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# NEXT GENERATION CONNECTIVITY:

A review of broadband Internet transitions  
and policy from around the world

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DRAFT



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# Key findings

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- **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

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- 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

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- 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

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- **Outcome measures**
  - **Quantity (penetration)**
  - **Quality (speed)**
  - **Price**

# Benchmarking

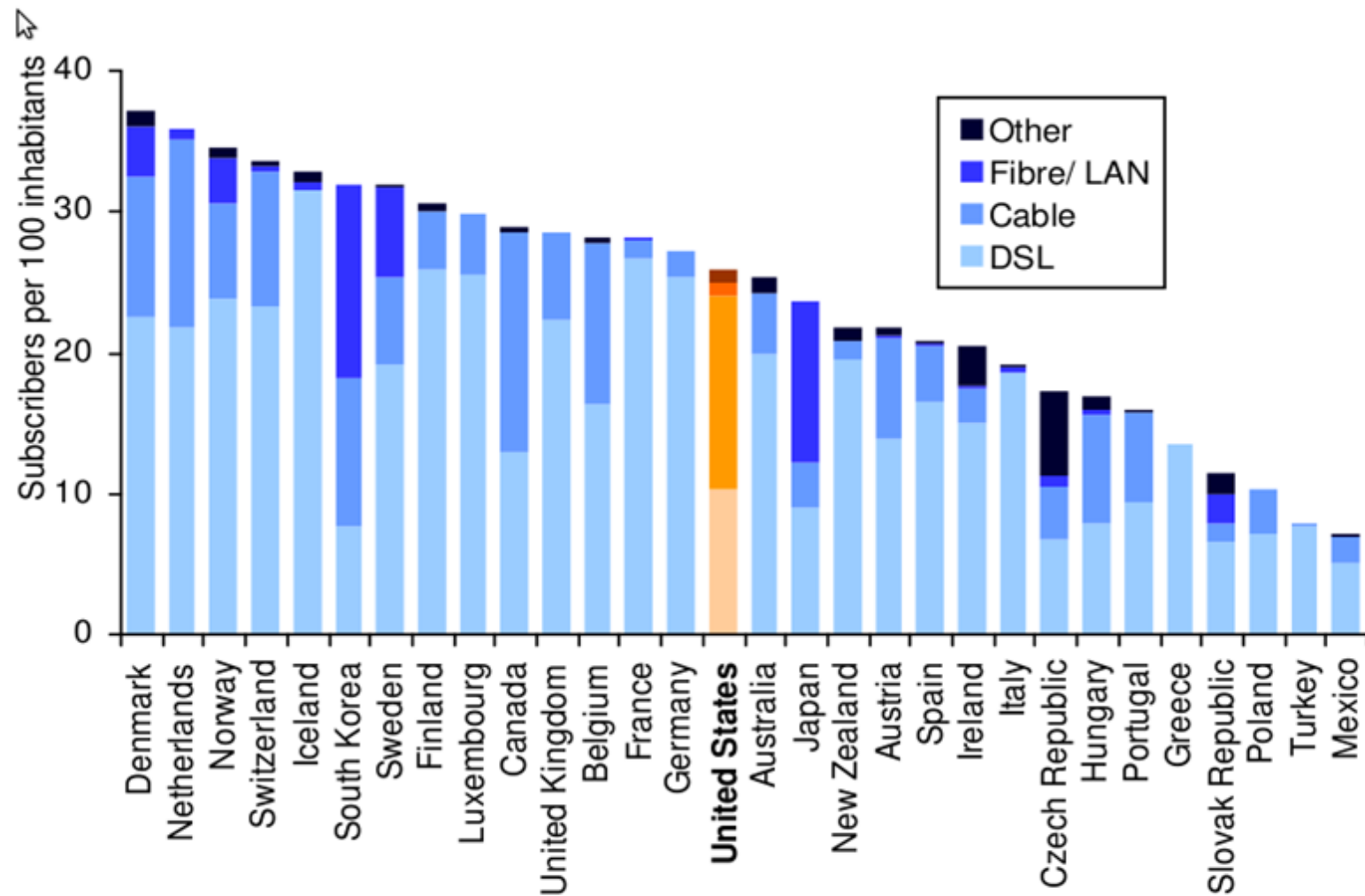
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- **OECD: much maligned, but still best, most comprehensive, longest time, most comparable countries**
- **We added independent sources and analysis of penetration, fixed and wireless, speeds and prices.**
- **Result: diverse set of sources; reasonably well correlated with each other; confirm findings with some variations**

# Penetration per inhabitants: Fixed

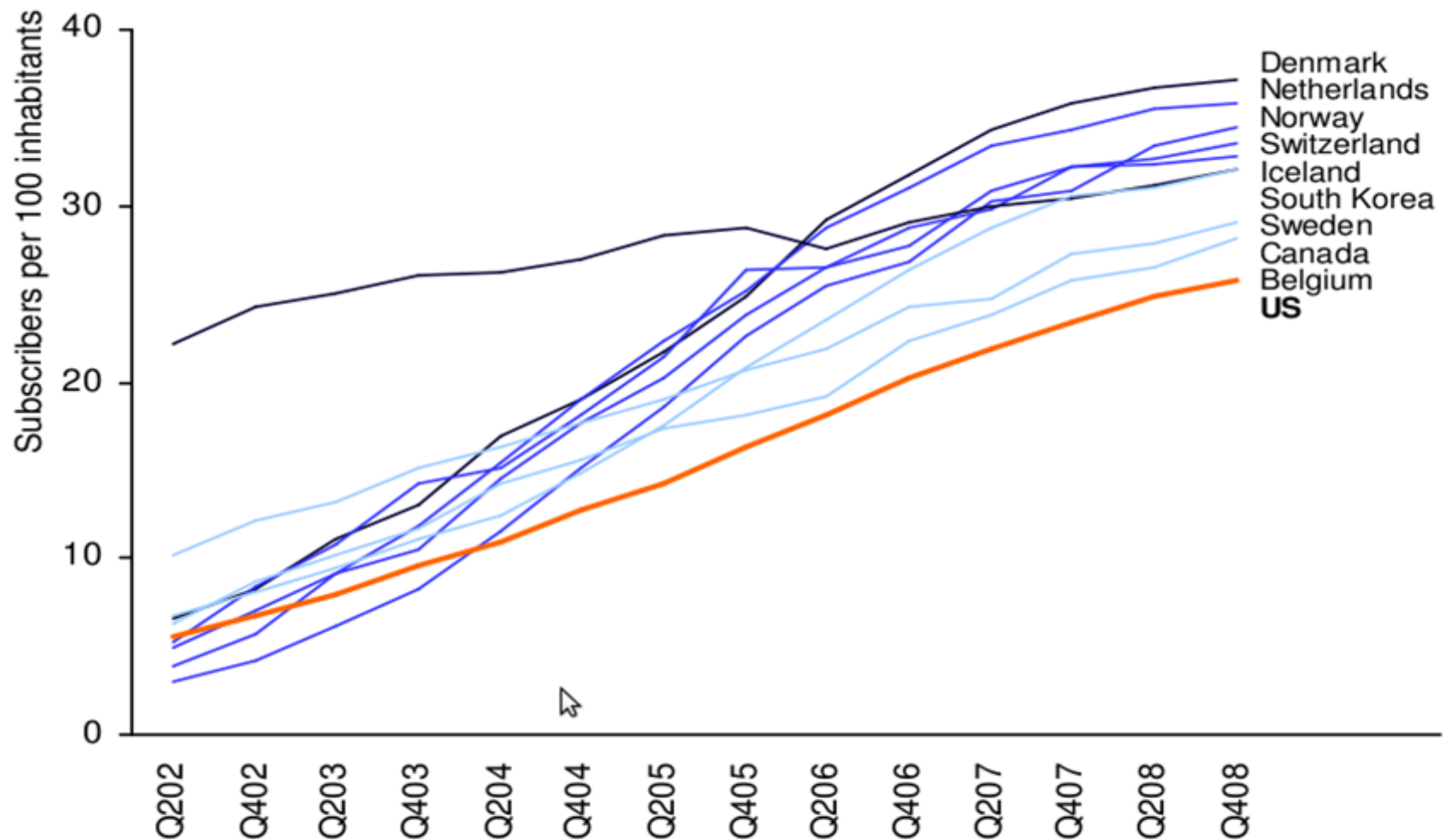
Figure 3.1. Broadband penetration



Source: OECD 2008

# Penetration per inhabitants: Fixed

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



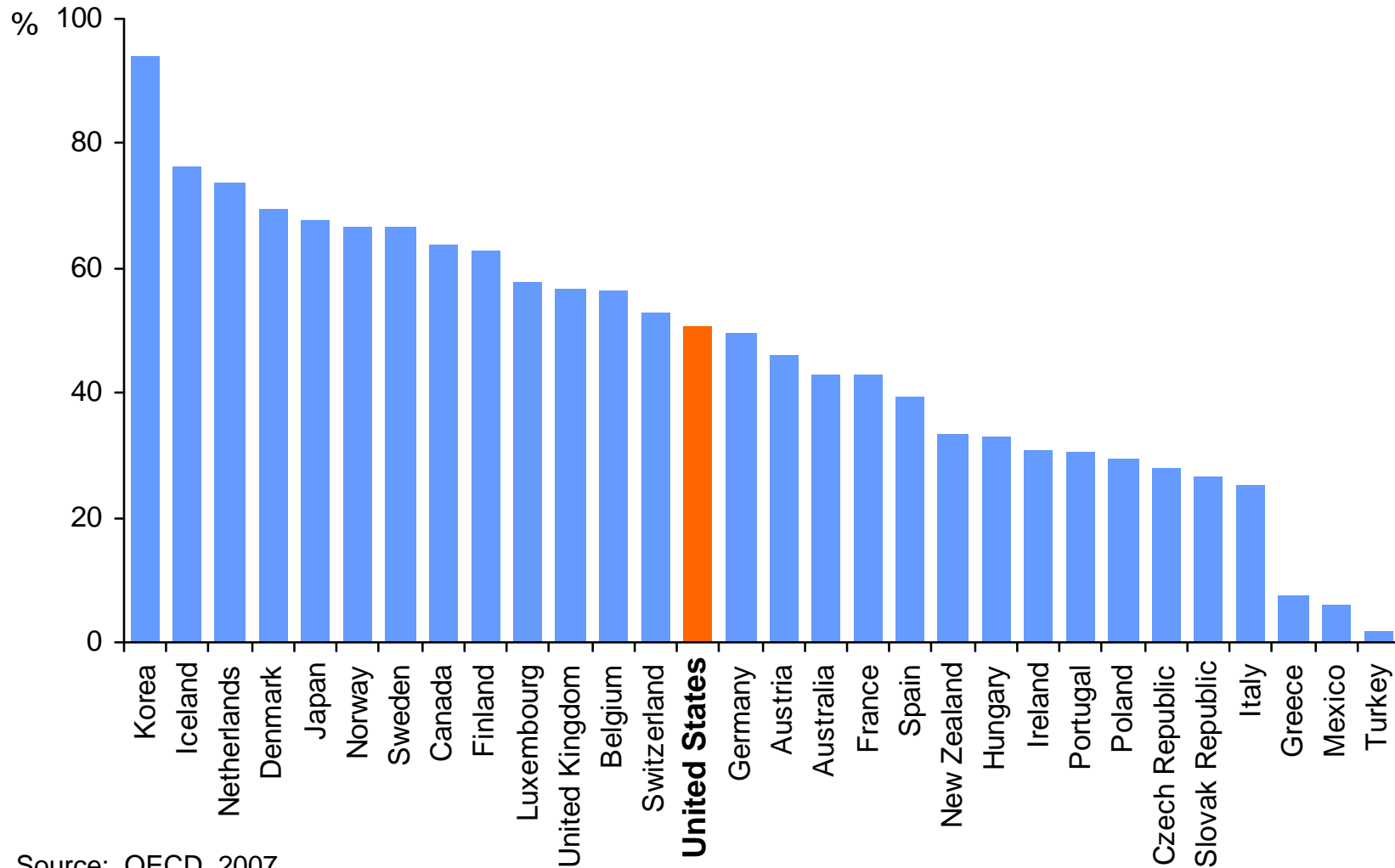
Source: OECD 2008

Note: US, Belgium, Canada, Sweden were top quintile in 2002, but are no longer in 2008



# Penetration: Households, fixed

Household broadband penetration

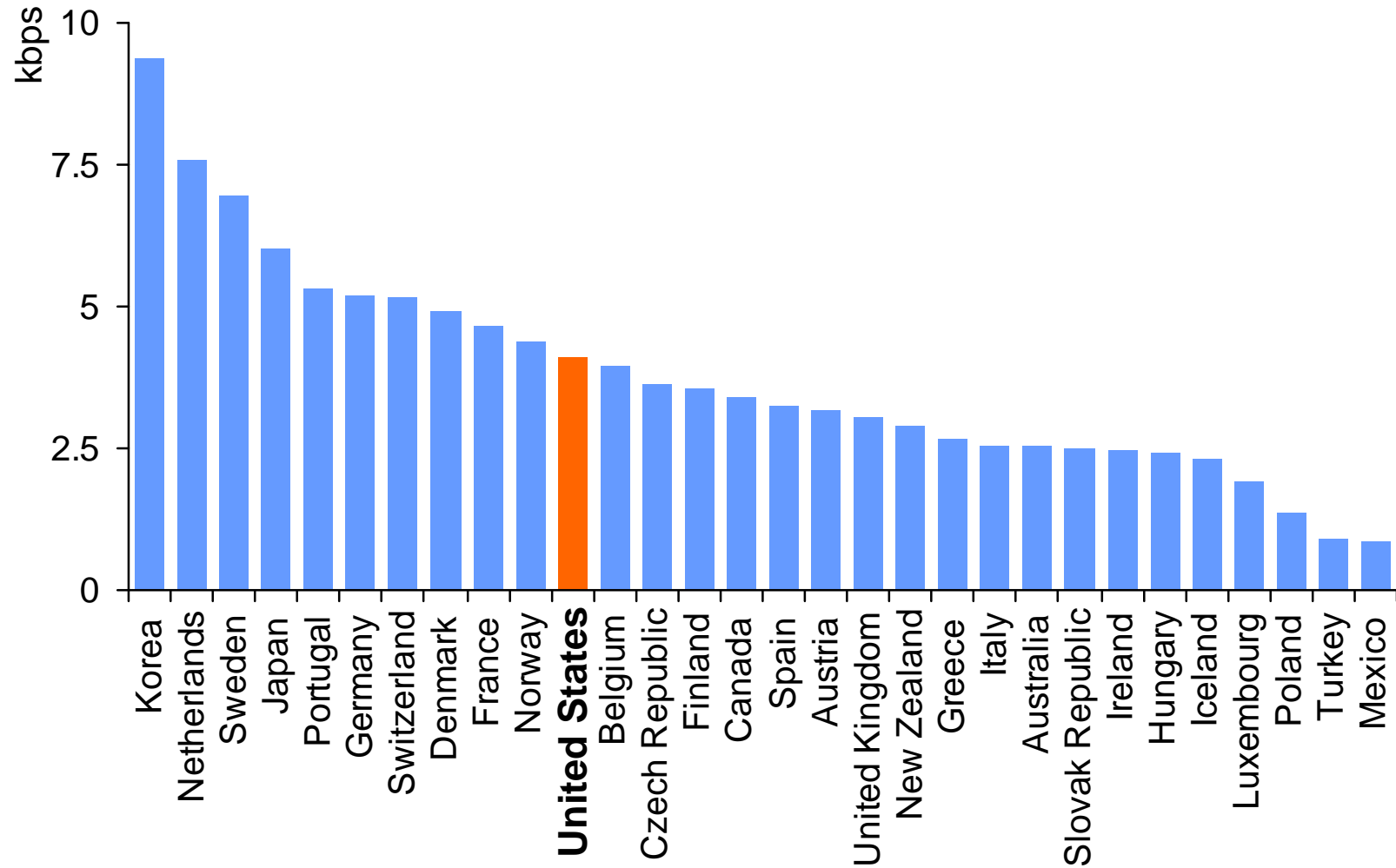


Source: OECD, 2007

# Speed: actual measurements; user side

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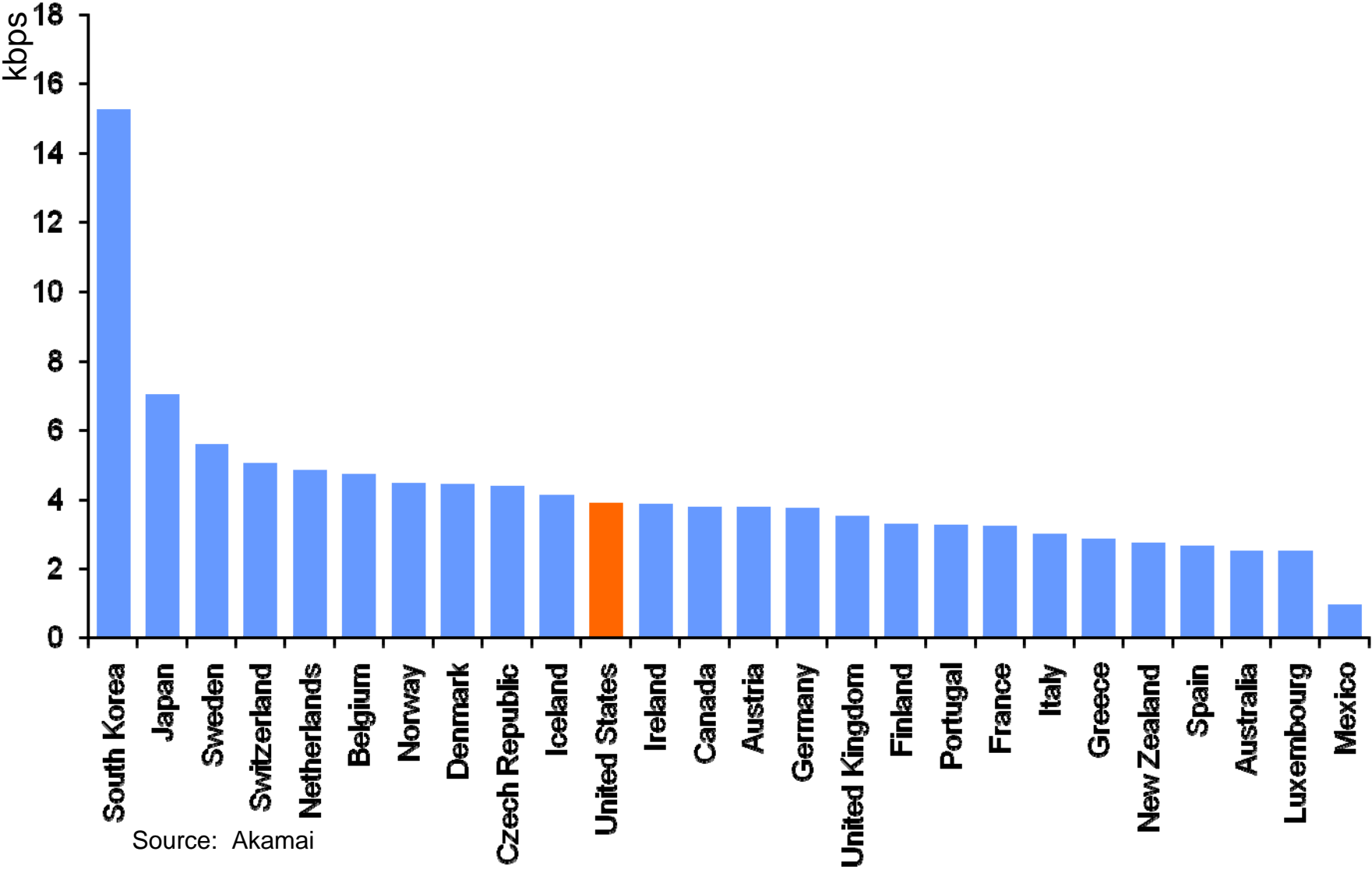
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Source: Speedtest.net

Median download speed

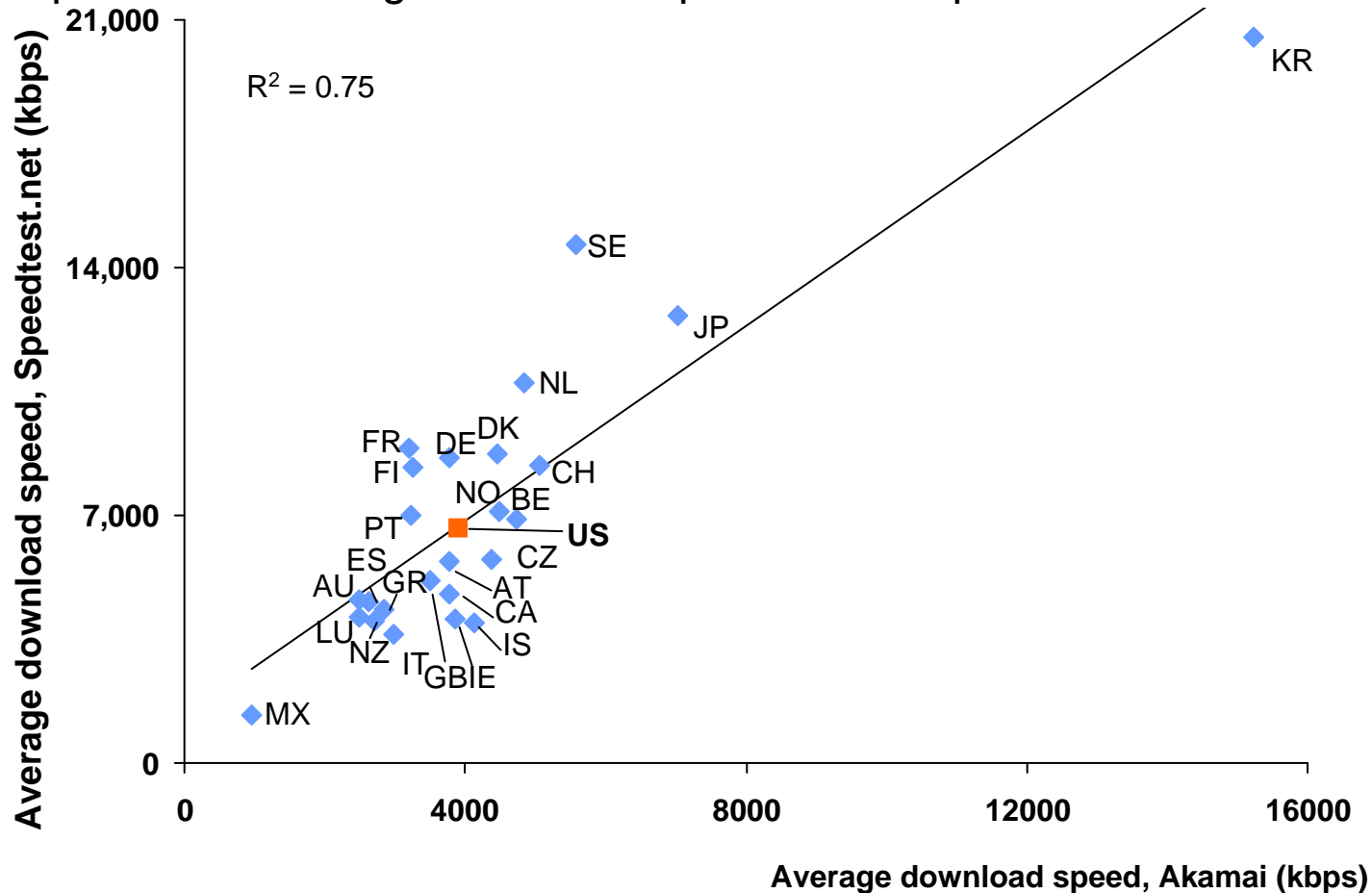
# Speed: actual measurements; in the net



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

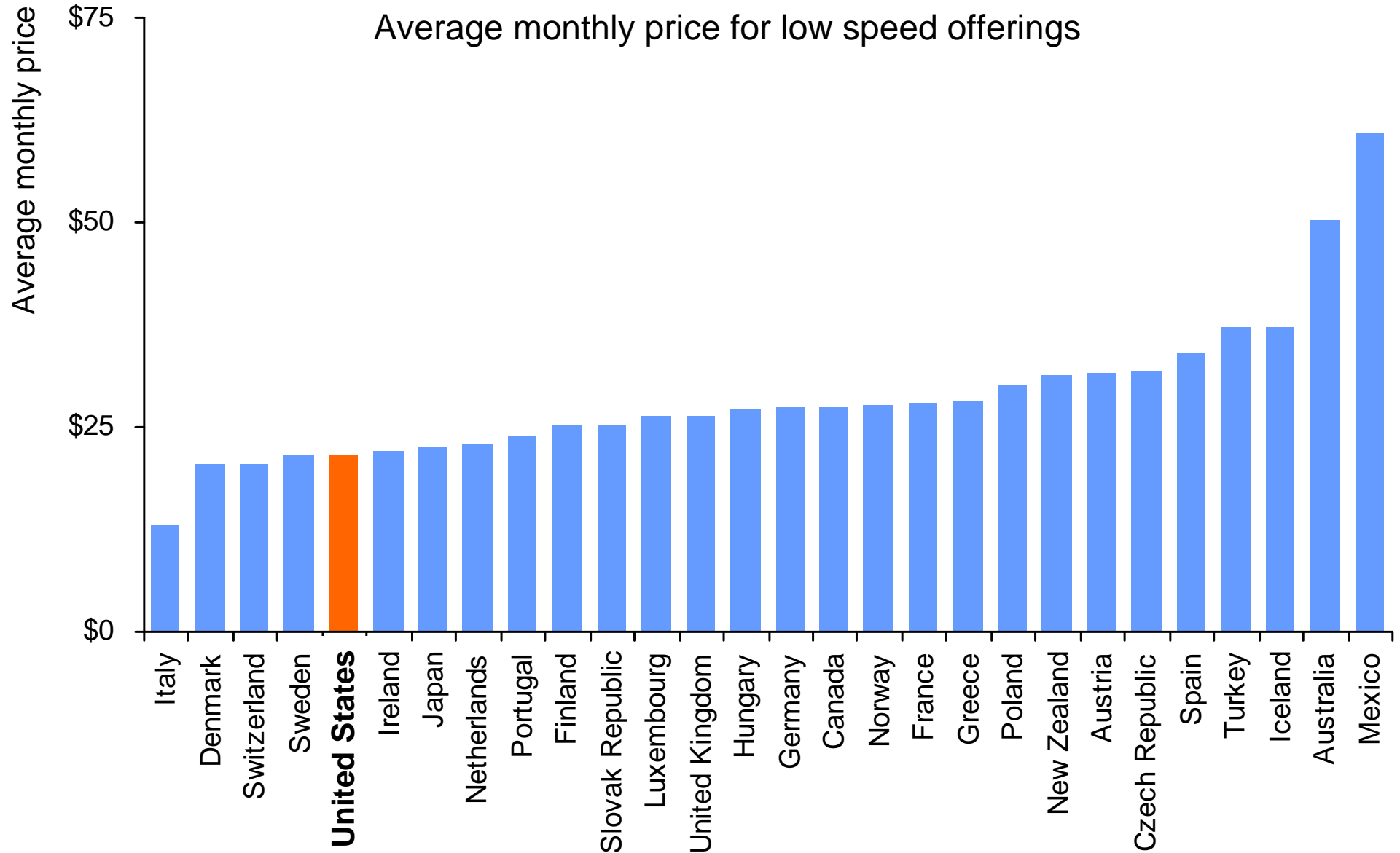
# Prices

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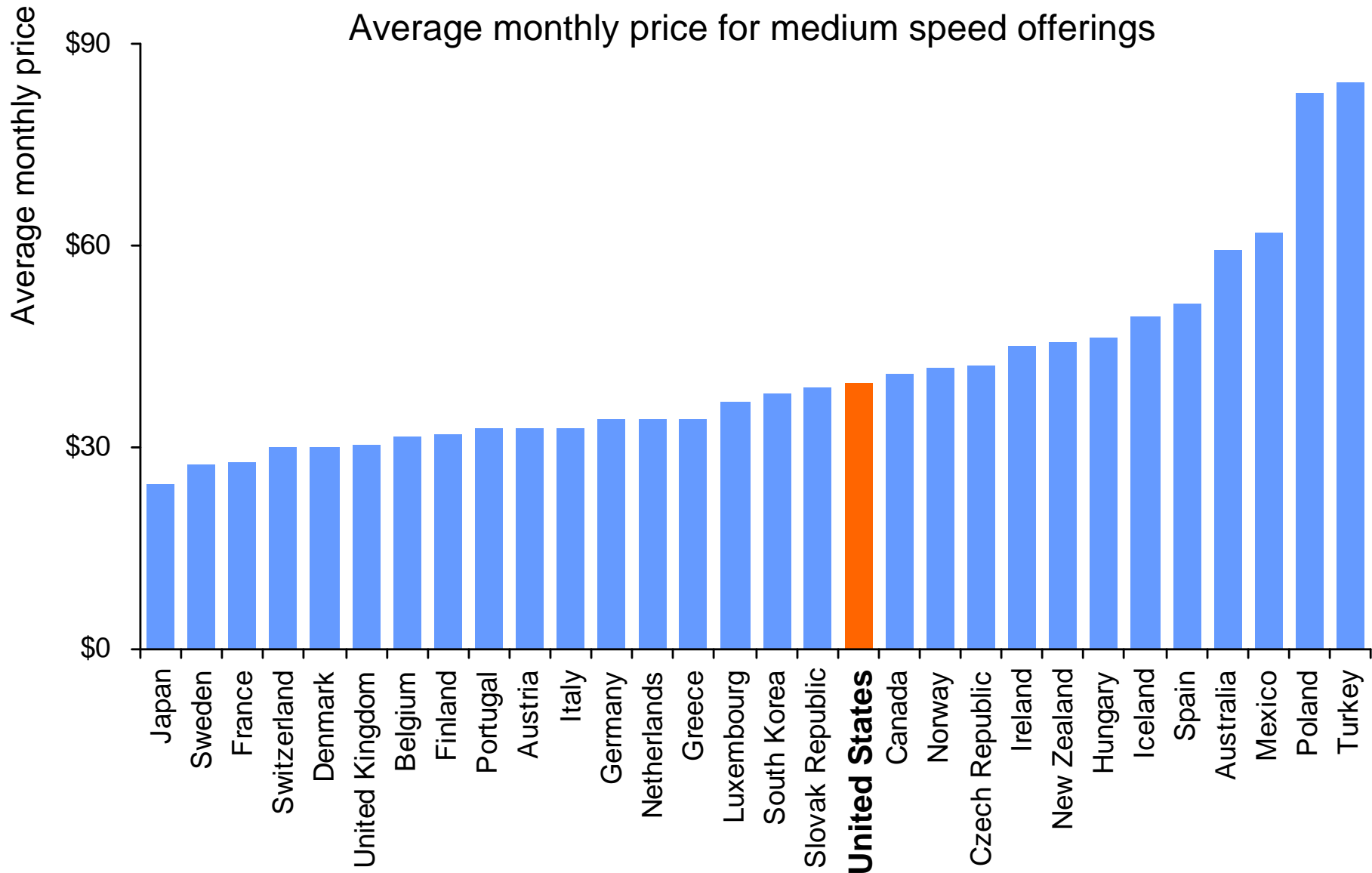
- **Initial draft: two independent sources  
OECD and Telegeography**
- **Added since: Point Topic**
- **Total: 950 unique observations; top 4  
providers in each country; 115  
companies**
- **Three entirely separate studies; three  
independent organizations;**
  - **Observations well correlated with each other**

# Price: US does well in low speeds



Note: Low is defined as < 2048kbps

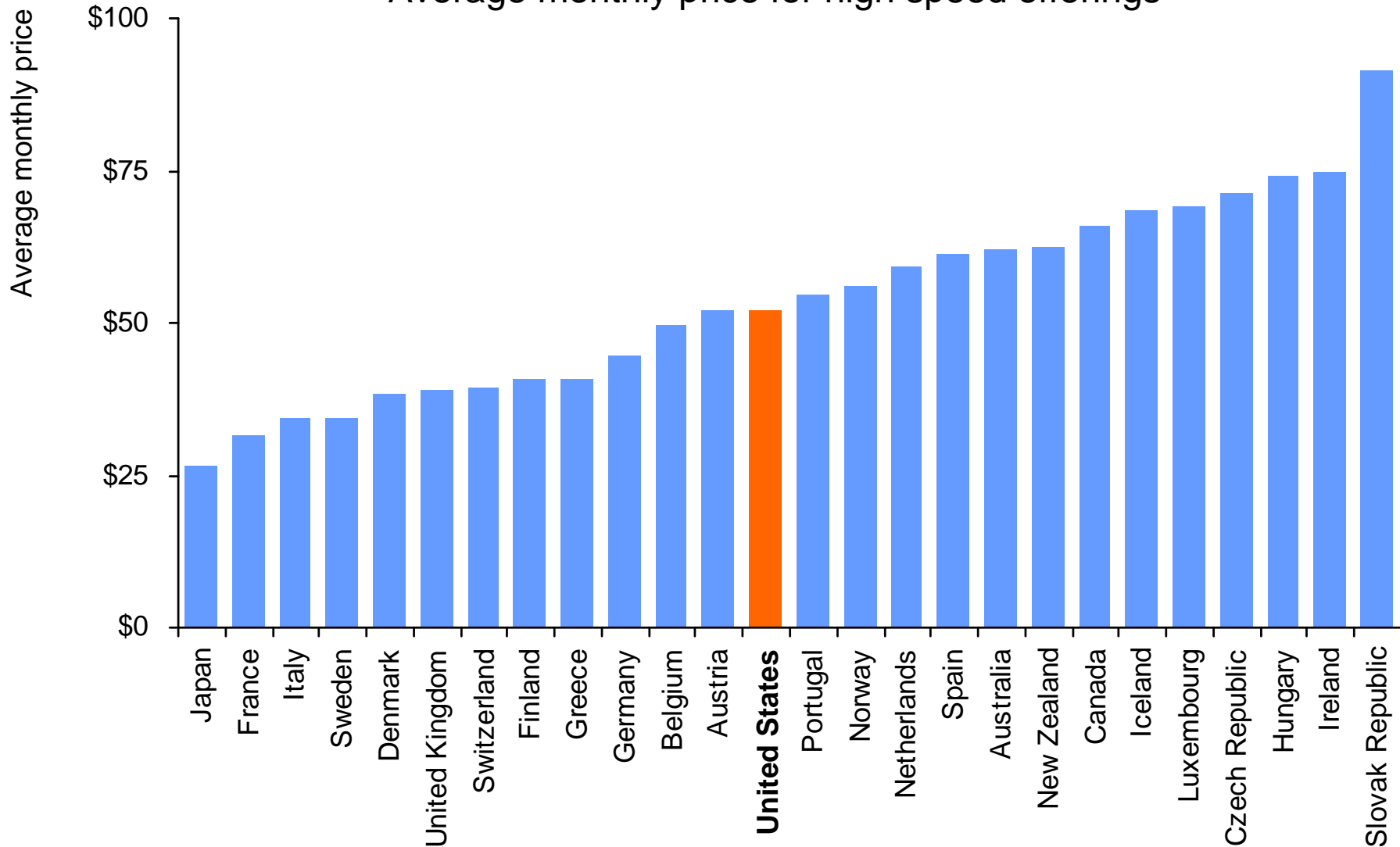
# Price: As speed increases, US prices become less attractive by comparison



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

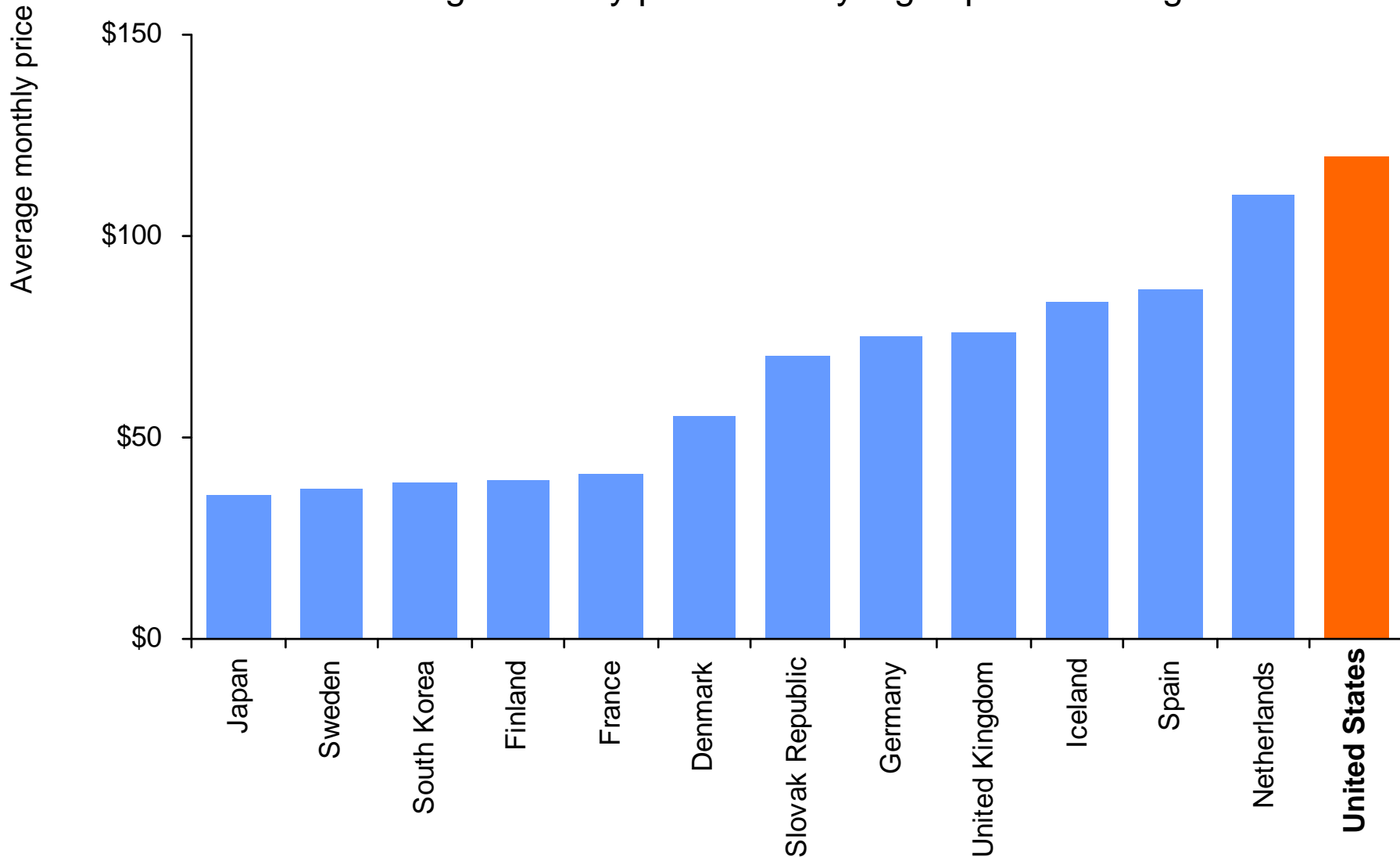


Note: High is defined as between 10 Mbps and 32 Mbps



# Price: Very high speeds priced as a luxury good relative to other countries

Average monthly price for very high speed offerings

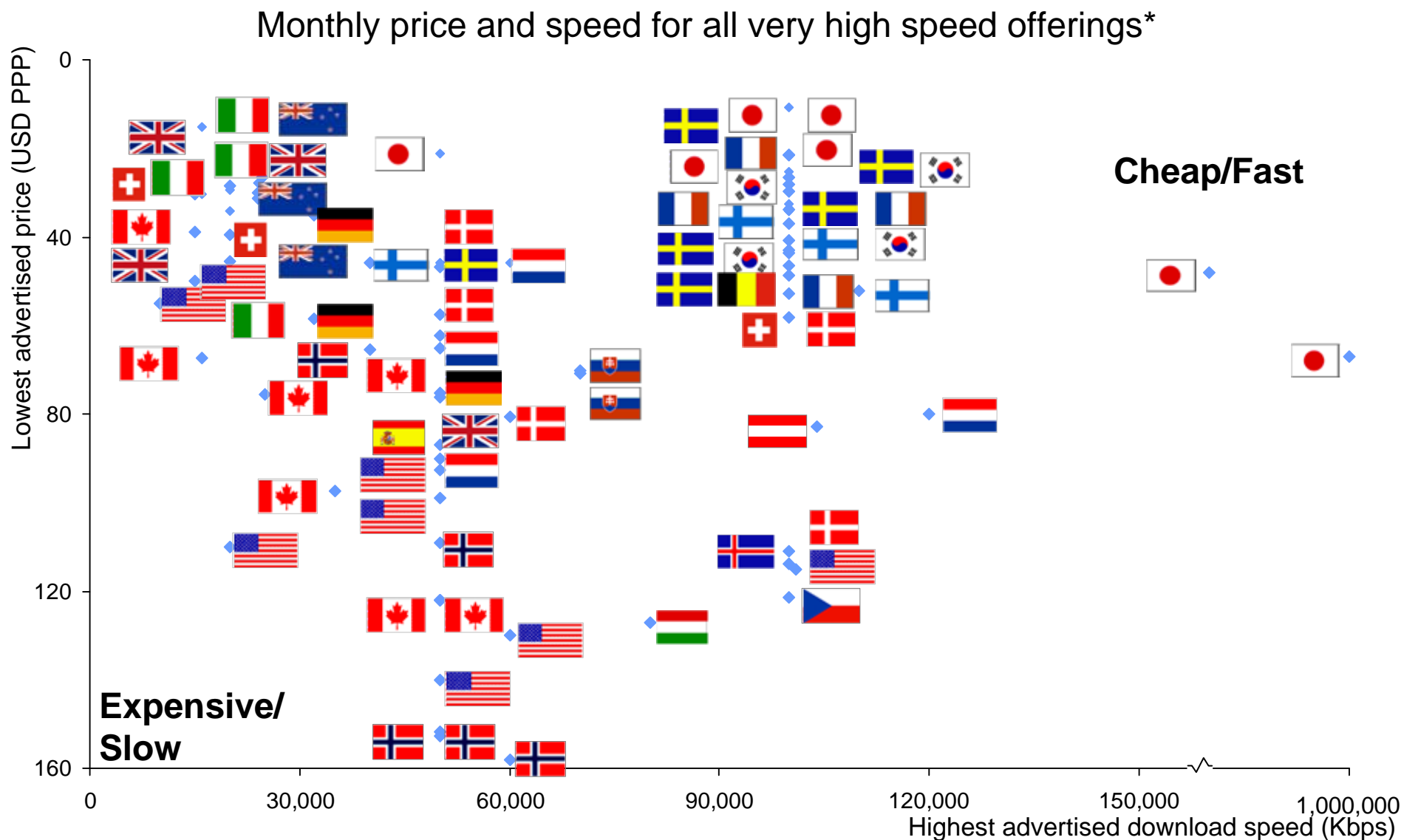


Note: Very high speed is defined as greater than 32Mbps

# All three datasets show a similar picture



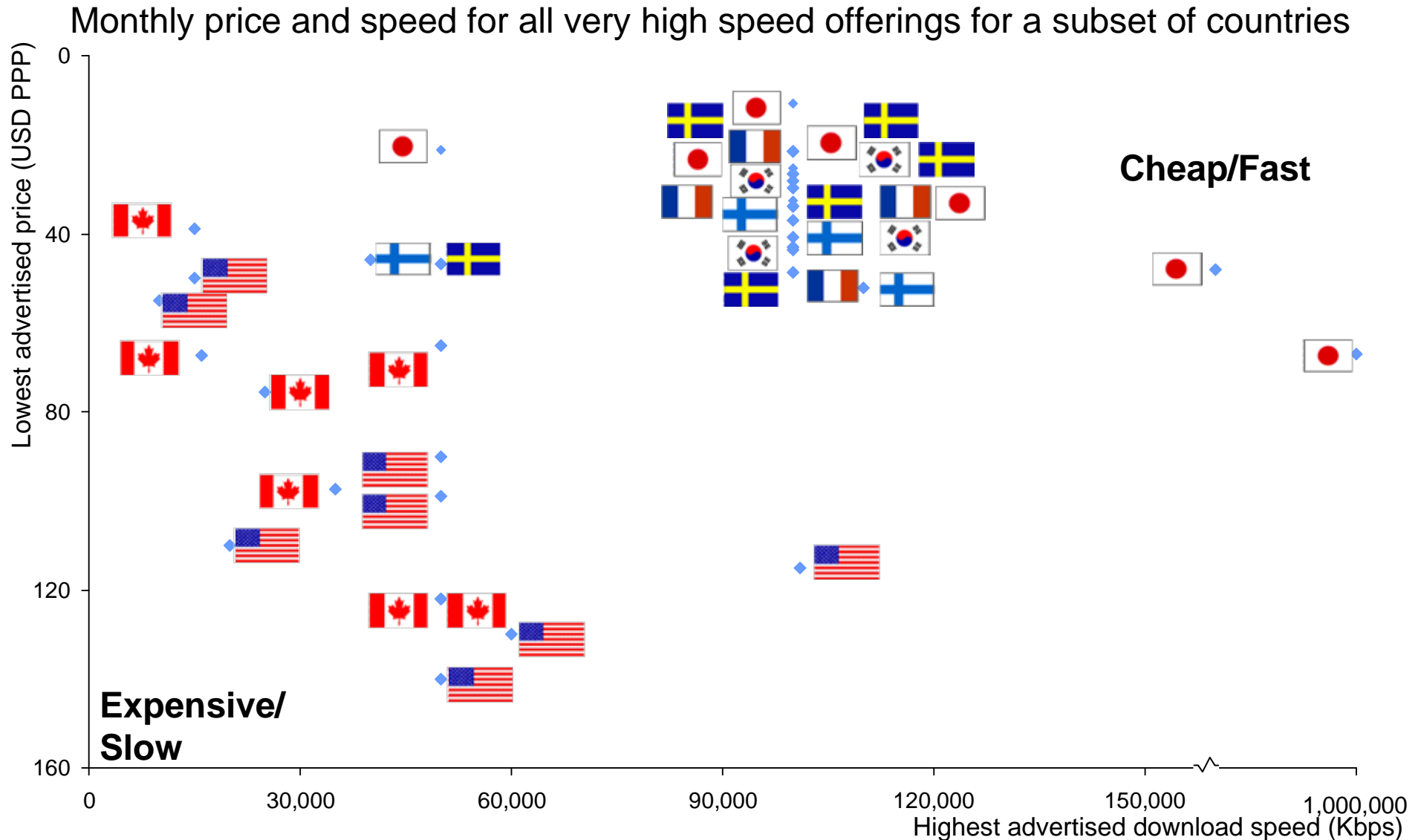
# Looking at next generation oriented offerings from all providers, clusters of countries begin to appear



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](http://www.theodora.com/flags) used with permission

# Limiting just the France, Sweden, Japan, Korea, Finland, Canada and the US



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](http://www.theodora.com/flags) used with permission

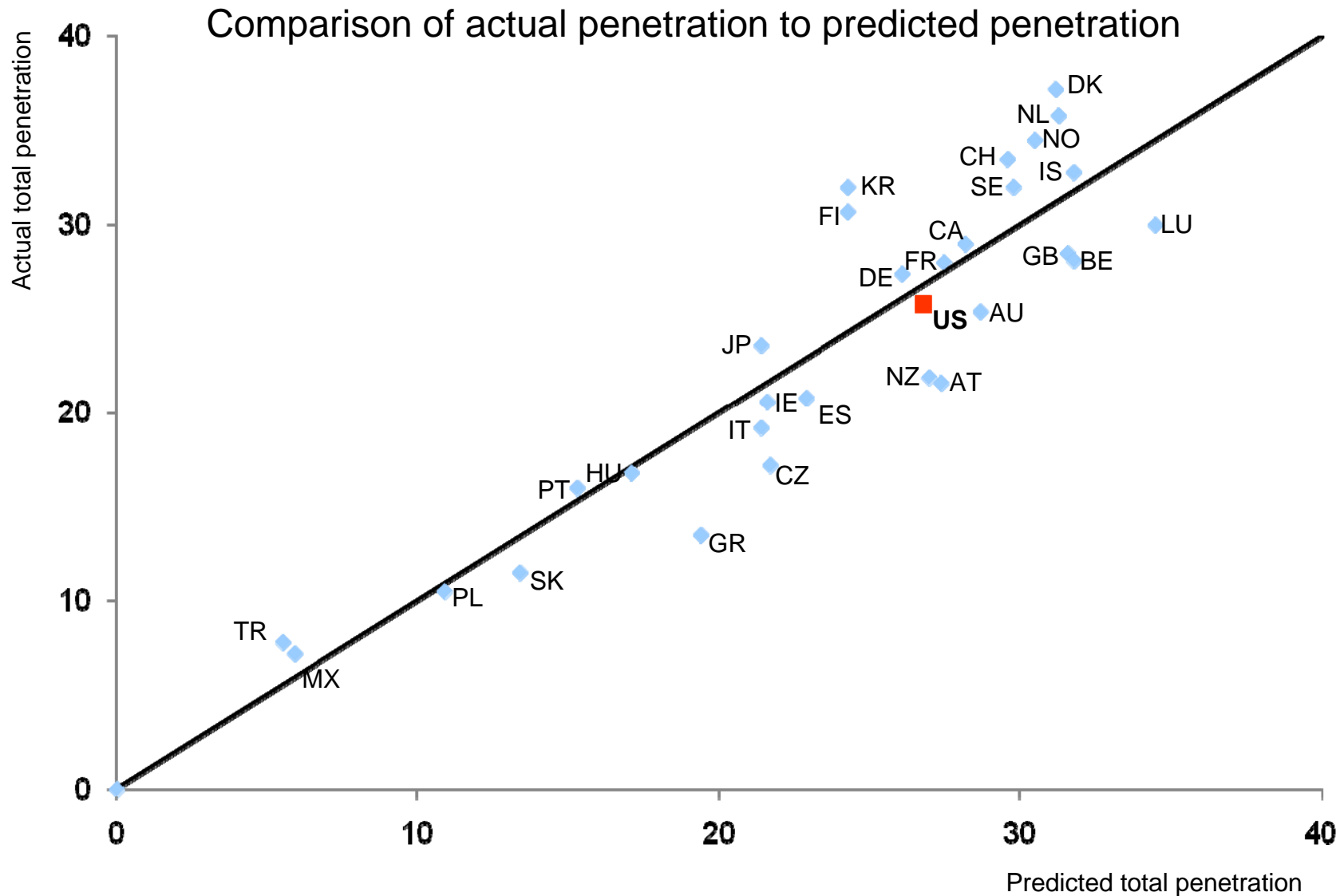
# **What might explains the differences?**

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- **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”



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

Average download speed		Average upload speed	
1.	Busan	1.	Yokohama
2.	Seoul	2.	Stockholm
3.	Göteborg	3.	Tokyo
4.	Stockholm	4.	Göteborg
5.	Yokohama	5.	Kosice
6.	Amsterdam	6.	Copenhagen
7.	Paris	7.	Aarhus
8.	Tokyo	8.	Oslo
9.	Aarhus	9.	Amsterdam
10.	Helsinki	10.	Paris
11.	Rotterdam	11.	Espoo
12.	Hamburg	12.	Bergen
13.	Kosice	13.	New York
14.	Bern	14.	Helsinki
15.	Berlin	15.	Rotterdam
16.	Copenhagen	16.	Wellington
17.	Espoo	17.	Bratislava
18.	Lyon	18.	Prague
19.	Lisbon	19.	Bern
20.	Oslo	20.	Busan



# **Looking at the experiences of other countries**

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- **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**



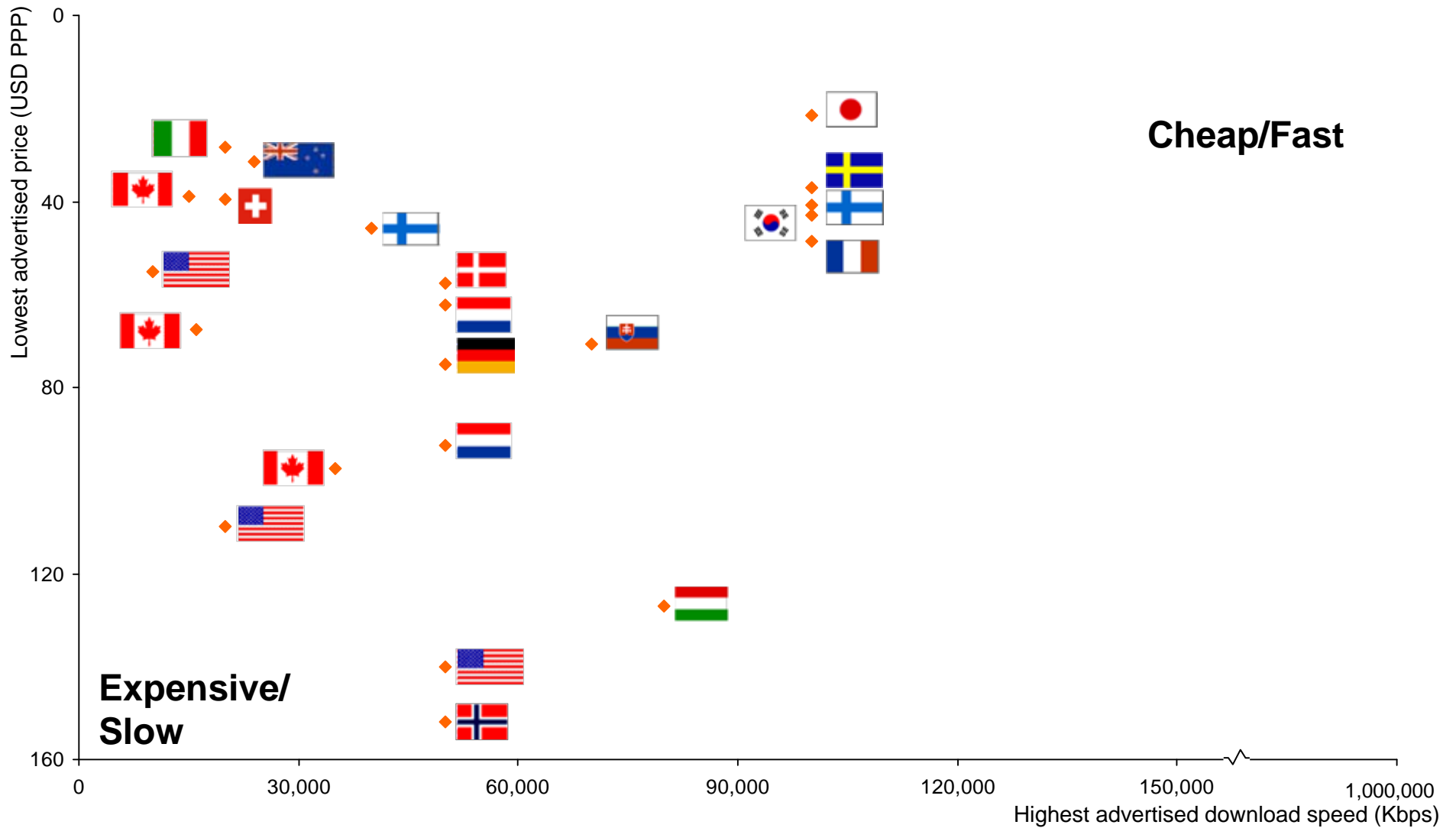
# Open access: Key findings

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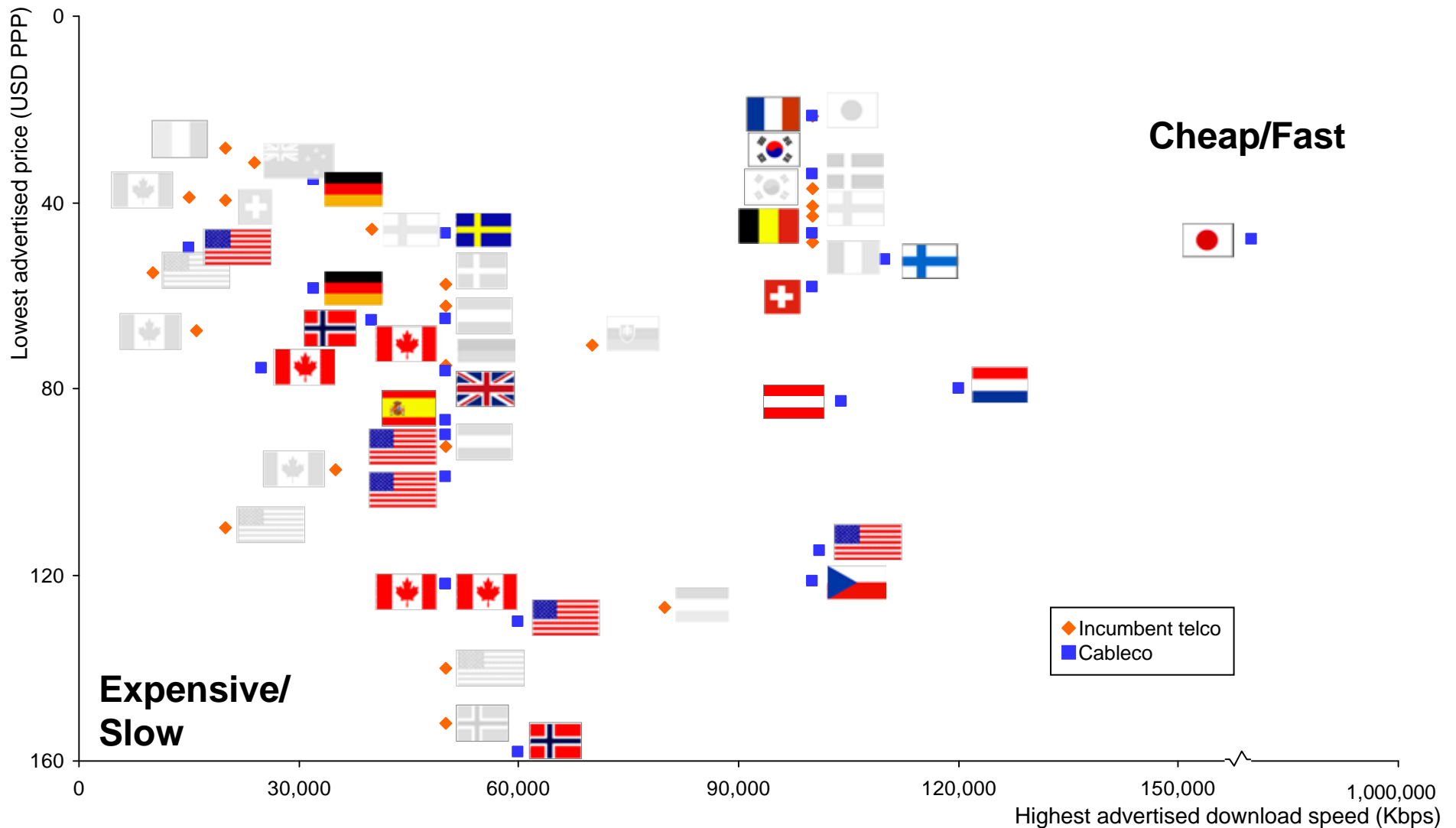
- **Open access/unbundling facilitated competitive entry in many countries**
- **Including where facilities-based alternatives available, access-based entrants play an important catalytic role**
  - **Facilities- and access-based competition complement each other at the system level**
- **Entrepreneurial 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



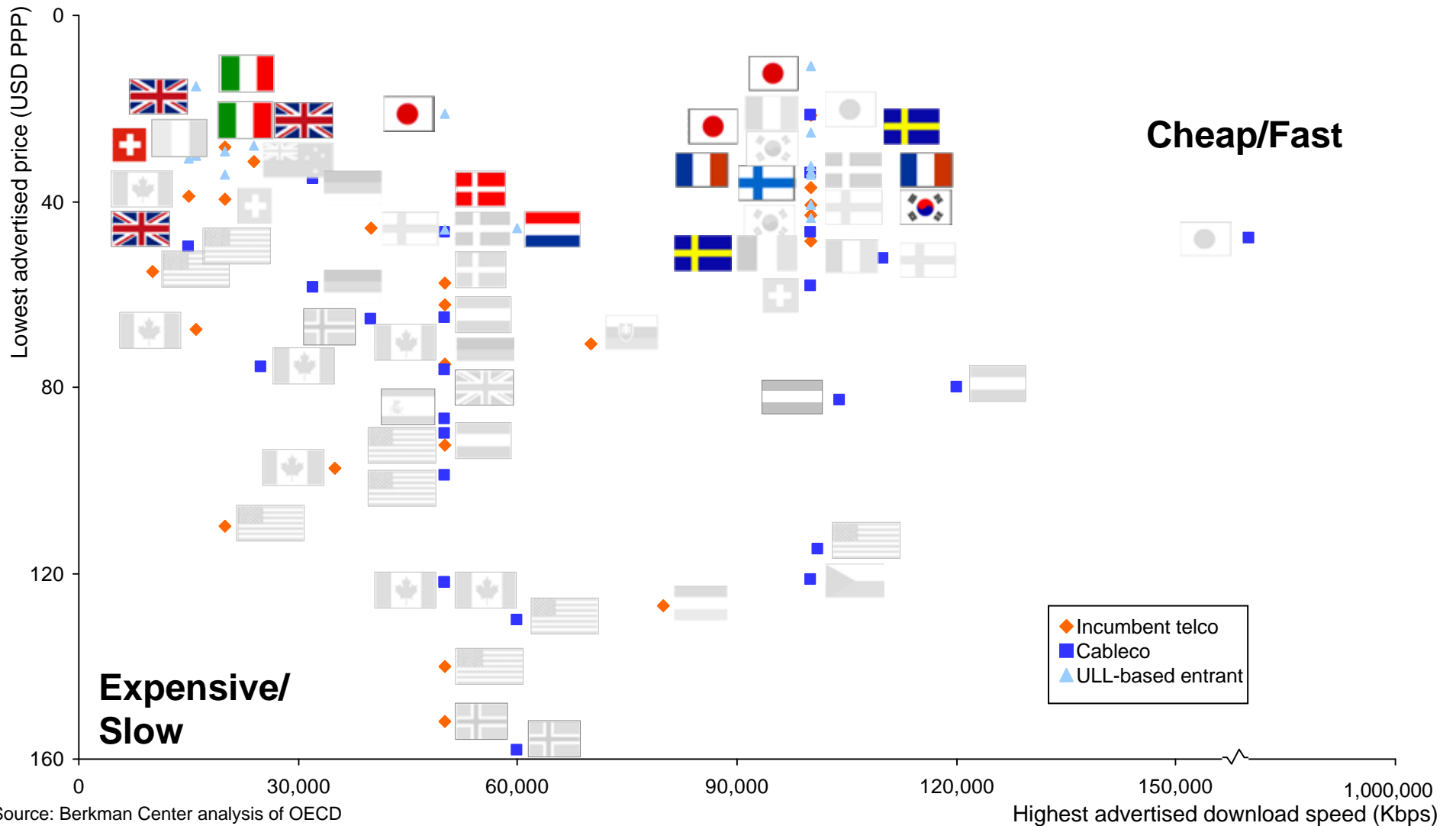
Source: Berkman Center analysis of OECD Broadband Statistics and Telegeography  
 Note: Includes highest speed offerings from US players with minimum 2M subscribers.  
 Flags courtesy of [www.theodora.com/flags](http://www.theodora.com/flags) used with permission

# Cable company offerings tend to group around their domestic incumbents



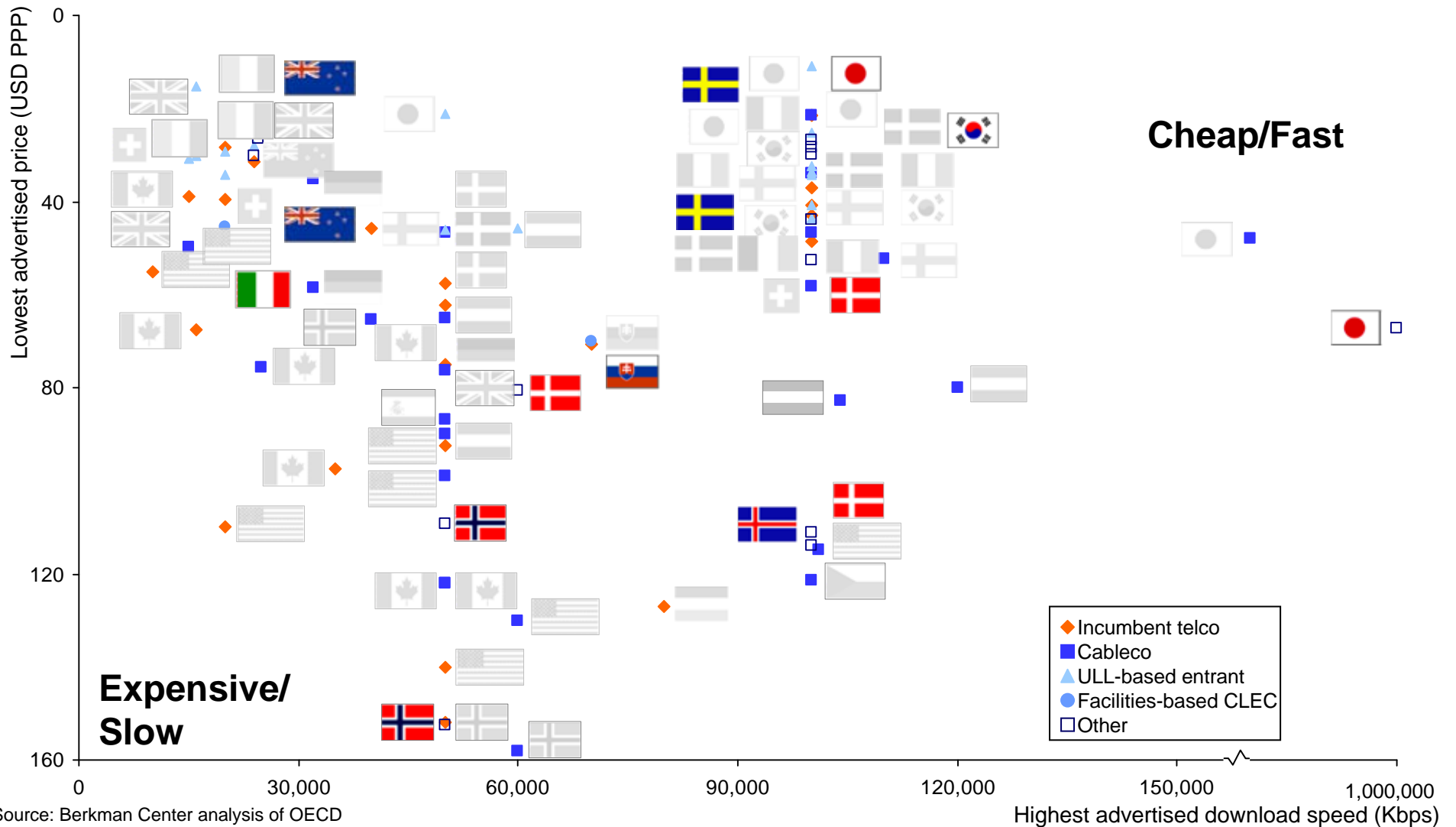
Source: Berkman Center analysis of OECD Broadband Statistics and Telegeography  
Note: Includes highest speed offerings from US players with minimum 2M subscribers. Flags courtesy of [www.theodora.com/flags](http://www.theodora.com/flags) used with permission

# 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](http://www.theodora.com/flags) used with permission

# Facilities-based and other



# But what's the theory?

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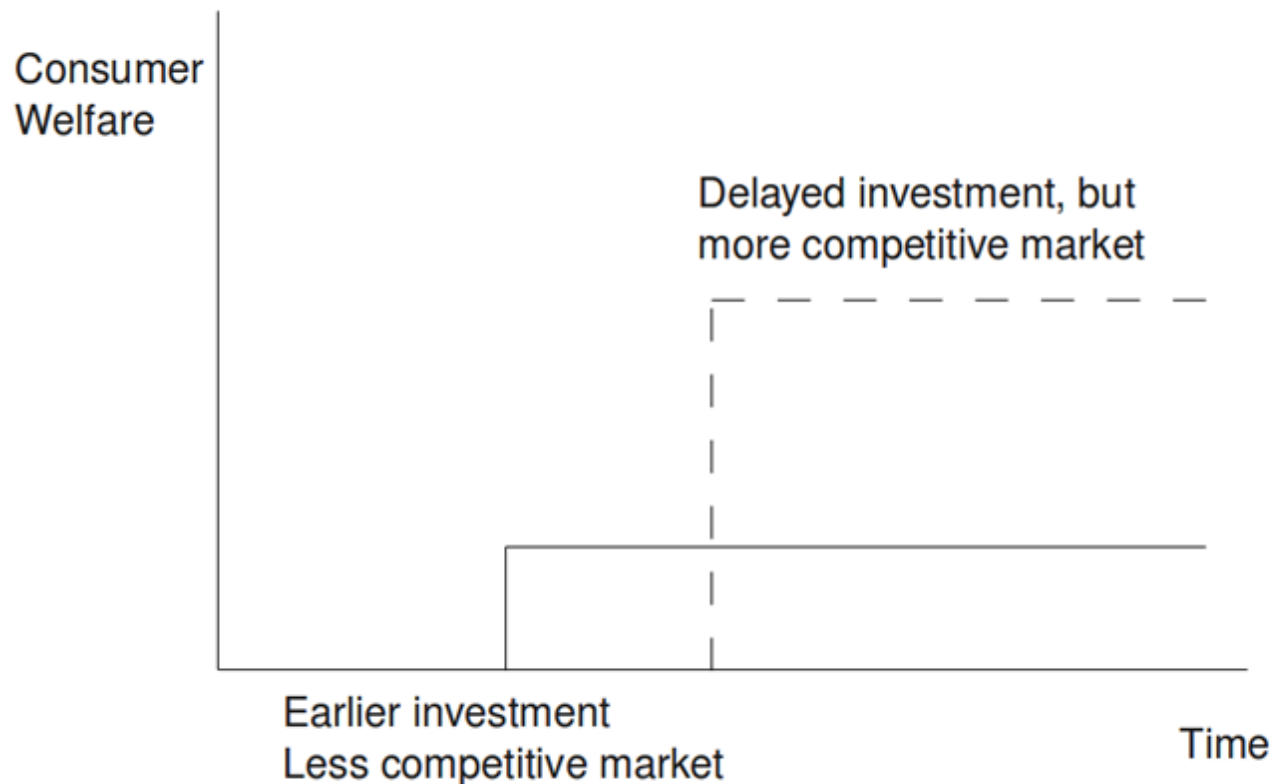
- **Contra: Investment deterrence (Hausmann 1998; Pyndick 2007)**
- **Investment ladder (Cave & Vogelsang 2003)**
  - **Start small; build market share and cash flow; invest more**
  - **Telenor investments in Sweden; Denmark**
  - **Free/Ilriad planned fiber deployments**
  - **Shifts over time from bitstream to LLU**

# But what's the theory?

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

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- 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?

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- 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**

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- **What is the existing evidence?**

# Literature review

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- **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

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- **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

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- **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

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- **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

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- 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**

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- **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**

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- **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**

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- **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

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- **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-Reggefiber
- **Voluntary sharing of deployment cost/risk and shared facilities:**
  - Swisscom; DT?

# Open access: Toolbox

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- 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

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- **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**

