Next Generation Connectivity:
A review of broadband Internet transitions and policy from around the world

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DRAFT
Key findings

- U.S. is a middle-of-the-pack performer on the most relevant outcomes measures
  - Various independent sources
  - Price and speed, not only penetration
  - Facts before interpretation
Key findings

- U.S. is a middle-of-the-pack performer on the most relevant outcomes measures
- Open access policies were important in the first generation transition
  - Other findings in report
- Widely regarded by policy makers as part of the toolbox for the next generation
  - In addition to and complementing facilities-based competition, not instead of
  - Regulation enables additional entrants
    - entrepreneurial entrants alongside one or two large players with own infrastructure
Key findings

- U.S. is a middle-of-the-pack performer on the most relevant outcomes measures.
- Open access policies played important role in the first generation transition;
- Widely regarded by policy makers as part of the toolbox for next generation
  - Background literature less determinate and more supportive than widely thought.
  - Detailed country and firm case studies support mixed-models, not purely inter-modal; but complex.
  - Not a solved problem; need continued study and experimentation.
Benchmarking

• Outcome measures
  • Quantity (penetration)
  • Quality (speed)
  • Price
Benchmarking

• OECD: much maligned, but still best, most comprehensive, longest time, most comparable countries

• We added independent sources and analysis of penetration, fixed and wireless, speeds and prices.

• Result: diverse set of sources; reasonably well correlated with each other; confirm findings with some variations
Penetration per inhabitants: Fixed

Figure 3.1. Broadband penetration

Source: OECD 2008
Penetration per inhabitants: Fixed

Figure 3.2 Top quintile penetration rates over the last 6 years.

Source: OECD 2008
Note: US, Belgium, Canada, Sweden were top quintile in 2002, but are no longer in 2008
Penetration: Households, fixed

Household broadband penetration

Source: OECD, 2007
Speed: actual measurements; user side

Source: Speedtest.net

Median download speed
Speed: actual measurements; in the net

Source: Akamai
Average download speed
Actual Speed: Speedtest vs. Akamai

Comparison of average download speeds from Speedtest.net and Akamai

Source: Akamai, Speedtest.net
Note: Hungary, Turkey, the Slovak Republic and Poland not included in Akamai reported data
Prices

• Initial draft: two independent sources OECD and Telegeography

• Added since: Point Topic

• Total: 950 unique observations; top 4 providers in each country; 115 companies

• Three entirely separate studies; three independent organizations;
  • Observations well correlated with each other
Price: US does well in low speeds

Note: Low is defined as < 2048kbps
Price: As speed increases, US prices become less attractive by comparison.

Average monthly price for medium speed offerings:

Note: Medium is defined as between 2048 kpbs and 10 Mbps.
Price: As speed increases, US prices become less attractive by comparison

Average monthly price for high speed offerings

Note: High is defined as between 10 Mbps and 32 Mbps
Price: Very high speeds priced as a luxury good relative to other countries

Average monthly price for very high speed offerings

Note: Very high speed is defined as greater than 32Mbps
All three datasets show a similar picture

Monthly price and speed for all offerings

Monthly price

Speed (kbps)

Low Medium High Very high

US RoW
Looking at next generation oriented offerings from all providers, clusters of countries begin to appear

Monthly price and speed for all very high speed offerings*

Source: Berkman Center analysis of OECD and Telegeography data
*Includes highest speed offerings from US players with minimum 2M subscribers. Flags courtesy of www.theodora.com/flags used with permission
Limiting just the France, Sweden, Japan, Korea, Finland, Canada and the US

Monthly price and speed for all very high speed offerings for a subset of countries

Source: Berkman Center analysis of OECD and Telegeography data
Note: Includes highest speed offerings from US players with minimum 2M subscribers.
Flags courtesy of www.theodora.com/flags used with permission
What might explains the differences?

- Urban concentration
- Income
- Education
- Poverty

Does that mean policy is just irrelevant? How much of performance is “talent,” and how much is “sweat”? 
“Meets expectations”

Comparison of actual penetration to predicted penetration

Source: OECD
Note: Regression run on median income, urbanicity, poverty and education
### Actual speeds: top two cities per country

**Table 3.3. Top 20 cities in OECD countries by actual speed measurements, Q4 2008**

<table>
<thead>
<tr>
<th>Average download speed</th>
<th>Average upload speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Busan</td>
<td>1. Yokohama</td>
</tr>
<tr>
<td>2. Seoul</td>
<td>2. Stockholm</td>
</tr>
<tr>
<td>3. Göteborg</td>
<td>3. Tokyo</td>
</tr>
<tr>
<td>5. Yokohama</td>
<td>5. Kosice</td>
</tr>
<tr>
<td>6. Amsterdam</td>
<td>6. Copenhagen</td>
</tr>
<tr>
<td>7. Paris</td>
<td>7. Aarhus</td>
</tr>
<tr>
<td>8. Tokyo</td>
<td>8. Oslo</td>
</tr>
<tr>
<td>11. Rotterdam</td>
<td>11. Espoo</td>
</tr>
<tr>
<td>15. Berlin</td>
<td>15. Rotterdam</td>
</tr>
<tr>
<td>17. Espoo</td>
<td>17. Bratislava</td>
</tr>
<tr>
<td>18. Lyon</td>
<td>18. Prague</td>
</tr>
<tr>
<td>20. Oslo</td>
<td>20. Busan</td>
</tr>
</tbody>
</table>
Looking at the experiences of other countries

• Detailed, country-level case analysis of the political economy
  • In particular regulator vs. incumbent

• Detailed, country-level case analysis of firms, when they entered, how they entered, relationship to regulation
Open access: Key findings

• Open access/unbundling facilitated competitive entry in many countries

• Including where facilities-based alternatives available, access-based entrants play an important catalytic role
  - Facilities- and access-based competition complement each other at the system level

• Entrepreneurial competitors tend to enter through unbundling
  - Greater control; room for innovation relative to reselling; less need to be a large, cumbersome player
Incumbent telephone company highest speed offerings

Source: Berkman Center analysis of OECD Broadband Statistics and Telegeography
Note: Includes highest speed offerings from US players with minimum 2M subscribers.
Flags courtesy of www.theodora.com/flags used with permission
Cable company offerings tend to group around their domestic incumbents

Source: Berkman Center analysis of OECD Broadband Statistics and Telegeography
Note: Includes highest speed offerings from US players with minimum 2M subscribers. Flags courtesy of www.theodora.com/flags used with permission
ULL-based entrants

Source: Berkman Center analysis of OECD Broadband Statistics and Telegeography
Note: Includes highest speed offerings from US players with minimum 2M subscribers. Flags courtesy of www.theodora.com/flags used with permission
Facilities-based and other

Source: Berkman Center analysis of OECD
Broadband Statistics and Telegeography
Note: Includes highest speed offerings from US
players with minimum 2M subscribers. Flags
courtesy of www.theodora.com/flags used with
permission.
But what’s the theory?

- **Contra:** Investment deterrence (Hausmann 1998; Pyndick 2007)

- Investment ladder (Cave & Vogelsang 2003)
  - Start small; build market share and cash flow; invest more
  - Telenor investments in Sweden; Denmark
  - Free/Illiad planned fiber deployments
  - Shifts over time from bitstream to LLU
But what’s the theory?

- **Investment ladder**

- Delayed investment, yes; but maybe still higher welfare over time? (Hoffler 2007; Alter 2009)
But what’s the theory?

- Investment ladder
- Long term welfare although delayed investment
- Greater competition increases uptake (prices; marketing; innovative offerings)
  - cash flow provides resources for investment (Chang et al 2003; Friederiszick et al 2008)
But what’s the theory?

- Investment ladder
- Long term welfare although delayed investment
- Greater competition increases uptake and cash flow
- A Neo-Schumpeterian dynamic (Bauer 2010)
  - large incumbents badgered by small number of innovative entrants
  - market has to be not too concentrated and not too competitive
  - regulation plays a dynamic role in “fine-tuning” this balance
Open access: existing evidence

• What is the existing evidence?
• 50 papers
  • 14 on penetration (~econometric)
    • 6 Open access has a POSITIVE effect on penetration
    • 2 Open access has NEGATIVE effects on penetration
    • 6 Open access has both POSITIVE and NEGATIVE or no impact
  • 4 of the 14 have old (pre 2001) data or weak methods
Literature review

• 50 papers
  • 14 on penetration (~econometric)
  • 21 on investment (~econometric) (Cambini & Jiang 2009 + more)
    • 2 POSITIVE effects on investment
    • 1 POSITIVE and NEGATIVE
    • 2 NO FINDINGS
    • 1 NEGATIVE
    • 15 NOT EMPIRICAL or FLAWED
      • 8 negative; 7 positive
Why are econometrics of cross-country comparisons so ambiguous?

• Too many factors:
  • Demography and geography
  • Local market conditions
  • Regulatory decisions and strategic behavior by market actors and governments
  • Effective regulation, not just formal
  • Financial markets
  • Regional diversity
  • Time diffusion effects
Why are econometrics of cross-country comparisons so ambiguous?

- Too many factors
- Too few observations to account for all these factors
- Need micro-level data; probably single country or more local; natural experiments with clean instruments (Fevrier & Sraer 2007; Sraer 2008; Alter 2009; aspects of Chang et al 2003)
- Large risk of overstating results; missing influential points; masking anecdotes as data
Literature review

- 50 papers
  - 14 on penetration (~econometric)
  - 21 on investment (~econometric)
  - 15 Qualitative
    - 8 POSITIVE effects on competition, prices, deployment, adoption, innovation
    - 1 NEGATIVE
    - 1 POSITIVE and NEGATIVE
    - 5 NO EFFECT
Literature review

• 50 papers
  • 20 of 35 quantitative papers self-published
  • 18 of 50 industry sponsored
    • 16 of the 35 quantitative papers
      • 13 of 21 on investment
  • Need to be read on their merits
    • But with caution
Summary of evidence

- Qualitative case studies looking in detail at what in fact happened in different countries, in different markets, and to different companies
- Other regulators’ experience and present positions and plans
- Econometric literature
Transposing open access to Next Generation Connectivity

• Access rules folded in to planning for next generation networks

• Japan, Korea, Sweden, Netherlands, France, UK; EU (European Regulators Group); New Zealand; Australia (to the NBN)
Transposing open access to Next Generation Connectivity

• High costs of next generation transition pushing countries and companies to
  • Share costs, risks, and facilities of slow-moving, expensive elements
  • Mute emphasis on redundant facilities as a hedge against regulatory failure
Transposing open access to Next Generation Connectivity

• Tradeoff:
  • Market failure in a necessarily-concentrated market
    • High fixed costs have not been repealed

vs.

• Risks of regulatory failure with monopoly infrastructure
• Approaches in the works
Open access: Toolbox

• Open access, transposed
  • incumbent or symmetric duties to provide access at regulated rates, while competing in the market

• Functional separation
  • Openreach on UK; Skanova Access in Sweden; New Zealand; Netherlands; Italy; Australia: (lower regulatory failure risk, at expense of benefits of integration)

• Joint ventures
  • KPN-Reggeefiber

• Voluntary sharing of deployment cost/risk and shared facilities:
  • Swisscom; DT?
Open access: Toolbox

• Standard open access
• Functional separation
• Joint ventures
• Voluntary sharing of deployment cost/risk and shared facilities
• New openness to government investment in EU (new guidelines)
  • If government $, must be open access
• New models of market-viable public-private partnerships
  • Amsterdam CityNet
  • Increasingly in UK
Conclusion

• A lot of experimentation and experience going on around the world

• US performance does not justify complacency

• We are at a transformative moment
  • What we do now will set the basic market structure of next generation connectivity
    • Is a market with only two competitors enough?
  • There seems to be a role for well-designed policy