

Broadband Network Performance In Canadian Provinces: 2007-2011

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Connecting the Future:
Rural Broadband Technology, Policy and Impact Conference

The Monieson Centre, Queen's School of Business
December 2012

1. Motivation

CRTC (2012):

- Near ubiquitous coverage: 100% of urban and 85% of rural households have access to some form of “broadband” connectivity
- Strong demand for high speed connectivity: + 50% subscribe to + 5 Mbps advertised speeds

But, diffusion of 2nd generation applications (multimedia, cloud computing, IPTV) rapidly consumes installed network capacity

- Congestions on local links and routers
- Actual speed \lll Advertised service quality/max link speed

Transition in policy focus in advanced countries:

As questions of geographic coverage are resolved

- Network quality/performance monitoring the actual quality of end user experience (QoE) in terms of connectivity speed

2. Overview

Previous research:

- Primarily at the national/cross country level
- Little analysis of broadband policies by sub-national governments
- Case studies of particular policies/programs

Objectives of this paper:

- Characterize differences in the development of Internet connectivity across the provinces using measurements from the logs of Akamai CDN servers between 2007 and 2011)
- Evaluate possible reasons for observed differences in levels and patterns of broadband infrastructure development
- Stimulate debate about the design of rural broadband policy and program evaluation

3. Broadband Development in Canada

Early 2000s: Fast growth in broadband penetration relative to OECD

- Relatively high degree of platform competition
- Higher than average telecom capital expenditures

Growing concern since mid 2000s: Relatively high prices, low speeds, heavy throttling, limited FTTP diffusion, rural access:

Telecommunications Policy Review Panel (2006):

- Strengthen essential facilities regime
- Relax barriers to foreign control

Consultation Paper on Digital Economy Strategy (2010)

- Some relaxation of entry barriers
- Limited substantive reforms

- Demands on provinces and municipalities for policy innovation
- Need reliable benchmarks to measure the pace of progress in network development and evaluate alternative policy design strategies

4. Broadband Policy Decentralization

A) Network deployment → Fundamentally a local process
(estimating demand, upgrading capacity)

B) Economies of scale in broadband network administration
→ Platform level corporate consolidation, structural
dominance across jurisdictions → Policy centralization

Beyond a certain size and complexity threshold

→ Too little or too much information at the center

→ Optimal allocation ambiguous

→ Multilevel governance & vertical policy coordination

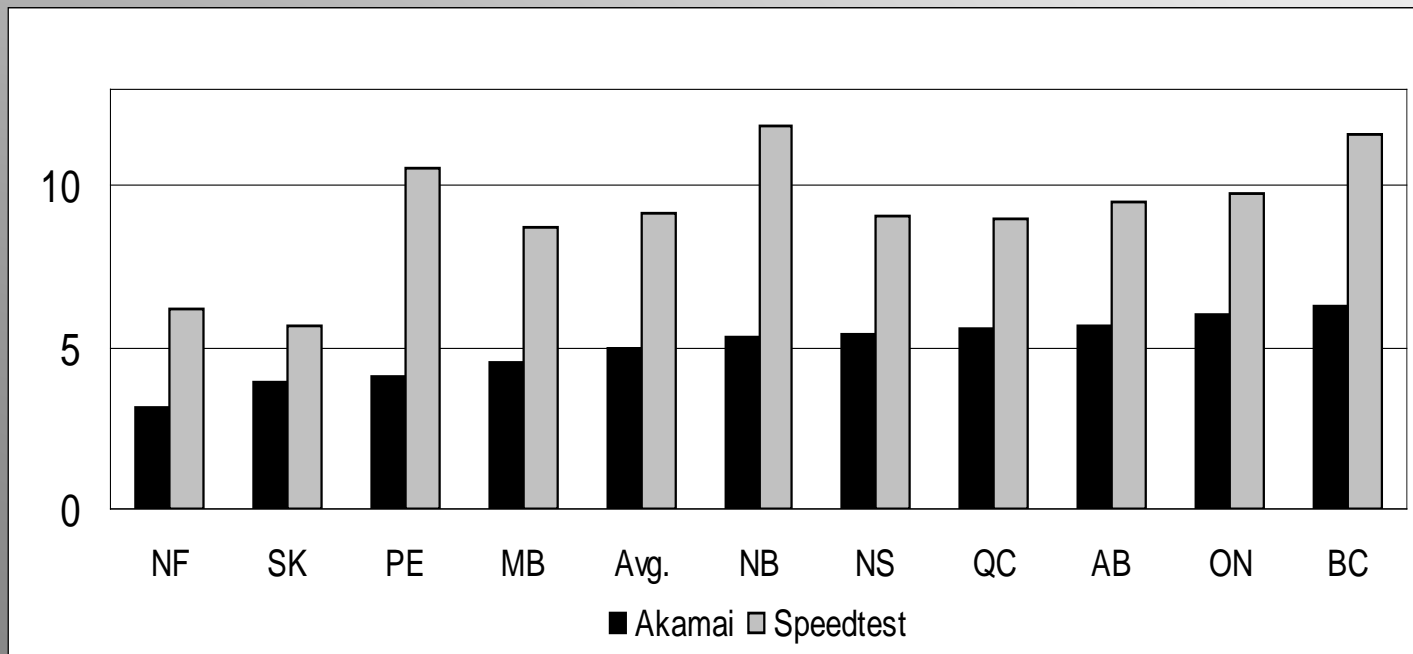
Multilevel governance issues relevant in other large and heterogeneous federations: e.g. U.S., EU, China, Russia, Brazil.

5. Federalism and Digital Infrastructure Policy

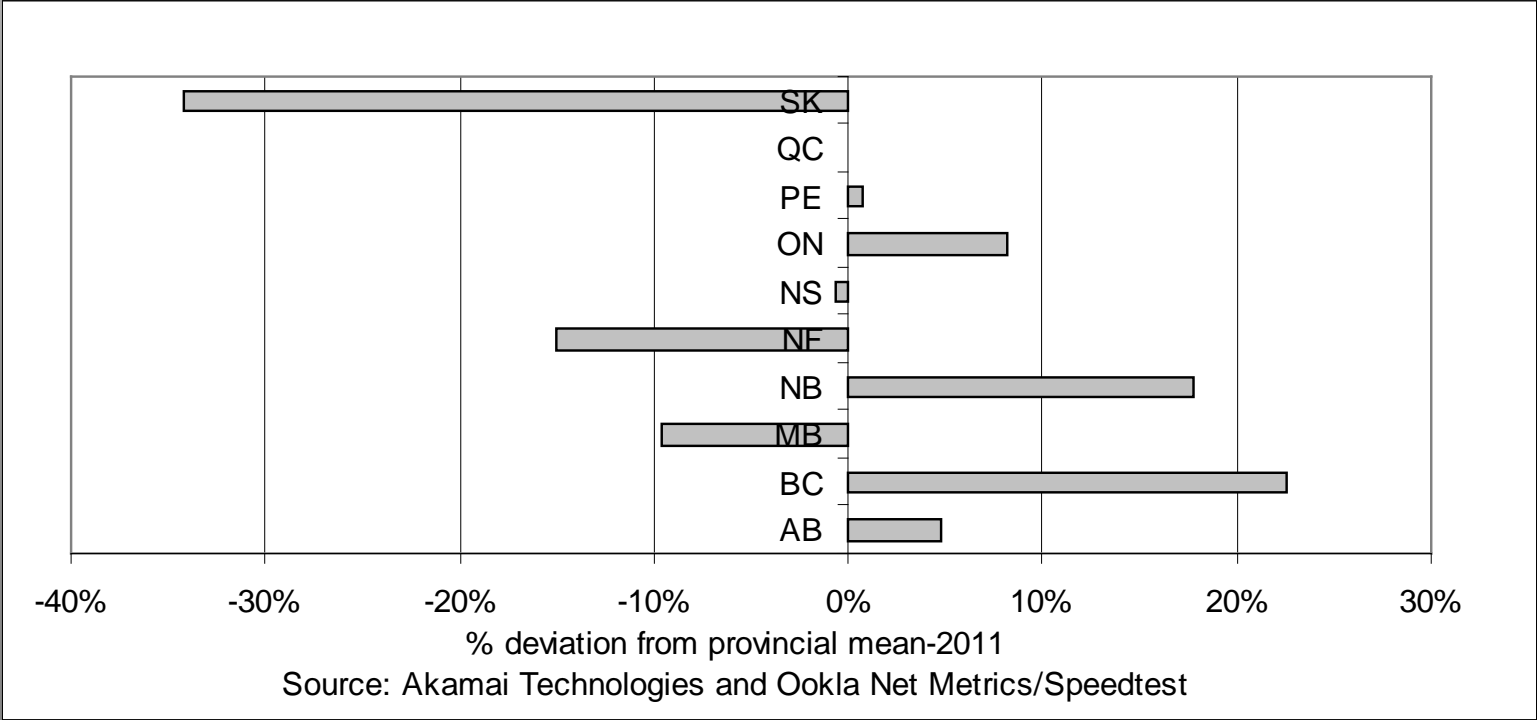
Lower levels responsible for delivering other public goods that can benefit from better broadband (health, education, business infrastructure): Less capable but better incentives?

- 1) Policy differentiation to attract mobile factors
e.g. Location in knowledge intensive industries (Mack et al. 2011)
- 2) Market-preserving federalism
e.g. More investment in last mile by competitors if stronger local essential facilities access regime (e.g. BC's contractual solution)
- 3) Instrumental specialization (Montolio and Trillas, 2011)
Horizontal v. vertical externalities
- 4) Experimentation and Institutional Learning in Multidivisional (M-form) hierarchies
- 5) Resistance to reform at the center: Only option/second-best solution

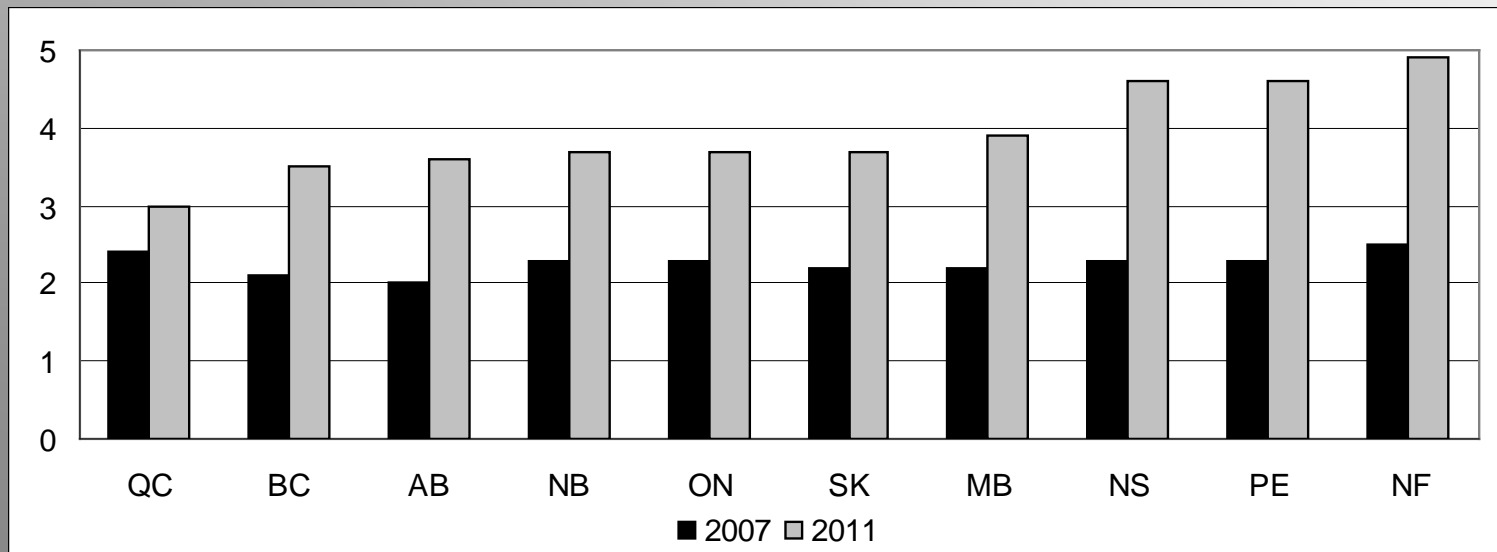
6. Broadband Speed Measurements: Active Versus Passive Tests (Mbps Q1-2011)



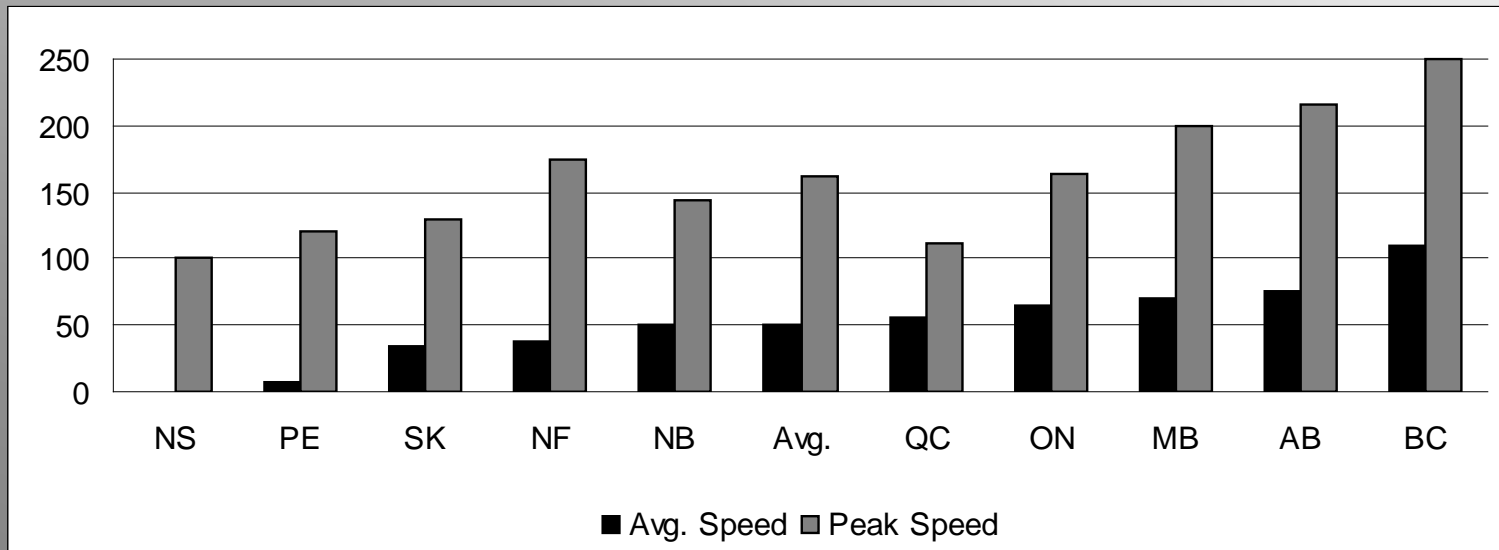
7. Provincial Variation in Network Performance



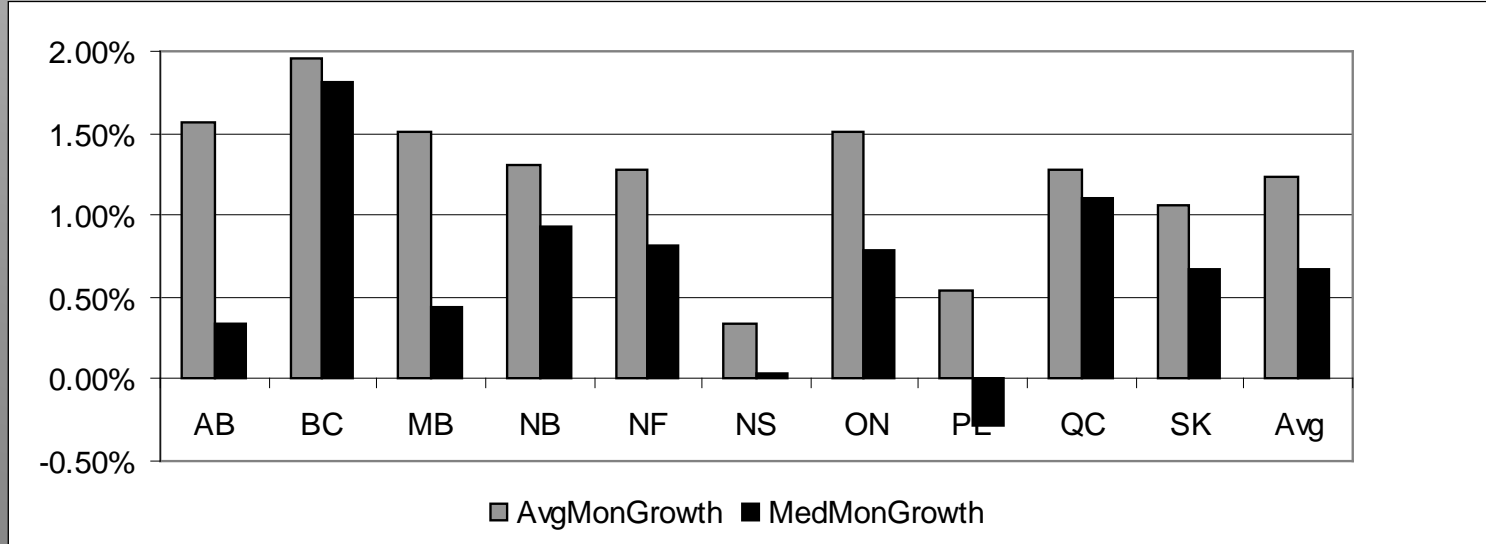
8. 2nd Generation Internet Applications and Demand for Network Resources: Ratio of Peak to Avg. Speeds (Akamai)



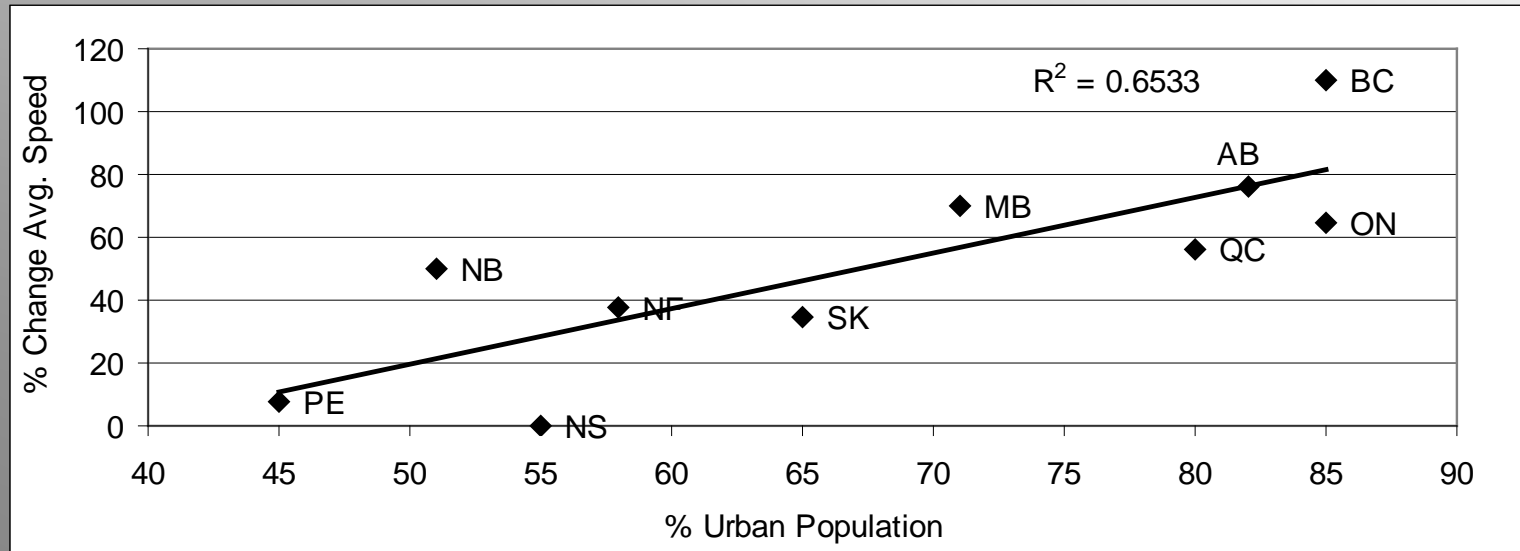
9. Cumulative Growth in Broadband Speeds (in %, 2007-2011)



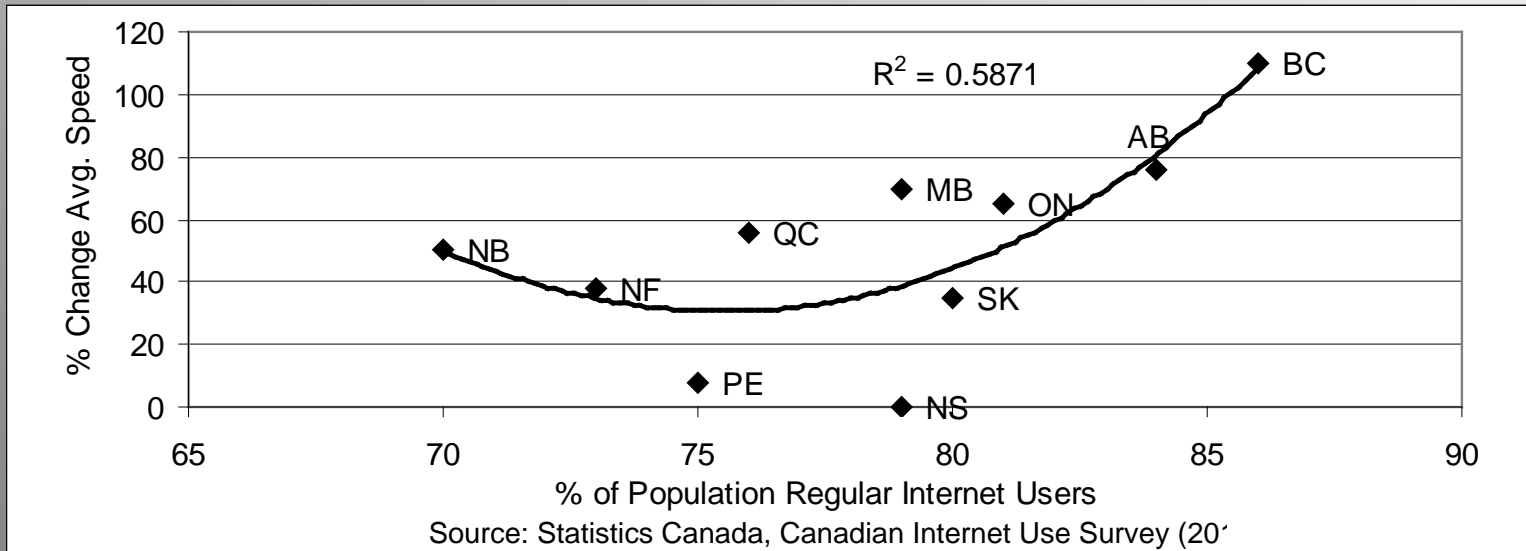
10. Network Development Patterns (Monthly change in Avg. speeds)



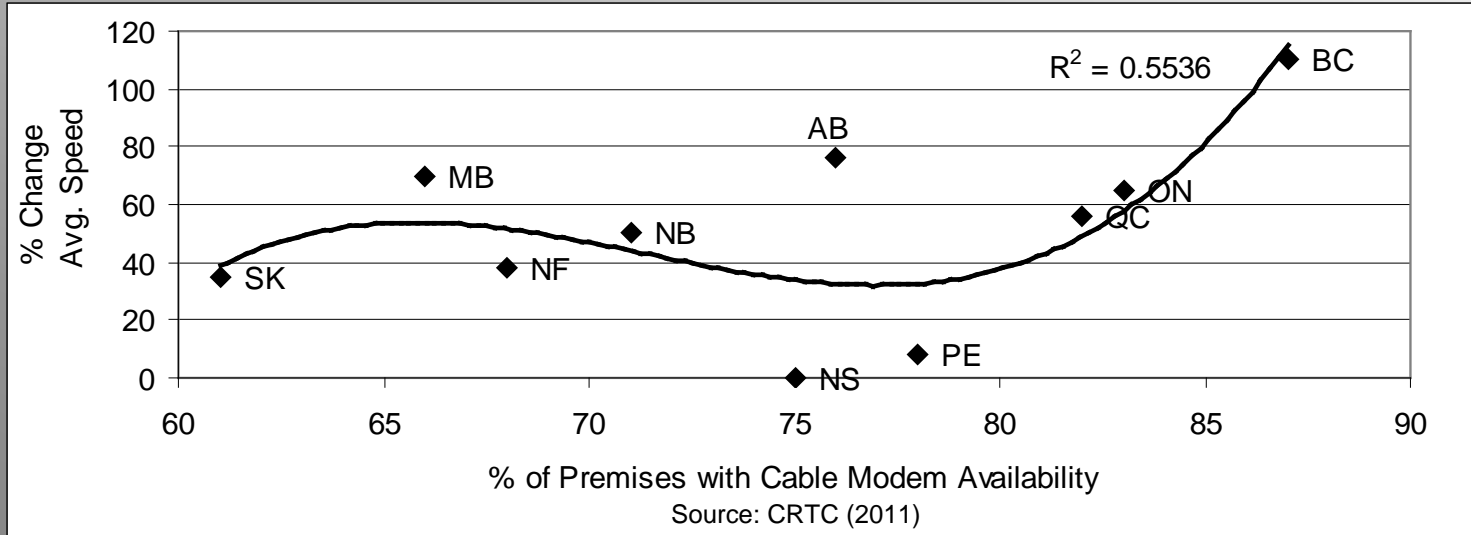
11. Potential Explanations: Geography & Performance Growth



12. Demand Intensity & Performance Growth



13. Platform Competition & Performance Growth



14. Provincial Policy Strategies

- 1) Alberta and BC: Leveraged public sector demand but had distinctive approaches:

Alberta SuperNet → Backbone investment

Contract granted to non-incumbents. Problems with third party access to SuperNet POPs (e.g. CRTC 2009-326)

British Columbia → Incumbent co-option to provide essential facilities access, upgrade networks, and increase speeds

Costs: Direct investments, procurement lock-ins

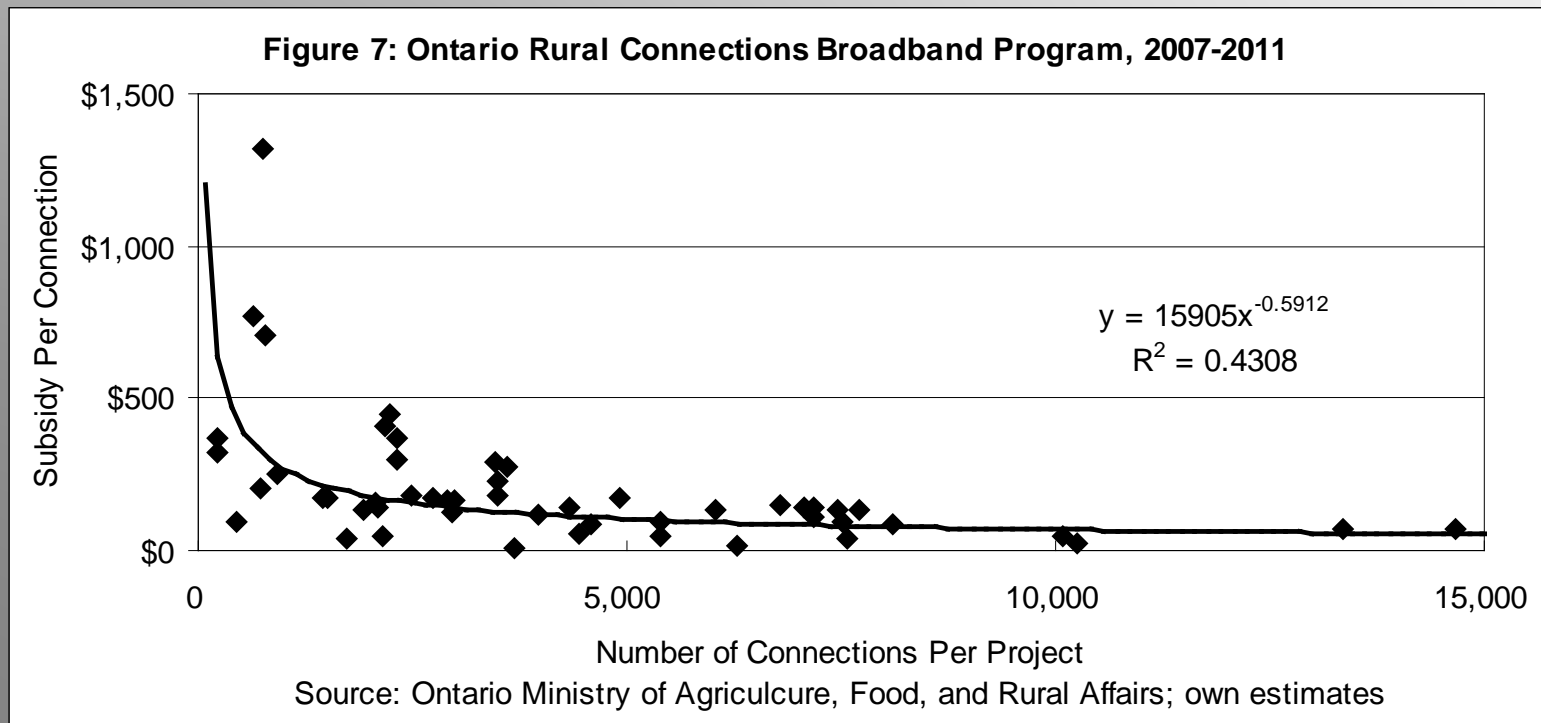
- 2) Ontario & Quebec: Rural subsidies only/average performance growth
- 3) SK: Public ownership, low platform competition
- 4) Atlantic Provinces: Demand vs. supply driven (e.g. NB vs. PE & NS)

15. Rural Program Design and Evaluation

Which business models more/less effective?

1. BC: Small/fixed grants (incumbents excluded) + incumbent co-option (\$8 mil. in 150 projects + long term procurement lock-in)
 2. Alberta: SuperNet (exclude incumbent) → limited incentives to interconnect with third parties → rural grants (\$330 mil. + undisclosed procurement guarantees)
 3. ON: Rural Connections: \$32 mil. in 54 projects (median \$ 500k for 1/3 of CAPEX)
 4. Multilevel: EORN (last mile + backbone subsidies for incumbent)
 5. Federal:
 - a. Targeted infrastructure transfers to provinces
 - b. Implicit subsidies incumbents via CRTC (~ \$.5 bil.)
 - c. Explicit subsidies: Connecting Rural Canadians: \$200 mil. app. \$2 mil. per project for ½ of CAPEX
- Most government entities only disclose aggregate program input data + Outcome indicators not collected/made public

16. Ontario: Rural Connections Broadband Program



17. Summary and Discussion

Some variation in both levels and patterns of network development

- Geography important, but policy has some effect
- Firm specific factors? (AB & BC v. ON & QC)

Federal regulatory strategy increases expected costs of local initiatives

- Entry barriers: Smaller number of bidders for public contracts to address market failures at provincial & municipal levels
- Weak essential facilities regime: Last mile to backbone interconnection challenges, particularly at rural POPs

Diverse approaches to rural broadband program design

- Little evaluation of their effectiveness in terms of actual speeds
- 3rd party measurements not appropriate for rural outcomes
- Need for program specific testbeds
- Hard performance targets in retail contracts and public-private broadband development initiatives