of their technical fecundity.[69] It is precisely these frequencies that harbour the growing cellular and personal communications services that are the visible focus of the domestic regulatory realignment 'energies' under consideration in this study. Not incidentally, these services are the first to be considered for competitive bidding. So there is evidence for a relationship between RF physical characteristics and the selection of policy instruments by a domestic regulator. One should also consider the supporting assertion that market-based licensing regimes

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[68]Michael Howlett, "Theories of Instrument Choice," Policy Studies Journal 19 (1991): 4.

[69]"The frequencies most sought after because of their technical characteristics, those under 2 Ghz, are tightly packed with users and uses." The Congress of the United States. Congressional Budget Office. Auctioning Radio Spectrum Licenses (Washington: Congressional Budget Office, 1992), 6.

may not be successful when higher frequencies, requiring a greater R&D and development effort to exploit, are being offered to applicants.[70]

However, even in cases that could support it, very few analysts propose a 'pure' spectrum market based upon freely transferable and flexible spectrum rights. Most national regulatory systems accord the spectrum the status of national resource and this principle is irreconcilable with private ownership of radio frequencies. Indeed, the international regulatory system considers the spectrum to be a common resource as well.[71] Secondly, there exists a number of economic arguments against exclusive spectrum rights. Cost externalities can be imposed upon spectrum users through interference (both adjacent and co-channel), intermodulation, and variability in signal outputs due to sunspot activity, or the altered propagation of some frequencies in different climactic conditions or at night may preclude the establishment of a market value for a user's license.[72] Furthermore, a free market in spectrum may encourage *inefficient* usage of the resource, requiring extension of the owner's radiation area to prevent interference.[73]

On the other hand, policy instruments that favour administrative discretion are often inadequate in selecting the firm that will best develop a frequency assignment in a market that is a competitive or unstable. Most administrative mechanisms are a poor substitute for the infinite adjustments a market environment imposes upon participating

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[70]Congressional Budget Office, xii.
[71]David Leive, 17.
[72]Harvey J. Levin, 92.
[73]Harvey J. Levin, 93.

firms in their exploitation of a given input.[74] The selection of appropriate policy instruments in pursuit of a desired outcome becomes even more difficult when ephemeral social and political policy goals such as universality of service or maintenance of sovereignty are sought through existing structures. Yet this does not prevent regulators from adopting alternative methods of allotting spectrum licenses.

Despite the unquestionable role the physical characteristics of the resource have in furnishing regulators with feasible policy instruments, these properties and the economic conditions they bear are not the sole determinants of a regulator's instrument selection. Instrument choice is not simply a process of calculating costs and benefits of given solutions to a policy problem. Instrument choice reflects the distribution of power at the societal level and within the policy subsystem.[75] The conservative nature of policy-makers may limit the range of assessment of alternative instruments. The contemporary normative environment may censor instrument choice, even if the proposed policy tool is technically feasible. For example, left of centre governments are less likely to favour market-based instruments if their prevalent ideological basis translates into more coercive state regulatory, distributive, or taxation-based instruments. If a policy instrument cannot be integrated into the value system of policy-makers it is unlikely it will ever become a plausible policy option, much less implemented. Quantifiable criteria such as organizational setting[76] and state capacity (fiscal resources, technical and organizational competence) determine the ability of a

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[74]John McMillan, "Why Auction the Spectrum," Telecommunications Policy 19 (1995): 197.

[75]Kenneth Woodside, "Policy Instruments and the Study of Public Policy," Canadian Journal of Political Science 19 (1986): 792

[76]Stephen H. Linder, and B. Guy Peters, "Instruments of Government: Perceptions and Contexts," Journal of Public Policy 9 (1989): 38

regulator to implement effectively a policy option. A policy-maker's self-assessment may either result in an underestimation or overestimation of capacity, wrongly precluding the adoption of a suitable policy option, or alternately, setting the stage for instrument failure. Such processes delineate the type of policy instrument that will be selected. Context paradoxically limits and expands the policy options for domestic spectrum regulators.

The policy instruments available to regulatory agencies to allot spectrum can be categorized along several dimensions (Figure 3) in a modified typology tentatively suggested by Linder and Peters:[77] first, according to the extent of direct regulator involvement in the spectrum allocation process. This qualifier roughly parallels the level of coerciveness and intrusiveness theorists such as Doern and Wilson ascribe to policy instruments in their continuum-based instrument taxonomy.[78] Administrative discretion in this context is a function of the extent of choice the regulator has in selecting the recipient of a radio license. This includes the ability to set the requirements for firm or sectoral participation in the licensing process and how precisely the public regulator can apply the procedure to achieve a desired policy outcome. A second major axis arrays degrees of reliance upon market forces versus government decision-making. An important qualifier of this dimension is that the relationship between the extent of market reliance and administrative discretion need not necessarily be negatively correlated. Market-based license allotments derive their public legitimacy from claims about their alleged efficiency *and* that they retain policy discretion to pursue social or political goals.

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[77]Stephen H. Linder, and B. Guy Peters, 56.

[78]G.B. Doern, and V.S. Wilson. "Conclusions and Observations," 111 in G.B. Doern, and V.S. Wilson, eds., Issues in Canadian Public Policy (Toronto: Macmillian, 1974)

Arguably, an instrument could score high both on market-reliance and administrative discretion (q.v). The third dimension qualifies instrument cost and administrative complexity. The two are positively correlated to the extent that 'complex' instruments (generally assumed to be those that attempt to duplicate market functionality) demand more bureaucratic inputs. Administrative costs will usually be greater when the process requires comparably more involvement by government officials in intensive procedures to determine the recipient of a given frequency or block of frequencies.

A number of spectrum allocation techniques are available to regulators including comparative review or administrative hearings, lotteries, requests for tender, 'first come, first served' distribution, and auctions. Common to all of these instruments is their compulsory nature. All public spectrum license allotments are conducted through the domestic regulator. Indeed, this regulatory monopoly places all of the conventional licensing techniques (from comparative allotment to spectrum auctions) high along the Doern and Wilson coercion continuum and also in our adaptation of Linders and Peters' matrix (Figure 3). Most regulatory regimes use a mix of these instruments to allot spectrum, within general guidelines established by the legislature or the executive. Central to this investigation is the idea that the replacement of administrative radio licensing policies (such as comparative reviews) with more market-based solutions (spectrum auctions) is symptomatic of convergence between spectrum regulatory regimes. Accordingly, each of the possible policy instruments available to national regulators will be considered in turn.

Comparative reviews are the most widespread of the processes utilized by national regulators. Governments establish criteria for evaluating each proposal, and award spectrum on the basis of applicants fulfilling those conditions. Spectrum can also be awarded in response to a request for tender. In this instance, the successful applicant has demonstrated *a priori* that they can deliver a service at least cost and at greatest spectral efficiency, within standards set by administrative process. Comparative process is seen, not only as a way to allot spectrum, but also as a policy tool. There is a general perception that in the use of such a technique, administrative discretion is maximized, thereby ensuring the realization of social and industrial policy goals. However, comparative or administrative reviews have come under considerable scrutiny in the last decade. Generally condemned for their lack of transparency and responsiveness to market demands, their high costs, and the bewildering complexity of their eligibility criteria, administrative hearings are being discarded increasingly in favour of allegedly simpler and more efficient market-based approaches. Sound arguments in favour of other approaches to spectrum allotment as policy effectors have futher undermined the case for the comparative process.

'First come, first served' distribution of spectrum is another commonly used method. Once minimum criteria for eligibility are set by a national regulator, the first qualified applicant is chosen. If multiple, equally qualified parties are applying for the same band, the regulator must decide which applicant receives the license,[79] resorting to some version of the aforementioned comparative process. The 'first come, first served' method is generally applicable to situations where there is no competition for spectrum,

[79]Laurent Benzoni, and Eva Kalman, 96.

or where alternatives are readily available -- otherwise, some form of administrative process, lottery, or auction must be used. The obvious benefits of this process are quick and relatively inexpensive allotment of frequencies, while preserving a modicum of administrative discretion to set requirements for applicants. However, there is no guarantee that licenses, once granted, will not be sold upon a secondary market, nor that awarded spectrum will be commercially developed by the recipient. Of greater concern is evidence that the 'first come, first served' method appears to encourage applications well in advance of technological capacity to efficiently utilize the spectrum,[80] leading to hoarding of an already scarce resource.

A lottery is used by some regulators to allot spectrum. When the policy goal is limited to distribute spectrum quickly and inexpensively, lotteries are often selected. Several critiques leveled against this approach stress the attraction this process has for bidders incapable, or unable to develop or maintain telecommunications services based upon the spectrum they receive, and the possibility of 'spectrum speculation' by parties seeking to quickly turnover what they are allotted for considerable profit.[81]

First utilized by New Zealand in 1990, spectrum auctions have attracted attention globally as regulators come under increasing pressure to rationalize their allocation process, reduce the costs of administration, remove obstacles to innovation, and accelerate entry of new firms into the market. Several techniques of auctioneering are utilized by national spectrum managers. New Zealand for example, has relied upon the

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[80]Laurent Benzoni, and Eva Kalman, 98.
[81]John McMillan, 192.

Vickerey second-bid auction to award licenses to the highest bidder at the second highest bid cost. Contemporary American auction techniques are classified under the sealed bid method.[82] Arguably, there are substantial advantages to auctions: transparency, since publication of eligibility criteria and rules of conduct by national regulators is a requirement of the bidding process;[83] and the promotion of efficient usage of the radio spectrum, as the willingness to pay is theoretically a function of the services a bidding firm plans to introduce to the market. Consequently, the auction process should reward those firms that place a high value upon a license and bid accordingly.[84] The value of the spectrum can also be established through this process and there is potential for considerable revenue for governments to be generated by this process as well - this appears to be borne out by the American experience. Many also argue that auctions are an effective public policy instrument. Discretion can be retained by governments to set conditions for firms to establish services in rural areas, limit accumulation of frequencies within certain geographical zones, or to retain some spectrum for minority interests. Overall application for frequencies are reduced by the presence of entry fees and combined with a simpler assignment mechanism (versus the comparative process) auctions should reduce both the applicant's and the administrator's overall costs, as well as limiting public costs incurred in the delay of the institution of services. Efficient, responsive, transparent, and resistant to corruption and participant collusion are some of the terms spectrum auction's most enthusiastic proponents use to describe this process. Yet, it is still debatable whether auctions are

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[82]An excellent survey article of auction methodologies and common auction problems is Paul Milgrom's "Auctions and Bidding: A Primer," Journal of Economic Perspectives 3 (1989): 3 - 22.
[83]John McMillan, 194.
[84]John McMillan, 193.

the most effective manner to distribute spectrum, or to serve the public good. In most of its manifestations, the competitive bidding process requires an auction fee from each participant that potentially will be passed onto consumers: thus ability to pay determines access to a public resource.[85]

The Americans appear to be the policy exemplar in the international system of spectrum allocation. While New Zealand and the United Kingdom adopted spectrum auctions earlier than the United States, the American market-based radio licensing methods are unparalleled in scope and scale. However, without examining the development of the present system of spectrum allotment in the United States it is impossible to establish a test for the movement of Canadian policy instruments to the same format. So, it is to the American regulatory regime that the focus of this investigation now turns.

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[85]M. Melnyk, Auctioning of Radio Spectrum: Preliminary Review and Analysis (Ottawa: Telecommunications Policy Branch, 1989), 7.

Chapter III: The American and Canadian Regulatory Systems: Overview and Detail

Spectrum Allocation in the United States

Responsibility for spectrum allocation is divided between two agencies in the United States. The NTIA manages federal government usage of the spectrum; the FCC is the sole arbiter of nonfederal frequency assignments. Agency independence and the regulatory primacy of the FCC have been important factors in enabling the changes in the the U.S.'s domestic spectrum regulation regime over the last decade. As a precursor to the FCC, the Federal Radio Commission (FRC) was established in 1927 to manage radio frequency allocation.[86] The 1934 *Communications Act* created the administrative mandate of the FCC and eventually brought microwave, satellite, and television broadcast services under the responsibility of this agency.[87] The FCC subdivides spectrum among wireless services and service providers within the delineated bands assigned by the ITU to *region two* (the Americas). Within each band, the FCC also designates primary and secondary services. Primary services have priority to operate within that band, and any interference generated by a secondary services requires the latter to relocate or cease operation.

The United States was one of the earliest adopters of what was considered at the time to be 'alternative' or market-based spectrum allocation methods. Taken on its own, however, this is insufficient to qualify the US as a policy exemplar. What the Americans were pioneering is a methodology to distribute spectrum among disparate market

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[86]Robert T. Hilliard, The Federal Communications Commission (Boston: Focal Press, 1991), 64.
[87]Robert T. Hilliard , 66.

services on a grand scale. Incumbent frequency designations for analogue cellular and FM radio are already apportioned on the basis of what the market will bear. Spectrum blocks have already been auctioned off for narrow and broadband PCS, and additional auctions are presently underway, or planned, for unassigned cellular frequencies in the 800 - 900 MHz band and other SMR services, LMCS, and location and monitoring services (LMS).[88] However, as a policy instrument, auctions have only recently been sanctioned. With the *Omnibus Budget Reconciliation Act* of 1993, Congress granted the FCC power to use a competitive bidding process to allot initial licenses among mutually exclusive applications,[89] and only of services that generate revenues from subscribers (thus exempting television and radio broadcasting, according to FCC Docket 93 - 253).[90] Auctions had been considered a number of times before their implementation in 1994. Proposals to auction television broadcast licenses had already been made to the FCC in the 1950s.[91] In 1978 the FCC also released a public notice of inquiry (NOI) soliciting public input for establishing radio license auctions in an effort to attempt to determine the commercial value of this public resource and return some of this revenue to the public. The applicability of competitive bidding to resource rights had expanded in the United States, being initially utilized to auction offshore natural gas and oil drilling rights and coal leases.[92] Expanding auctions to include RF was seen as a natural extension of this process. Despite a general awareness of the economic efficiency benefits of

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[88]Kobb, Bennet Z. [http://navisoft.com/nspi/what.htm]

[89]Charles H. Kennedy, An Introduction to U.S. Telecommunications Law (Norwood: Artech House, 1994), 111.

[90]Ira Brodsky, 32.

[91]Congressional Budget Office, 11.

[92]Evan Kwerel, and Alex D. Felker, Using Auctions to Select FCC Licensees. (Washington, Federal Communications Commission, 1985), 7.

auctions on the part of FCC policy makers, the first major land mobile radio allocation for cellular telephony was conducted via comparative hearings. These streamlined hearings were designed to expedite cellular licensing; in this respect they failed, requiring an average of eighteen months to allocate a license.[93] Lotteries succeeded the comparative process in another attempt to hasten the distribution of new cellular telephone licenses. By 1985, these were also recognized to be a failure. The minimal entry criteria set by the FCC attracted a large number of applications (400,000) from many individuals unable to construct a cellular system, and interested only in reselling their licenses on the secondary market that developed. Stung by the negative experience of the cellular lotteries, FCC Chair Mark Fowler repeatedly and unsuccessfully proposed the auctioning of radio licenses to Congress in 1985 and 1986. Giving spectrum auctions the visibility they required to be elevated to into the public policy discourse was left until the 1989 presidential budget request which included estimates of revenue to be generated from FCC license auctions.[94] The introduction of the *Emerging Telecommunications Technology Act* of 1989 (ratified in 1991) by Congressman Dingell (D-Michigan) proposed an allocation of 220 MHz of spectrum from the federal government (NTIA) to the public sector (FCC), and while not expressing a preference for licensing techniques, this act did raise the visibility of spectrum management issues.[95] Finally, the presidential budget request for 1992 included an auction proposal that eventually was codified in the 1993 *Omnibus Budget Reconciliation Act*, and subsequently, competitive bidding for new radio licenses became a legislated mainstay of American spectrum management.

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[93]Ewan Kwerel, and Alex D. Felker, 12.
[94]Congressional Budget Office, 14.
[95]Michael Paetsch, 137.

While in the United States, alternatives to comparative hearings to distribute radio licenses for activities such as television broadcasting had been investigated and proposed in the early 1950s and 60s,[96] it was in the field of cellular telephony that substantive changes in the procedure of awarding transmission licenses were first implemented. A high capacity mobile radio network, based upon a system of geographically distinct cells (each with a unique frequency assignment not shared by any neighboring cells) and extensive frequency reuse, served by individual mobile telephone switching offices (MTSO) using the analogue Advanced Mobile Phone Services (AMPS) transmission standard already had been proposed by AT&T in 1970.[97] It was this proposed technical foundation that provided the FCC with an opportunity to release a considerable block of spectrum to mobile services. Previous standards of mobile telephony (MTS/IMTS) simply did not have the capacity to support a mass market cellular service efficiently. As part of the preparation for land mobile radio, the FCC abandoned its regional frequency assignment process and returned to planning channel assignments nationally.[98] In 1970, the FCC had already designated several blocks of spectrum (between 806 - 902 MHz and 928 - 947 MHz) for mobile usage (both private and common carrier),[99] and by 1981 issued technical standards and other service criteria for cellular radio. Initially, cellular licenses were awarded via comparative hearings, however, the low rate of processing and lack of explicit selection criteria came

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[96]Congressional Budget Office, 11.

[97]Bennett Z. Kobb, Spectrum Guide: Radio Frequency Allocations in the United States, 30 MHz - 300GHz (Falls Creek, Virginia: New Signals Press, 1996), 105.

[98]John O. Robinson, Spectrum Management Policy in the United States: An Historical Account (Washington: Federal Communications Commission, 1985), 51.

[99]John O. Robinson, 42.

under heavy criticism, even from a former FCC commissioner.[100] A substantial backlog of unassigned licenses mounted, and by 1982, Congress had abandoned comparative hearings in favour of a lottery system in an attempt to achieve a quicker and cheaper apportionment of cellular licenses. Unfortunately, cost and time savings were not realized by lotteries because of the expense and effort to process the huge number of applications received. In round three alone, the FCC received 5,000 applications.[101] Overall, nearly 400,000 applications were submitted to the FCC for cellular licenses, many from applicants who were incapable of establishing or running cellular telephone services.[102] To the Americans' consternation, a large secondary market for licenses materialized, supporting the lucrative turnover of cellular service permits by a number of individuals and organizations. Ultimately, these licenses were acquired by those with the intention of providing the public with mobile communications services, but at considerable cost to the government and a lengthy delay of services to market.

By the end of 1983, the FCC had established a functional cellular duopoly in each of the 306 US Metropolitan Statistical Areas (MSA) and 400 Rural Statistical Areas (RSA), by awarding 20 MHz each to an incumbent local wireline telephone company (designated as the 'B' carrier) and its cellular services rival (or the 'A' carrier).[103] By most standards, cellular radio became an extremely successful service: in the United States subscribers increased from 203,000 in 1985 to nearly 7.6 million in 1991, with revenues climbing to $5.7 billion from $482 million in the same period.[104] The burgeoning demand for land

[100]Ewan Kwerel, and Alex D. Felker, 3.
[101]Ewan Kwerel, and Alex D. Felker, 5.
[102]John McMillan,192.
[103]Congressional Budget Office, 26.
[104]Congressional Budget Office, 24.

mobile radio forced the FCC to allocate additional frequencies to these services in the mid eighties. Along with FCC technical and administrative adjustments came a realization that the cellular market could support spectrum auctions to assign initial license assignments. However, spectrum auctions would remain an elusive policy goal at least until an even larger wireless service opportunity, building upon the success of cellular telephony, made itself evident: namely PCS/PCN.

Portable, low power digital telephones had been in use in the United Kingdom and France for nearly a decade before they attracted any attention from North American telecommunications firms. European service providers had established 'telepoints', or short range base stations in areas of high pedestrian traffic (such as train stations, airports, or shopping malls) permitting digital telephone subscribers to avail themselves of communications services within these areas. Unfortunately, these early offerings were unsuccessful in Europe. Customers were restricted to outbound calling and limited to a few service areas. Successive generations of portable digital telephony, such as the UK's Personal Communications Network (PCN) met with greater success, encouraging American proponents of a similar system. Reacting to demand for experimental PCS licenses, the FCC began formal proceedings into PCS in 1989.[105]

PCS is an umbrella category, encompassing a disparate range of technologies and business services. What distinguishes personal communications services from 'traditional' cellular telephony is an expansion of the information carried to include data and video and the means by which it is transferred, to encompass satellites and the

[105]Bennett Z. Kobb, 161.

public switched (fixed) telephone network (PSTN). [106] Often touted as liberating modern telecommunications of its spatial focus, PCS allegedly will facilitate communications between people and systems, wherever their geographic position may be, by routing voice/data/video to them along an intelligent network. This ambitious goal requires the involvement of incumbent wireline network carriers, 'traditional' cellular carriers, wireless equipment manufacturers and computer firms with nascent PCS entrepreneurs in some collusive arrangement.[107] Integration of historically separate public and private networks is a necessary technical requirement for PCS to live up to its marketing hype of providing communications "anyplace, anytime". The wireless aspect of PCS is typically described as *digital cellular*, in both in its narrow and broadband incarnations, conducted via small, inexpensive, and ubiquitous handheld telephones or PDAs. This service also plays a prominent role in another ambitious project. The frequencies assigned to PCS by European and North American national regulators are also those allotted by the ITU to a proposed global network of networks, the Future Public Land Mobile Telecommunications System (FPLMTS).[108] Conceivably, the infrastructure that is developed under the aegis of PCS, along with the integration of existing networks, will provide the foundation for future globally networked personal communications. However, while grandiose plans exist for these services, it is matter of some debate what the economic value of the PCS market is. Some analysts are skeptical PCS will be able to

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[106]The research consortium of the RBOCs "...PCS should provide a telephone quality family of personal and portable services that will enable systems to (1) locate and efficiently route calls to people rather than places, (2) offer advanced call handling services (voice mail, three way calling, call screening, etc.) and (3) transport data as well as voice." Donald C. Cox, Statement before the FCC *en banc* Hearing on Personal Communications Services, December 5, 1991. quoted in Congressional Budget Office, 24.

[107]Alternately, it may merely spur the acquisition of smaller wireless services providers by the entrenched RBOCs, telecommunications equipment manufacturers, or computer software/hardware firms to achieve some manner of vertical integration.

[108]Bennett Z. Kobb, 166.

repeat the success of cellular telephony. Wireless communications are merely a single part of this enterprise, and the value of a franchise can be overestimated if one does not divide expected returns among all of the inputs. Two estimates presented to the FCC by wireless industry officials reveal the variation in predicted market size and revenues: the first predicted a service base of 150 million people globally, and revenues of $50 - $60 billion; the second, 60 million subscribers, and revenues of $30 - $40 billion.[109]

Nevertheless, PCS has attracted considerable attention from national governments, evoking claims that leadership in PCS will be the key to national competitiveness in the evolving information economies, as well as a source of budget-balancing revenue.[110] Consequently, national spectrum regulators are further enmeshed in industrial policy-making. Since anything but a cursory treatment of the technical and business merits of PCS is beyond the mandate of this investigation, one is compelled to examine the tangible policy response to this telecommunications 'ideal'.[111] What is important to note is that along with government and industry's optimistic predictions as to the success of PCS and its importance to the national economy, large allocations of spectrum have been made to this service, and considerable revenue has been generated for the U.S. federal treasury through the auctioning of PCS licenses. Indeed, the speculation surrounding PCS provided the opportunity for which the FCC had been waiting to implement large scale auctions of spectrum licenses.

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[109]Congressional Budget Office, 30.

[110]Ira Brodsky, 20.

[111]This writer would go so far to suggest that PCS is less a label for a bundle of services or a system of integrated networks and terminal devices (handsets), and more an idealized *scenario* for personal communications. Communications "any place, any time" is the marketed promise of PCS.

Already mentioned in Part II, the *Omnibus Reconciliation Act* of 1993 gave congressional permission to the FCC to use auctions to apportion licenses to services providers. In September, 1993, 160 MHz of spectrum between 1.8 and 2.2 GHz was set aside for broadband PCS in the United States, split among two ('high' and 'low' bands).[112] A 30 MHz allocation in the latter band was made to 'unlicensed' and experimental (generally indoor and short range data transmissions) personal communications services and additional frequencies in the 900 MHz were designated as narrowband PCS. The FCC also decided to subdivide all of the initial PCS spectrum bands into blocks: each of the two major PCS bands were split into two 30 MHz, one 20 MHz, and four 10 MHz allocations, matched to service providers on the basis of their status (i.e. incumbent wireline companies would receive the smaller blocks because of their existing network capacity). Later, under criticism from telecommunications providers that the initial block scheme contained too many low capacity 10 MHz blocks, the FCC revised the allocations to three 30 MHz blocks and three 10 MHz blocks, labeled A though F.[113] This block system is currently in effect, with only a few minor revisions to some of the narrowband PCS allocations. However, these frequencies are by no means the only ones required by PCS. PCS service providers require multiple block allocations. 1.8 - 2.2 GHz supports the 'personal' transmission component of the system, but additional spectrum allotments (usually in the range 36 - 39 GHz[114]) are often required for fixed point-to-point links between PCS switching stations and to the PSTN.

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[112]Ira Brodsky, 32.
[113]Ira Brodsky, 32.
[114]Bennett Z. Kobb, 256.

The first spectrum auctions on the North American continent were conducted in July 1994, for ten narrowband PCS licenses covering the entire American market. The FCC reaped $617 million in auction fees from these proceedings,[115] setting the tone for lucrative future auctions. Additional narrowband PCS auctions took place in October and November 1994 with 28 participating firms, contributing nearly $395 million to the federal treasury. The last round of auctions for PCS licenses concluded in January 1997. Blocks D, E, F, each representing 10 MHz of spectrum were divided into nearly 1500 geographically distinct licenses generating an estimated $2.5 billion in revenue for the American government -- less than in previous auctions because of the smaller frequency blocks.[116]

Auctions have become the FCC's primary policy instrument for distributing radio licenses in service areas other than land mobile radio. Interactive video and data services (IVDS) and local multipoint distribution services (LMDS) are another two license categories that have been assigned via a competitive bidding process. IVDS auctions were first conducted in the summer of 1994, licensing usage of the 218 - 219 MHz band. IVDS is a subscription service that is carried by existing network infrastructures (mainly cable and satellite television) permitting home banking and shopping, interactive entertainment, and pay-per-view programming.[117] LMDS supports high frequency (27.5 - 29.5 GHz) broadband point-to-point transmissions that can carry broadcast (video), voice, or data transmissions to subscribers. Intended to compete against DBS and conventional coaxel

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[115]Bennett Z. Kobb, 112.

[116]Sari Kalin, "Sprint Bids the Highest in the FCC's Final Auction for PCS Licenses," Infoworld January 16, 1997.

[117]FCC Auctions Fact Sheet [http://www.fcc.gov/wtd/aucfct.html], October 1996.

cable television (CATV) systems, and like PCS, with the potential to bypass the "local loop" of the PSTN, LMDS licenses are "permissive", meaning the FCC places no limitations on bandwidth or emission characteristics.[118] Presumably, this would allow service providers to utilize whatever mix of compression technologies and network protocols they see fit, to provide whatever service (broadcast television, Internet access, and voice communications) they feel their market can support. Auctions for LMDS licenses for a 1 - 1.3 GHz block in 493 American markets are already underway.[119] Other services such as DAB, promising clear 44.1 kHz quality sound and the simultaneous transmission of data and the audio signal, are also future candidates for the FCC's auction system.[120]

Spectrum Allocation In Canada

While Canadian spectrum allocation policy has seen little procedural change over the last decade, recent developments have conceded administrative supremacy to a more flexible regimen that will eventually permit a greater role for market forces. Canada has traditionally relied on a "first come, first served" process to allot spectrum to service providers, and as late as 1992, an estimated 99% of licenses were still awarded to applicants by means of this method. [121] However, in cases where there is a 'competitive situation', defined as greater demand for spectrum than supply, a comparative process is applied. Used to select candidates for cellular services in the 800 - 900 MHz range,

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[118]Bennett Z. Kobb, 250.

[119]Bryan Gruley, and John Keller, "FCC to unveil long-awaited Plans for Two Auctions of Airwave Licenses," Wall Street Journal March 03, 1997: A3.

[120]Bryan Gruley, and John Keller, "FCC to unveil long-awaited Plans for Two Auctions of Airwave Licenses," Wall Street Journal March 03, 1997: A3.

[121]Laurent Benzoni, and Eva Kalman, 181.

paging in the 400 and 900 MHz range, and frequencies for public cordless telephones,[122] this technique has been subjected to several public policy reviews, and despite general commercial acquiescence of the regulatory status quo, may be superseded by some form of competitive bidding process in the near future. The current comparative review process in conducted in three stages.[123] Stage one commences with a formal announcement of intent in the *Canada Gazette*. Calls for interested service providers/equipment manufacturers are made at this point and a summary of proposed services, technical and spectral prerequisites, and filing instructions are also provided. More importantly, the minimum criteria for eligible candidates are explicitly established. Industry Canada requires information from license applicants based upon these conditions: corporate ownership/structure; telecommunications experience; and a description of the proposed service(s). A list of interested parties is then made publicly available to provide, in Industry Canada's own words "...an opportunity to identify who else is interested and with whom they might wish to form alliances."[124] A second phase is initiated by the submission of the commercial information requested in the *Canada Gazette* first stage criteria. Thorough descriptions of applicant intent and service execution (including technical, socioeconomic, and institutional requirements) are requested by Industry Canada. At this point, the information provided by the prospective service provider or equipment manufacturer becomes the material used by administrators to compare the applicant's claim against Canadian telecommunications policy objectives. Objective criteria, such as fulfillment of Canadian ownership conditions

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[122]Industry Canada, Public Review of the Comparative Selection and Radio Licensing Process (Ottawa, 1994)

[123]Industry Canada, Industry Canada's Three-Phase Selection and Radio Licensing Process (Ottawa, 1994)

[124]Industry Canada, Industry Canada's Three-Phase.

laid out in Section 16(3) of the *Telecommunications Act* (1993)[125], applicant eligibility to hold a radio license, or an explicit commitment to conduct research and development in Canada are part of these considerations. However, subjective prerequisites are also taken into account, mentioned as "wants" and "suitability" in Industry Canada's 1994 outline of the comparative process. Economic feasibility, impact upon industry concentration, and the applicant's general capacity to offer a needed service come under administrative scrutiny as part of the comparative process.[126] The above criteria are considered in sum when a panel of Industry Canada departmental officials recommends its choice of license recipients, and any accompanying conditions, to the Minister responsible for Industry Canada.[127] By the authority granted to the Minister, he or she selects the successful applicants after a second review of policy and technical requirements, and fixes license conditions. Again, the result is made public through the *Canada Gazette* or via a press release, commensurate with the scope and/or political importance of the decision. The process is concluded with the issuance of licenses. After license fees are paid (these monies flow into the consolidated revenue fund, generally for deficit reduction) spectrum assignments are made, and interference, transmitter frequency and power requirements are set.

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[125]16(3) For the purposed of subsection (1), a corporation is Canadian-owned and controlled if
(a) not less than eighty percent of the members of the board of directors of the corporation are individual Canadians;
(b) Canadians beneficially own,directly, or indirectly, in the aggregate and otherwise than by way security only, not less than eighty percent of the corporation's voting shares issued and outstanding' and
(c) the corporations is not otherwise controlled by persons that are not Canadians.

[126]The applicant's record of service provision, area coverage, and financial and management competence are also among the criteria graded. Bob Fedoruk, Industry Canada. Interview, October 10, 1996.

[127]Industry Canada, Industry Canada's Three-Phase.

As was previously mentioned, public input is solicited through the *Canada Gazette*: all regulatory decisions, calls for tender, and proposed changes to spectrum allotment and utilization policy, and current or future frequency allotments are published in this document. The *Canadian Table of Frequency Allocation* and the spectrum utilization series (SP) and radio system policy (RP series) documents are a codified record of all spectrum management policies.[128] Industry Canada also utilizes a limited public review process to solicit input on general spectrum management policy or license choices.[129] Several public reviews of the spectrum allocation process were conducted in the late 1980s and early 1990s by the former Department of Communications (DOC),[130] culminating in a number of policy documents that recast the key tenets of Canadian spectrum allocation policy. The international scope of spectrum management was a salient theme of these reviews, recognized through Canadian obligations to coordinate spectrum allotment multilaterally as a signatory to ITU conventions, and through bilateral agreements with neighboring countries, namely the United States.[131] The Canadian government stated a number of exogenous factors that would determine the nature of spectrum policy over the next decade: the increasing pace of innovation (primarily in digital transmission and reception technologies), tremendous growth in mobile services, broadcasting, and value added networks (VAN), as well as the restructuring of the ITU, and reduced fiscal and administrative capacity of governments.[132] Canadian spectrum

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[128]Industry Canada, General Information Related to Spectrum Utilization and Radio Systems Policies (Ottawa, 1991), 1.

[129]Limited participation by consumer or social interests typifies these proceedings. Spectrum management is a highly technical field and by its very nature tends to exclude lay interests from the discourse.

[130]Assimilated into Industry Canada in 1993 as part of Prime Minister Campbell's administrative reorganization.

[131]Industry Canada, A Spectrum Policy Framework for Canada (Ottawa, 1992), 5.

[132]Industry Canada, A Spectrum Policy Framework, 5.

allocation policy goals remained essentially unchanged throughout the 1980s and early nineties. The avoidance of interference, domestically and internationally, is the primary 'technical' goal to which all other concerns are subordinated. Allotting spectrum to services (or potential services) that best serve demand for Canadian radio communications services in an equitable, orderly, and efficient manner could only then be realized. Much of what comprises current spectrum allocation policy is governed by the tenets laid down in a 1992 Industry Canada document titled A Spectrum Policy Framework for Canada. The result of nearly two years of public consultations and policy proposals, this report reiterated the core policy objectives Industry Canada was pursuing in spectrum allocation and utilization, and radio licensing.

The orderly and efficient development of radio communications was reaffirmed, along with objectives of efficient usage and planning of the spectrum; adoption of advanced techniques of spectrum management; protection of Canadian cultural industries; a commitment to international schemes of spectrum management;[133] promotion of research and development; and a reiterated commitment to including public interests in radiocommunications policy.[134] Furthermore, a number of policy guidelines were adopted, building upon the core objectives laid out in this report. Of relevance to this examination were those statement that dealt specifically with spectrum allocation: the balance between public and private uses of the spectrum continued to be supported, along with the general recognition that RF has socioeconomic importance as a *national*

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[133]Indeed, the spring 1993 spectrum policy review was in response to frequency assignments made at the 1992 WARC. Industry Canada, Revisions to Microwave Spectrum Utilization Policies in the Range of 1 - 20 GHz (Ottawa, 1995), 2.

[134]Industry Canada, A Spectrum Policy Framework, 6.

public resource,[135] and that public services would continue to receive priority. Resource policies that had served well in the past would be adhered to in the future, with modifications to encourage new service innovations. Of major importance, however, were the allusions to allowing a greater role for market forces in spectrum allocation. The reported prevailing commercial and public view of the existing comparative process was positive, with only a few reservations that it was not responsive enough or did not adequately determine the value of the spectrum to the user.[136] At the time, Industry Canada committed to maintaining a flexible approach to spectrum management. An adopted policy guideline explicitly stated, "If other market-based approaches are deemed to be in the public interest and applicable to specific services or frequency bands, they will be implemented only after full public consultation."[137] The possibility of alternative spectrum management schemes is clearly established in this document. Subsequent policy reviews under the Chrétien Liberals indicated a further softening of Industry Canada's position vis-a-vis market-based spectrum allocation techniques.

Notice SMRR-001-94 initiated a public review of the existing comparative selection and licensing process in April 1994. The findings of this review were published in a February 1996 report and are worthy of note. According to the outcome of Industry Canada's extensive consultations with industry, user interest groups, and other federal and provincial government departments, there was a general recognition that the comparative process served the public good. Nearly a half of the respondents to the review gave the existing process a favourable rating in criteria such as responsiveness

[135]Industry Canada, A Spectrum Policy Framework, 6.
[136]Industry Canada, A Spectrum Policy Framework, 16.
[137]Industry Canada, A Spectrum Policy Framework, 18.

to industry requirements for spectrum, or in the encouragement of innovation.[138] Not surprisingly, a majority of the incumbents continued to *disapprove* of allowing a greater role for the market, even to the extent where the opinion "that the current comparative process already efficiently allocates spectrum to the most qualified applicants." was expressed.[139] Commensurate with global trends towards market-based approaches by national telecommunications regulators, auctions attracted considerable attention from the respondents and the Canadian government, and this was evident in these findings. Auctions, or some comparable form of bidding technique, were perceived as the major market alternative for spectrum allocation.[140] Each point of contention respondents raised against auctions was carefully rebutted by Industry Canada. Concerns that auctions would encourage the idea of frequency ownership, instead of the contemporary orthodoxy that accorded the spectrum the status of a public good, were dismissed. Industry Canada insisted the idea of licensing is based upon usage, not ownership.[141] Much of what the former DOC had argued *against* auctions in response to a 1992 Organization of Economic Cooperation and Development (OECD) sponsored questionnaire was rejected. At the time, auctions were not an option in Canada because they were perceived to limit administrative discretion and were incompatible with the then DOC principle of spectrum leasing.[142] Now the key was in instrument design. Industry Canada would determine the eligibility criteria for auction participants. A screening process could filter out frivolous bids; bidding credits would encourage the

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[138]Industry Canada, Review of the Comparative Selection and Radio Licensing Process - Findings (Ottawa, 1996), 4.
[139]Industry Canada, A Spectrum Policy Framework, 6.
[140]Industry Canada, A Spectrum Policy Framework, 8.
[141]Industry Canada, A Spectrum Policy Framework, 9.
[142]Laurent Benzoni, and Eva Kalman, 182.

participation of smaller firms; and limits upon frequency block sizes with geographic areas could be imposed in order to prevent interference with established users and the aggregation of possible "monopoly" frequency blocks.[143] Public policy goals could be pursued by establishing conditions for each auction participant.[144] Licenses would be set aside for regional, public, or minority interests. Terms setting a required investment in infrastructure or telecommunications research and development could also be part of the auction procedures. For Industry Canada, the key to retaining administrative discretion was contingent upon the methodology of a proposed competitive bidding process.

At the same time, Industry Canada settled upon streamlining the current distributive process, but did not rule out, after a "thorough examination of the issues" integrating auctions, or elements of a competitive bidding system into spectrum allocation policy. An illustrative modified auction process documented in the 1996 report would be a combination of the existing comparative process with that of the American auction system.[145] At the market level, Industry Canada recognized consumer choice should determine what spectrum is required by nascent services: administrative decision-making was to be gradually de-emphasized.[146] The means to effect these changes did exist without further parliamentary involvement. The Minister responsible for Industry Canada has the authority to pursue market-oriented allocation policy as per section five of the *Radiocommunication Act*, pursuant to section seven of the *Telecommunications Act.*[147] The impetus to adopt market-based techniques of spectrum

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[143]Industry Canada, Review of the Comparative Selection, 11.
[144]Industry Canada, Review of the Comparative Selection, 10.
[145]Industry Canada, Review of the Comparative Selection, 16.
[146]Bob Fedoruk, Industry Canada. Interview, October 10, 1996.
[147]7. It is hereby affirmed that telecommunications performs an essential role in the maintenance of

allocation was also present. Criticism of the comparative process from some quarters had become increasingly vocal, despite the general commercial support for the regulatory *status quo* expressed in the February 1996 report. A commercial need for consistent criteria in the comparative process has compelled some firms to lobby for the standardization of licensing procedures.[148] Ostensibly this meant deviating from the comparative process to a more 'objective' licensing scheme in the American mould. The subjective nature of the eligibility criteria was of the most concern to prospective service providers, evident in the related comments of a license applicant describing the Canadian comparative process as 'Byzantine'.[149] Nevertheless, the 1996 Budget Bill amended the *Radiocommunication Act* to permit explicitly the Minister of Industry to circumscribe and utilize a competitive bidding process to award a spectrum license.The policy direction that Industry Canada had set over the previous five years finally culminated in a decision to allot licenses for LMCS via a competitive bidding process. This decision was announced publicly by Industry Minister John Manley, on October 29, 1996.[150] Other auctions would also be considered for two remaining PCS spectrum blocks, direct broadcast by satellite frequencies, and fixed or point-to-point communications above 23 GHz.[151]

Canada's identity and sovereignty and that the Canadian telecommunications policy has as its objectives (f) to foster increased reliance on market forces for the provision of the telecommunications services and to ensure that regulation where required, is efficient and effective.

[148]Harminder Gill, BC Tel Mobility. Interview, October 23, 1996.

[149]John McMillan,195.

[150]Hon. John Manley, "Announcement of LMCS Licenses," Ottawa, October 29, 1996.

[151]Darius Breau, "Economic Techniques in Canadian Spectrum Management: A Case Study" Paper presented at ITU conference, Geneva, 1996.

The above review of recent major assignments of spectrum in the United States clearly reveals the acceptance and implementation of a licensing regime based upon competitive bidding by the FCC. The last decade has seen movement toward a similar system in Canada, paralleled by an increasing focus upon the role telecommunications play in the national economic interest. Wireless telecommunications industries have been long recognized as key actors in securing export markets for Canadian goods and services. The advent of cellular radio in Canada was heralded in 1979 by the allocation of the 806 - 890 MHz block to nascent mobile services as per spectrum assignments made at WARC-79.[152] The initial license assignments were executed via comparative review, and a functional duopoly was legislated in most markets (split between the wireless services subsidiary of an incumbent Bell or provincial carrier and an 'exclusively' mobile services carrier, such as Cantel). Cellular telephones first found acceptance with mobile business users in the early and mid 1980s, but later grew in the residential and personal user markets to an estimated four million cellular users in Canada in 1997.[153] Canadian cellular carriers were also the most vocal proponents of PCS. The first group of PCS licenses were granted via comparative review to Microcell Telecommunications Inc, Clearnet Communications, Rogers Cantel Mobility, and Mobility Canada in December, 1995. These spectrum allotments provided a good example of Industry Canada's intention to tie some conditions to licenses: no fees were required from the successful applicants, but they were required to dedicate a minimum of 2% of their revenues to telecommunications R&D.[154] Industry Canada recognized the

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[152]Department of Communications, Radio Licensing Policy for Cellular Mobile Radio Systems and Preliminary Mobile-Satellite Planning in the Band 806-890 MHz (Ottawa, 1981), 6.
[153]Andrew Allentuk, "Telecom Firms Deliver a Mobile Feast," Globe and Mail December 03, 1996.C12.
[154]Gordon Arnaut, "Are PCS Firms Delivering as Promised?" Globe and Mail December 03, 1996: C11.

success of cellular telephony as being dependent upon the existence of a continental market for equipment and subsequently tailored its PCS frequency plan to be compatible with the block assignments adopted by the FCC and in accordance with a 1994 Interim Sharing Agreement between the US and Canada for RF in the 1.85 - 1.9 MHz band.[155]

In February 1995, Industry Canada solicited public comments on the usage of millimetric frequencies (above 20 MHz) with the intention of determining commercial interest in LMCS (which had been in experimental trials since 1994).[156] Exactly a year later, the ministry published policy guidelines and a call for application for the institution of common carrier LMCS in the 27.35 - 28.35 GHz band. Therein the focus was threefold: policy objectives encompassed the enhancement of competitiveness of Canadian telecommunications, the increased reliance upon market forces for the provision of services, and the stimulation of domestic R&D.[157] Little mention of social or cultural objectives, outside of a brief nod to citizen's privacy concerns, was made. Industry Minister John Manley later confirmed the desire to capture the economic and industrial policy benefits of a Canadian technological lead in this area stating,

> "When we license LMCS our technology is going to be a year ahead of anybody else. And if we can get up and running and establish a base in Canada, we've got a big step forward on the market internationally. Canadian companies are going

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[155]Industry Canada, Wireless Personal Communications Services in the 2 GHz Range (Ottawa, 1995).
[156]Terrence Belford, "Industry Decision Means Billions," Globe and Mail September 24, 1996.
[157]Industry Canada, Local Multipoint Communications Systems (LMCS) in the 28 GHz Range: Policy, Authorization Procedures, and Evaluation Criteria (Ottawa, 1996), 3.

to be out there, and that's where the jobs and growth come from. There's no other solution in today's economy."[158]

The first round of comparative hearings concluded in the fall of 1996, with the announcement of three successful license applicants. By this time it had also been decided that the second round of applications for LMCS licenses would be dealt with using a competitive bidding system. This was explicitly stated in October 29, 1996 speech made by Minister John Manley, while announcing the winners of the first round comparative process.[159]

In retrospect, a number of interesting points can be made regarding the Canadian policy positions on each of these major wireless services. As early as 1981, there was strong private sector support for a 40 MHz allocation of frequency to achieve national and international (Canada and United States) compatibility, not only for network connectivity but also with the intention of achieving economies of scale for equipment and services. [160] The Department of Communications also indicated its interest in this opportunity to establish regionally compatible systems, recognizing not only the competitive advantage that lay therein for Canadian firms, but also the market demand that would be made by "today's highly transient society" for such a service.[161] While PCS licenses were awarded through comparative review, PCS policy goals manifested the heightened

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[158]William Boei, "More Signs Needed on Wider Info Highway," Vancouver Sun October 17, 1996: C1/C4.

[159]"To make sure that new services bring new competitors into the market, existing phone and cable companies were not eligible in this licensing round. They will be able to take part in the next round which will involve a competitive bidding process." Hon. John Manley, "Announcement of LMCS Licenses," Ottawa, October 29, 1996.

[160]Department of Communications. Radio Licensing Policy, 2.

[161]Department of Communications. Radio Licensing Policy, 11.

importance of wireless telecommunications as an industrial policy issue. Industry Canada documentation made reference to the significance of the domestic telecommunications equipment and carriage industry and the expectation PCS would fulfill in positioning said industry for global leadership.[162] The later Canadian policy position on LMCS was tangible evidence of the further crystallization of the government's desire to seize competitive advantage in the international marketplace for Canadian firms. This singular application is expected to generate 12,000 - 15,000 new jobs over the next ten years, but only after an investment of $3 billion in infrastructure.[163] Nevertheless, a number of firms believe that sufficient demand for broadband wireless services exists to warrant such optimistic predictions. Arguably, license auctions should expedite this process.

In sum, Canadian spectrum *utilization* and radio licensing policy appears to be converging with that of the Americans. Commercial requirements for seamless continental networks can only be fulfilled if frequency assignments for major mobile services are coordinated north and south of the 49th parallel. Common frequency allotments and equipment standards also mean larger markets for Canadian wireless equipment manufacturers as firms are able to reap the benefits of economies of scale and scope. To facilitate these policy goals, Canadian spectrum licensing instruments are also becoming similar to those used in the United States. There will be no abrogation of the comparative process in the short term. However, license auctions will be adopted and adapted to the Canadian market. Apparently this means license applicants will bid

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[162]Industry Canada. Wireless Personal Communications.

[163]Terrence Belford, "Industry Decision Means Billions," Globe and Mail September 24, 1996: C17.

the amount they are willing to pay annually to retain or acquire their frequencies[164] instead of the lump sum bidders must present to gain entry into license auctions in the United States. The unequivocal DOC rejection of auctions in 1992 has been replaced by a more pragmatic acceptance of the utility of alternative policy instruments evident in the attitude of the Assistant Deputy Minister.[165] In total, this is evidence of a shift in policy style, but not as we have defined it previously. The concept of policy style as "a diffuse notion signifying the process by which policy responses are formulated."[166] is not entirely applicable here, and must be further qualified. Conventional usage limits policy style to general categories of structural or institutional definition of policy formulation. However, what has been observed over the last decade in Canada is a change of the normative and ideological basis for telecommunications regulation. Alternative spectrum allocation techniques are merely the tangible manifestations of an (admittedly) ephemeral and difficult to quantify change in attitude by policy-makers. Recent statements by Industry Canada officials are demonstrative of this new position, advocating reduced governmental regulation of wireless services and an increased reliance upon market and consumer discipline to regulate service providers. Elements of this view are apparent and shared among line staff in Industry Canada's telecommunications directorate, in the competition bureau of Industry Canada,[167] and extend up to the ministerial level. Especially revealing of this attitudinal change was a comment made by Industry Minister Manley regarding telecommunications services:

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[164]Darius Breau, "Economic Techniques."

[165]"We are pursuing any and all tools appropriate for a given situation." paraphrased by David Warnes, Industry Canada. Interview, October 30, 1996.

[166]Colin J. Bennett, "Policy Convergence," 218.

[167]"The Competition Act and the Canadian Telecommunications Industry," speech by George N. Addy, Director of Investigation and Research under the Competition Act. Toronto, March 29, 1994.

> "My view is that we get it [LMCS] out there fast and let the market decide. Companies will succeed and companies will fail and companies will innovate based on how the market responds."[168]

This change in attitude did not occur suddenly, nor was it an inevitable development. The last decade of Canadian spectrum allocation policy played out against the backdrop of larger departmental and sectoral perturbation. The liberalization of telecommunications in the U.S. was well underway in the late 1980s when the Free Trade Agreement (FTA) and the North American Free Trade Agreement (NAFTA) recast Canadian telecommunications as a trade in services issue, providing an opportunity for pro-market actors in the departments of Industry and Finance, and in the Trade Negotiation Office to gain a voice in domestic regulatory matters.[169] The protectionist and introspective DOC, forced onto the defensive by the inclusion of these actors in domestic telecommunications, was absorbed into Industry Canada in 1993, bringing telecommunications policy and research, investment, consumer, and competitive policy, as well as business framework law into the department's fold and repositioning it for micro-economic management.[170] Industry Canada would be responsible for the promotion of sectoral development, "by promoting services to the private sector to assist in increasing the competitive capacity of industry."[171] It appears

[168]William Boei, "More Signs Needed on Wider Info Highway," Vancouver Sun October 17, 1996: C1/C4.
[169]Richard J. Schultz, and Mark R. Brawley, "Telecommunications Policy," 103 in G. B. Doern, Leslie A. Pal, and Brian W. Tomlin eds., Border Crossings: The Internationalization of Canadian Public Policy (Toronto: Oxford University Press, 1996).
[170]G. B. Doern, and Brian W. Tomlin,"Trade-Industry Policy," 175 in G. B. Doern, Leslie A. Pal, and Brian W. Tomlin eds., Border Crossings: The Internationalization of Canadian Public Policy (Toronto: Oxford University Press, 1996).
[171]Industry Canada, The Impact of the Budget on the Industry Canada Portfolio, cited G. B. Doern, and

that this new role as an externally-oriented industrial sector development department has been the seminal influence behind the adoption of market-based spectrum allocation instruments. In support of this, Industry Canada has developed a concern with making its "policy-making machinery flexible, to allow business to do business and to do it quickly."[172] Additionally, the Industry Canada budget was cut by 42.5% in the 1994 - 95 programme review,[173] limiting the funding available for complex bureaucratic policy instruments, such as the comparative process for radio frequency licenses. This reduction of administrative capacity requires the departmental staff to do more with less and intensifies an ongoing shift from regulation to information and service provision.

Granted, it is also difficult to argue that there is a wholesale consensus among Industry Canada officials and their commercial constituency or that the comparative process or first come, first served allotments are inadequate to deal with the accelerating rate of change in the global wireless telecommunications market. Dissenting opinions will be found in any organization, and incumbent wireless firms are unlikely to support unreservedly spectrum auctions and the potentially higher costs they may incur. Nevertheless, the acceptance of market-based tools for spectrum allocation reached critical mass. Industry Canada has made obvious its preference for less complex and less costly instruments that speed services to market quickly. The need for an expeditious and relatively inexpensive dispensation of radio licenses to support

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Brian W. Tomlin,"Trade-Industry Policy," 181 in G. B. Doern, Leslie A. Pal, and Brian W. Tomlin eds., Border Crossings: The Internationalization of Canadian Public Policy (Toronto: Oxford University Press, 1996).

[172]David Warnes, Industry Canada. Interview, October 30, 1996.

[173]G. B. Doern, and Brian W. Tomlin,"Trade-Industry Policy," 181 in G. B. Doern, Leslie A. Pal, and Brian W. Tomlin eds., Border Crossings: The Internationalization of Canadian Public Policy (Toronto: Oxford University Press, 1996).

burgeoning service opportunities under the aegis of commercial and consumer interests appears to have overridden the public utility discourse of the past.

These points beget several questions. How has the awareness of market-based techniques of spectrum management been transferred from administration to administration? Has the adoption of auctions in the United States influenced the perception of systemic actors in Canada? The example set by the Americans was mentioned several times in the February 1996 Industry Canada report. Are the indications of a shift to market forces as the mainstay of Canadian spectrum allocation evidence of emulation of American policy, an inevitable outcome of the liberalization of the Canadian telecommunications policy, or merely political expediency in an era of minimal government orthodoxy and sectoral deregulation? Moving from the particular to the general, it is apparent that there are pressures toward conformity exerted upon both systems. The most obvious of these is the ordering influence the ITU has upon wireless communications. Canada and the United States participate in the ITU World Radio Administrative Conferences (WARC), and as signatories to the ITU convention generally defer to the spectrum assignments laid out in its International Radio Regulations. Is this involvement in an international spectrum regulation regime conducive to the development of similar regulatory systems? Both states grapple with similar technical, legal, and economic problems in the execution of their spectrum activities, so it is not surprising to see similar solutions adopted in both countries. Yet the question remains, to what extent (if any) does the ITU determine the nature of *this aspect* of domestic telecommunications policy?

Chapter IV: International Influences, Domestic Foils?

The international telecommunications regime performs two general functions: one legal, the other technical. The *International Telecommunications Union Convention and Radio Regulations* constitute international law,[174] codifying some of the traditionally implicit norms that accord the spectrum the status of a common resource. Participant states are obligated to apply the Radio Regulations to their national legal systems. Signatories to the ITU Convention, operating in accordance with the Radio Regulations, are conceded priority usage of frequency bands and the "right to international protection from harmful interference."[175] While a planning mechanism for spectrum assignments is not explicitly laid out in the Convention and Radio Regulations, most states abide by the norm established by spectrum zoning conducted at World Radio Conferences (WRC) because it is in their mutual interest to do so. The instrumental importance telecommunicatons has assumed to modern economies guarantees that states will continue to dismantle perceieved barriers to the free flow of commerce to in an attempt to increase their economic welfare. Zacher and Sutton point out "states and their industries do not want to risk uncertainty with regard to the flow of radio communications."[176] and this demands national compliance with the international spectrum planning regime and the technical standards endorsed by the ITU's Telecommunications Standardization Sector. In sum, the international spectrum

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[174]David M. Leive, 12.

[175]David M. Leive, 22.

[176]Mark W. Zacher, and Brent A. Sutton, Governing Global Networks: International Regimes for Transportation and Communications (Cambridge: Cambridge University Press, 1996), 178.

management regime has been successful thus far because it derives its functionality from the utility-maximizing behavior of contemporary states.

The ITU's mandate can be further split into three general spheres of activity, according to Savage, encompassing the coordination of radio services and assignment; the endorsement of technical standards (both software and hardware) for network connectivity; and thirdly, the regulation of international data (voice, video, and text) exchange.[177] Of relevance to this investigation are those roles that mitigate radio interference,[178] and encourage the standardization of wireless technologies. The main international fora for determining spectrum assignments are the aforementioned WARC and Regional Administrative Conferences (RARC). The former are conducted either every two decades as major administrative undertakings that "entail massive preparation and comprehensive overhauls of the entire Radio Regulations, as well as renumbering and republishing existing regulations."[179] or as specialized WARCs focusing on a particular frequency block, technical standard, or service, or as multiple session conferences for particularly contentious or technical (particular technologies or services that are rapidly evolving, or transmit past national boundaries) spectrum allotments.[180] A 1993 reorganization of the ITU's conference procedures and regulatory structures has elevated the importance of WARCs, and increased their frequency to biennial World Radio Conferences (WRC). At these conferences regulations governing

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[177]James G. Savage, 11.

[178]Mark W. Zacher, and Brent A. Sutton, 178.

[179]James G. Savage, 83.

[180]For example, a two session WARC met in 1985 and 1987 to attempt to settle the assignments of geosynchronous orbital slots and associated services dependent on such satellites. James G. Savage, 16.

spectrum usage are established, reviewed, or revised. The consequent frequency assignments by major service category (fixed, mobile, maritime navigation etc.) are allotted to each ITU regional division. A second type of conference is conducted at the ITU regional level: specific frequency issues dominate these affairs. According to Savage, agreements over localized radio frequency services, such as FM/AM radio, specialized mobile radio (SMR), television broadcasting, and direct broadcast by satellite (DBS) have been successfully completed at these types of conferences, often aided by regional broadcasting agencies (such as CEPT) or technical organizations.[181]

There are two agencies within the ITU of direct relevance to national spectrum managers: the Radio Regulatory Board (RRB)[182] is a semiautonomous, five member committee in the ITU's Radiocommunication Sector, charged with the task of registering, mapping, and analyzing the legality, usage, and potential of every radio frequency.[183] Additionally, national regulators must register their frequency assignments with the RRB and its master frequency list. It is upon this agency that the task of preventing interference from conflicting national frequency assignments falls. The second body is the Telecommunications Standardization Sector, which studies technical and operational issues in wireless telecommunications as well as evaluating standards. System and protocol standardization advocacy is part of this bureau's purview as well,[184] and it often provides technical background and recommendations for achieving system inoperability for the WARCs. A major effort initiated after the 1987 WARC-MOB (mobile services) for

[181]James G. Savage, 84.
[182]Formerly the IFRB. In 1993 the ITU undertook a number of organizational changes, including merging the CCIR and CCIT into the Telecommunications Standardization Sector.
[183]James G. Savage, 18.
[184]James G. Savage, 185.

the proposed global FPLMTS involved the former International Radio Consultative Committee (CCIR) in studies to assess the standards such an undertaking would be required to meet.[185] Together, the RRB and the Telecommunications Standardization Sector constitute an international Canadian Standards Association (CSA) of sorts, a clearinghouse for the commercially developed standards that enable systems to exchange data. This decidedly unglamorous activity facilitates the order necessary for realizing global communications, the "vast array of procedural and technical standards have promoted stability and a reduction in barriers in international communications,"[186] and for telecommunications industries to reap economies of scale and scope from large, standardized markets. These three instruments, international and regional administrative conferences, the RRB and the Standardization Sector, constitute the ITU's spectrum management regime. National spectrum allocation is a derivative of the ITU Frequency List and Radio Regulations.

With few exceptions, domestic spectrum utilization (summarized in the Canadian and American tables of allocation) is a direct outcome of the frequency assignments made to services at the WRCs. However, many of these assignments are merely official endorsements of *de facto* frequency usage coordinated at the regional level or bilaterally. These reflect established patterns of spectrum usage by public agencies and major corporations. The 1992 radio conference witnessed hitherto unprecedented involvement by these commercial interests. While commercial involvement in WARCs was not novel -- indeed the American government had a long history of including the

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[185]Michael Paetsch, 401.

[186]Mark W. Zacher, and Brent A. Sutton, 179.

private sector in its ITU activities[187] -- the scope and aggressiveness of firms and consortia at WARC-92 was. Individual firms such as Motorola and AT&T, as well as global combines such as INMARSAT, sent representatives to WARC-92 as part of national delegations and directly lobbied individual governments often well in advance of the conference.[188] In parallel, the French, American and Swedish national administrations, among others championed their own industries commercial interests.[189] These commercial efforts undoubtedly had a hand in ensuring the success of mobile services allotments (at the expense of many fixed systems), freeing frequency assignments for PCS and LEO slots.

However, the question remains whether the choice of domestic licensing techniques is determined in any way by ITU proceedings. Harmonization of domestic radio licensing policies is not expressed in existing ITU legal structures; nor could the ITU enforce national compliance should it want to ensure homogeneity across domestic licensing regimes.[190] Instead, the ITU endorses the usage of whatever licensing arrangement each regulator desires, providing these measures comply with international agreements and the norms established in the ITU Convention and Radio Regulations. It is conceivable that the commercial penetration of national spectrum regulators, evident in the increased private sector influence at recent ITU proceedings will generate pressures

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[187]John J. Havick, Communications Policy and the Political Process (Westport: Greenwood Press, 1983), 96-97.

[188]Liching Sung, "WARC-92: Setting the Agenda for the Future," Telecommunications Policy (November, 1992): 629.

[189]Liching Sung, 629.

[190]Indeed, the only coercive mechanism possessed by the ITU is its power to strip a signatory states of its voting rights. Robert Milton Everton, International Management of the Radio Spectrum (Diss. Burnaby: Simon Fraser University, 199)1, 138.

for licensing regimes that are conducive to commercial interests. Once industry has secured the necessary spectrum for nascent mobile services, it would naturally encourage a domestic licensing regime that permits exploitation of those frequencies at least fixed cost. Yet it is debatable whether all firms would advocate spectrum *auctions* as the most advantageous licensing instrument. Arguments have been advanced that competitive bidding rewards service providers with the 'deepest pockets'. Auctions do increase the initial outlay of a firm seeking to enter the wireless market, or that of an incumbent constructing a new system using a hitherto unassigned frequency. The recent lobbying effort of American cellular providers against spectrum auctions supports the assertion that this policy instrument is not favoured by all business.[191] In Canada, incumbent firms traditionally have lobbied against spectrum auctions because of their inherent potential to raise fixed costs for service providers and admit new entrants into their markets. Relatively recent arrivals to the wireless telecommunications market have also voiced their opposition to spectrum auctions, however. The founder of Telesystem International Wireless Inc. and the aforementioned Microcell Telecommunications Inc, Charles Sirois, recently argued against spectrum auctions in Canada on the grounds they stifled investment in new telecommunications services and granted unfair advantages to incumbent network operators.[192]

The choice of policy instruments is influenced by regional agreements. The regulation of the most contentious and valuable spectrum assignments fall within domestic or regional

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[191]Peter Passell, "Radio Spectrum Sales Seem a Success. Why the Attack?" New York Times 29/05/97, P.D.2.

[192]Jan Ravensbergen, "'Don't Auction Bandwidth' U.S. Alternative to Licensing is Crazy Microcell's Sirois Says." The Gazette (Montreal) 04/06/97, P.B.4.

domains. Pursuant to this is the appearance of an intriguing connection between frequency band, frequency usage, and ITU regulatory activity. For example, the ITU has lavished considerably more attention upon the HF band, which is a medium for television broadcasts and propagates extremely large distances, often across continents. This observation has important consequences for this investigation. The emergent services discussed in this investigation such as PCS, cellular radio, or LMCS, are the most salient cases of regulatory realignment, but largely fall within exclusively national or regional policy systems. These services can generate inference, but their short range limits such externalities to metropolitan areas, and rarely internationally. Furthermore, most international radio frequency policy in North America is conducted at the regional level and bilaterally (Canada/Mexico vis-a-vis the United States) or trilaterally when all NAFTA actors are involved. Regional cooperation has its historical exegesis in NARBA (North American Regional Broadcast Agreement) of 1929, a multilateral agreement between the US, Canada, and Mexico over broadcast services spectrum.[193] There are also extensive terrestrial broadcasting and radiocommunications agreements between the United States and Canada. Interim sharing agreements have been signed between the two administrations for frequency bands that extend over national boundaries, or in cases where coordination of frequencies are necessary to ensure network interconnectivity.[194] What this implies is the operation of a process of policy harmonization at the regional level. It must be stressed, however, that this is Canadian and American spectrum *utilization* policy that is converging, and not that of spectrum allocation.

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[193]James G. Savage, 35.

[194]Industry Canada, Wireless Personal Communications.

The deliberate implementation of policy lessons drawn from other domestic regimes is another possible source of policy convergence. It is difficult to discount the possibility of policy transfer in the formalized exchange of ideas between members of epistemic communities. Communities of legal, technical, and administrative expertise in the field of telecommunications exist internationally. Canadian and American policy-makers are involved in these epistemic networks when national delegations attend WARCs or RARCs. Canadian policy experts explain domestic spectrum management techniques and the rationale behind them at various ITU conferences.[195] National spectrum managers discuss regulatory structures and administrative techniques at ITU Plennipotentiaries, WRCs, and in working committes. The informalized contacts between economists, engineers, and research scientists in the private sector host exchanges of the technical aspects of policy instruments. It has been argued such *epistemes* are responsible ultimately for the current drive to redefine telecommunications as an international, competitive, market-based regime.[196] The consensus of the past, based upon domestic monopolies and bilateral cartels, has yielded to an epistemic community favouring competition, according to analysts such as Peter Cowhey.[197]

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[195]An example of this is the November 29, 1996 presentation made by Darius Breau in Geneva at the ITU, "Economic Techniques in Canadian Spectrum Management: A Case Study."

[196]Cowhey also states that the challenge to the prevailing regime originated in the domestic political and economic arenas and was escalated to the international level. Peter F. Cowhey, "The International Telecommunications Regime: The Political Roots of Regimes for High Technology," International Organization 44 (1990): 173.

[197]Peter F. Cowhey, 196.

Granted, the knowledge 'taken home' by policy-makers from international and bilateral contacts is filtered through domestic political structures (bureaucratic, legislative, executive, judiciary, and party) as well as the 'political' environments of commercial entities. Some does survive to enter the national policy discourse or be integrated into a business plan. Unfortunately, the implementation of such policy lessons is difficult to substantiate. Few policy makers are eager to credit other administrations for inspiring their programmes. Emulation of policy cannot be ruled out as a possible source of convergence, and the United States is unquestionably a major source of inspiration. If there is any tangible evidence of policy emulation, it would be visible in the attention Canada pays to developments in the United States. A previous mention was made of the U.S. as a policy exemplar. The adoption and implementation of spectrum auctions there was carefully watched by Canadian policy makers.[198] A number of analyses were conducted as to the feasibility of such techniques in Canada and these were published either as 'stand alone' reports or portions of Industry Canada documents.[199] The necessary conditions for lesson drawing, a common problem and a policy programme amenable to transfer, are certainly present in the Canadian context.[200] Furthermore, a shift in the values and preferences (our redefined notion of policy style) of Canadian policy-makers to favouring a liberalized, competitive telecommunications regime establishes the ideological propinquity (with the U.S.) that facilitates policy transfer and emulation.

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[198]"We've been watching auctioning for some time now, and studying it. Hopefully, maybe, the Canadian version will also gain from the fact that the United States has been in there longer doing it, so that we can gain from the knowledge and perhaps make an improvement upon it and perhaps not have some of the downfalls." David Warnes, Industry Canada. Interview, October 30, 1996.

[199]Some of these have been cited throughout this document.

[200]Richard Rose, Lesson Drawing in Public Policy: A Guide to Learning Across Time and Space. (New Jersey: Chatham House Publishers, 1993), 35.

Of equal importance to explaining policy convergence is the process of 'normalizing' telecommunications as a domestic service, subject to bilateral or multilateral trade agreements which extracts wireless concerns from the exclusive jurisdiction of the ITU. There seems to be a gradual enervation of the ITU as telecommunications are redefined as commodity services subject to the 'truck and barter' of trade regimes. Telecommunications have been removed from the exclusive domain of the state and the international regime dependent upon state control over domestic communications. The considerable economic and political influence of key state actors such as the United States, the United Kingdom, and Japan, accorded them enough leverage to redefine the normative basis for the international regime along the lines of their own liberalized telecommunications sectors.[201] The 1989 Free Trade Agreement brought the issue of the definition of telecommunications services to the fore in North America.[202] NAFTA further reinforced the ideal of telecommunications services as a legitimate topic in trade liberalization talks. In the NAFTA negotiations, enhanced and basic telecommunications were defined and subject to the three dominant trade principles (at the time) of favoured nation status, national treatment, and transparency.[203] Telecommunications services are further subjected to multilateral scrutiny under the General Agreement of Trade in Services (GATS) , and the recently concluded WTO Telecom Pact which requires an elimination of domestic barriers to competition.

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[201]Peter F. Cowhey, 172

[202]Hudson Janisch, "The Canada - US Free Trade Agreement: Impact on Telecommunications," Telecommunications Policy 13 (1989): 102.

[203]Richard J. Schultz, and Mark R. Brawley, "Telecommunications Policy," 104, in G. B. Doern, Leslie A. Pal, and Brian W. Tomlin eds., Border Crossings: The Internationalization of Canadian Public Policy (Toronto: Oxford University Press, 1996)

We must conclude that while pressures toward harmonization of spectrum utilization policies are exerted upon national administrations by participation in ITU structures or regional frequency coordination regimes such as NARBA, the choice of national radio licensing policy largely is a domestic decision, and one must look at the national level to find sufficient cause for policy convergence between national regimes. There one finds the 'drivers of convergence'. In the Canadian case, it is an acceptance of the normative basis for a competitive consumer and industry-centric telecommunications regime that has made possible a shift to market-based instruments of spectrum allocation as part of Industry Canada's policy options. This process of convergence of policy style is the consequence of deliberate decisions by Canadian policy-makers to involve Canada in a regional and international trade regime that defines telecommunications as a service (convergence through harmonization). The convergence of Canadian policy instruments with those of the Americans' merely supports the goals of domestic policy-makers to seize competitive advantage for Canadian firms in this new telecommunications order. Paradoxically a shift in policy style is necessary for these market-based policy instruments to be implemented.

Chapter V: Conclusion

Canadian spectrum licensing policy is clearly evolving along American lines. License auctions have been adopted to expedite the development of a Canadian wireless telecommunications services and equipment within a North America defined by transcontinental networks and their gradual integration into a global 'network of networks'. Policy-makers have adopted the perception that administrative review, while not to be entirely abandoned as a policy instrument, is not responsive enough to meet the need for regulatory flexibility in a policy system increasingly marked by fluid, rapid change. Like many other national regulatory agencies, Industry Canada has become deeply involved in industrial policy-making. The Canadian regulatory system is now called upon to perform the Herculean task of simultaneously securing competitive advantage for national industries while nominally accommodating the public utility and social welfare commitments of the past.

Telecommunications policy is an ideal arena for the divination of domestic and international influences in public policy convergence. A meso or sectoral level comparative analysis can expose the underlying processes that are symptomatic of convergence, often obscured by higher level analyses. The prevention of radio frequency interference within a complex legal, technical, and economic framework extending far beyond the purview of the state, constitutes the most immediate policy problem for radio licensing regimes. A cross national comparison of regulatory histories sheds light on the policy tools (and their context) used by regulators to manage

spectrum but is insufficient to account for observed similarities between regulatory regimes. Paradoxically, we have found policy convergence in this case has been primarily driven by domestic process. In this investigation, convergent policy is evident in the greater Canadian reliance upon market-based solutions for radio license allotment and spectrum utilization. A change in our redefined notion of policy style, while more difficult to quantify, is also observable and a necessary condition for the acceptance of market-based instruments for spectrum allocation (Figure 4). Moving from the specific to the general, one can also argue that the developments discussed in this paper call into question the validity of the technological determinism inherent in some expressions of the convergence thesis. An epigrammatic remark by a CRTC official summarizes a facet of this argument, "Technology makes the policy decision easier."[204] Technology really only provides the platform of possibility for public policy choices. Previously unavailable options are opened by the implementation of new technologies. But decisions, be they by individual consumers, firms, or industries, or public agencies are consciously made first to apply a technology and secondly, to impose some parameters upon it. Our focus upon meso-level explanations revealed each movement toward convergent policy instruments was deliberately and rationally conducted at the domestic level. This also helps counter the charge that the conclusions of this investigation are idiosyncratic to the policy sector examined. These findings also parallel those of other studies in telecommunications and environmental policy.[205]

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[204]Stephen Delaney, CRTC. Interview, September 17, 1996.

[205]Richard J. Schultz, and Mark R. Brawley, "Telecommunications Policy" in G.B. Doern, Leslie Pal, and Brian W. Tomlin eds., Border Crossings: The Internationalization of Canadian Public Policy (Toronto: Oxford University Press, 1996) and Michael Howlett, "Sustainable Development: Environmental Policy" in Andrew Stritch, and Andrew F. Johnson eds., Canadian Public Policy: Globalization and Political Parties (Toronto: Copp Clark Ltd, 1997).

What does all this analysis mean for Canadians? At the consumer level, wireless services apparently are coming to market faster than in the past. PCS networks have recently been launched in British Columbia and Ontario, and LMCS should be available nationally by spring 1997. Yet it is debatable whether spectrum auctions *will* speed such applications to market. The proliferation of wireless services in Canada appears to have more to do with consumer demand,[206] competition, and general sectoral liberalization than the adoption of minimalist policy instruments. Ironically, while consumers acquire more consumptive options, their ability to participate in public regulatory structures may be curtailed. Once commercial interests are fully engaged in a market-based regime of resource allocation it becomes difficult for social and consumer groups to represent their views. Deregulation of the FCC in the 1980s brought about further reduced public involvement in telecommunications regulation.[207] Can one expect a different outcome in Canada? Another related legitimate criticism of telecommunications deregulation originates from rural areas. Will government allow business to concentrate their capital investment only in areas that promise a high return? Commercial networks may bypass not only less populated or affluent areas, but even certain demographics (the 'less affluent' of the 'affluent'?) within urban areas as well.

Canadian license auctions are in their natal stages; their economic impact will remain undeterminable until well into the next century. Although the American experience with

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[206]Especially in 'grey areas' such as DBS, where consumer preferences act well advance of government regulation. Gordon Arnaut, "Will Canada Lose Out to DBS Grey Market?" Globe and Mail, December 03, 1996, C6.

[207]Robert T. Hilliard, 98.

competitive bidding predates Canada's by nearly four years, it still also is too early to foresee accurately what policy outcome these market-oriented regimes will have. In the United States, the administrative costs of spectrum management have been reduced, and the Commerce department has realized considerable windfall from auctions. However, there are some disturbing early indications that PCS licenses were auctioned off at a prohibitively high price raised by the bankruptcy of a major C block bidder and the temporary FCC suspension of accepting license fees for some of the C block assignments.[208] Whether this is a consequence of failure of the auction design or a general miscalculation of the size and returns of the PCS market remains to be seen. Regardless of the outcome, Canadian policy-makers should heed these developments and the lessons taught by New Zealand's and the American auctions, continuing to learn from the experiences of foreign administrations. Assessments of the effectiveness of spectrum auctions will remain problematic, even in the long term. The consequences of spectrum auctions will be difficult to isolate from the tremendous realignment that characterized the American telecommunications sector well before the AT&T divestiture of 1982 - 84 and intensified by the signing of the *Telecommunications Act* of February 1996.

Canadian policy-makers should resist the easy solutions represented by spectrum auctions and other market-based techniques. While they have recognized correctly that the often cumbersome administrative instruments of yesterday may not meet the needs of the future, they should attempt to anticipate future policy problems as the

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[208]Mark Landler, "Airwave Auctions Falter as Source for Funds for U.S." New York Times April 03, 1997, P.A.1.

implementation of new technologies in response to changing market demands again restructures their policy environment.[209] Doing so without losing sight of the whole telecommunications sector in its social as well as political and economic dimensions will be one of the main challenges facing domestic regulators.[210]

Intriguingly, the debate over market versus bureaucratic models of regulation may be a moot one. Convergent policy may be its own undoing. There exists a third policy paradigm that remains unexplored in most of the contemporary literature: the eventual and complete *absence* of government from spectrum regulation. While for some commentators, spectrum auctions are the apotheosis of a market-based licensing system, others view national regulators as an unnecessary nuisance. One of these arguments stands upon a technological premise,[211] the other upon recent commercial developments[212], although both are intimately interrelated.

There is an ongoing trend (particularly advanced in Europe) of relocating many wireless applications (such as television broadcasting and microwave transmissions) to fibre optic cables. The massive capacity of this relatively inexpensive (declining costs over the long run) medium may eventually help mitigate spectrum scarcity. The movement of broadcast video to broadband wireline networks, leaving voice and data to be carried by the radio spectrum, is referred to alternately as the 'Negroponte Switch' or the 'Pelton

[209]Which would be a change in policy style as Colin Bennett defines it, from 'reactive' to 'anticipatory'. See Christine Ogan, "Communications Policy Options in an Era of Rapid Technological Change." Telecommunications Policy 16 (1992): 575.

[210]This will be especially problematic in light of Industry Canada's new focus on micro-economic policy.

[211]For a proponent of the 'technological fix' see Ira Brodsky, Wireless: The Revolution in Personal Communications (Norwood: Artech House, 1995).

[212]See Simon Forge, "The Radio Spectrum and the Organization of the Future," Telecommunications Policy 20 (1996): 53 - 75.

Merge'[213] and is advanced by a number of telecommunications analysts.[214] This trend in conjunction with technologies such as spread spectrum and "frequency agile" transmission and reception devices[215] makes regulation of the radio spectrum unnecessary according its proponents. A concurring opinion ties the necessity of business to have global systems of communications and control to reform of the present state-centric system of spectrum licensing. Since spectrum usage is global, so should its system of governance be. Despite evidence of increasingly convergent regimes of radio licensing, national regulation is seen to be a hindrance to economic progress.[216] The next logical step is to elevate spectrum management to the supranational level to match the globalization of business communications. The merits of these arguments aside, these observations have their empirical basis in processes that bode ill for the present system of spectrum licensing. This is not a refutation of the proceeding arguments, however. Domestic regulators may be divesting themselves deliberately of substantive policy instruments and capacity, leaving a vacuum to be occupied by business interests or technology. Eventually spectrum regulation may flee the state entirely.

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[213]Joseph Pelton, 68.
[214]Liching Sung, 627.
[215]Ira Brodsky, 23.
[216]Simon Forge, 74.

Glossary

ADM	Assistant Deputy Minister
AMPS	Advanced Mobile Phone Services
CATV	cable television
CEPT	European Conference of Posts and Telecommunications Administrations
CCIR	International Radio Consultative Committee
CDMA	code-division multiple access
CSA	Canadian Standards Association
CRTC	Canadian Radio-Television and Telecommunications Commission
DAB	digital audio broadcasting
DBS	direct broadcast by satellite
DGSE	Director General Spectrum Engineering
DOC	Department of Communications
DS-SS	direct sequence spread spectrum
FCC	Federal Communications Commission
FDMA	frequency-division multiple access
FH-SS	frequency-hopping spread spectrum
FPLMTS	Future Public Land Mobile Telecommunications System
FTA	Free Trade Agreement
GATT	General Agreement on Trade and Tarrifs
GATS	General Agreement on Trade in Services
GSM	Group Speciale Mobile
HF	high frequency
Hz	hertz
IEEE	Institute of Electrical and Electronics Engineers
ISM	industrial, scientific, and medical
IFRB	International Frequency Registry Board (RRB since 1993)
IMTS	improved mobile telephone service
ITU	International Telecommunications Union
IVDS	interactive video and data services
LAN	local area network
LMS	location and monitoring services
LMCS	local-multipoint communications services
LMDS	local-multipoint distribution services (US)
LOS	line-of-sight

MAN	metropolitan area network
MF	medium frequency
MSA	Metropolitan Statistical Area
MTSO	mobile telephone switching office
MTS	mobile telephone service
NAFTA	North American Free Trade Agreement
NARBA	North American Regional Broadcast Agreement
NOI	Notice of Inquiry
NRC	National Research Council
NTIA	National Telecommunications and Information Administration
OECD	Organization of Economic Cooperation and Development
PCS	personal communications services (US)
PCN	personal communications network (Europe/UK)
PDA	personal data assistant
PSTN	public switched telephone network
RBOC	regional Bell operating companies
RF	radio frequency
RRB	Radio Regulatory Board
RSA	Rural Statistical Area
SMR	specialized mobile radio
TDMA	time-division multiple access
UHF	ultra high frequency
VAN	value added network
VHF	very high frequency
WAN	wide area network
WARC	World Administrative Radio Conference (WRC since 1993)
WRC	World Radio Conference
WTO	World Trade Organization

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