

Telecom Innovation, Investment, and Public Policy

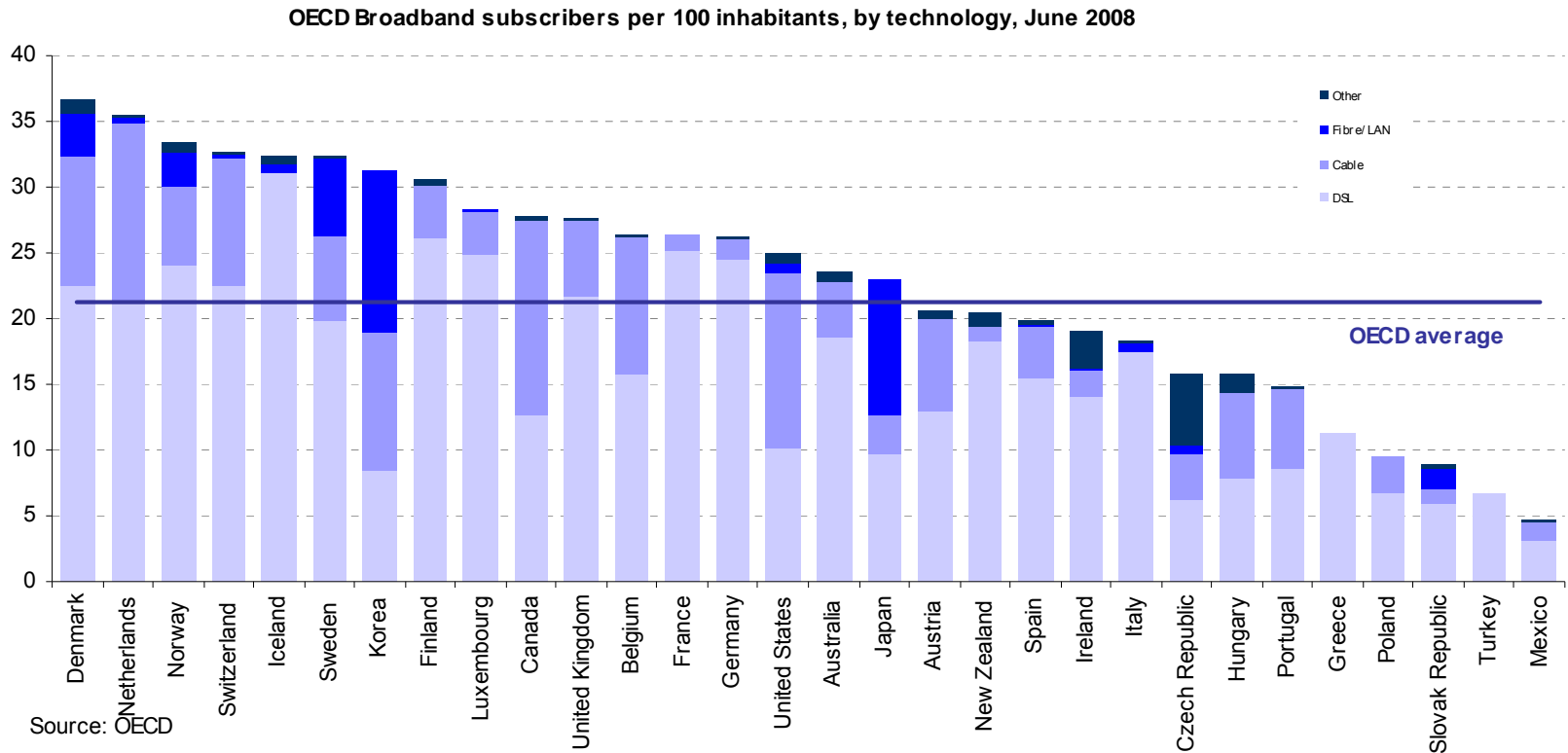
Johannes M. Bauer

40th IPU Annual Regulatory Policy Conference
Williamsburg, VA, December 11, 2008

How is the U.S. doing?

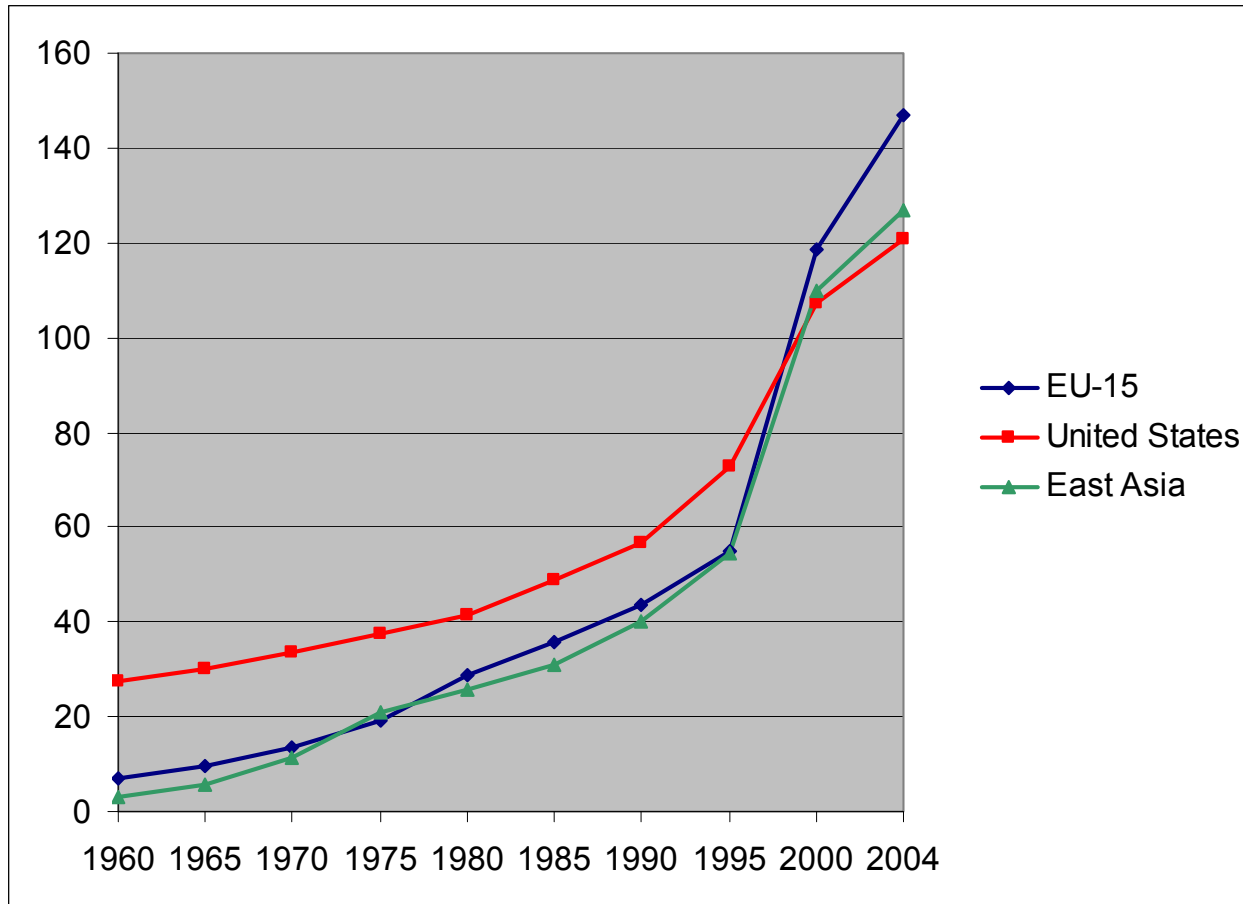
International comparison (1)

(per 100 inhabitants)



Source: <http://www.oecd.org/sti/ict/broadband>

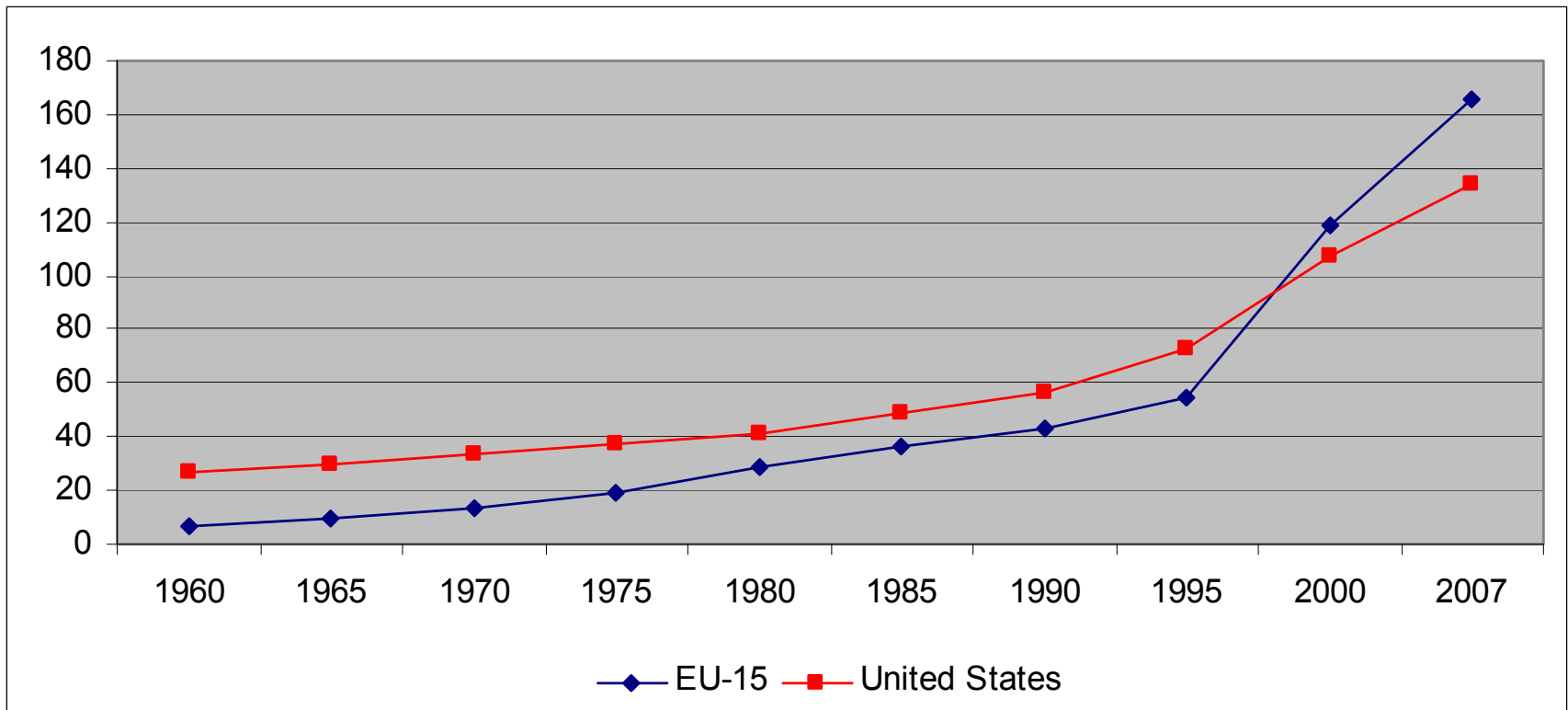
Voice access paths (per 100 inhabitants)



Source: ITU; Quello Center ICT Observatory, 2006

EU-US voice access paths

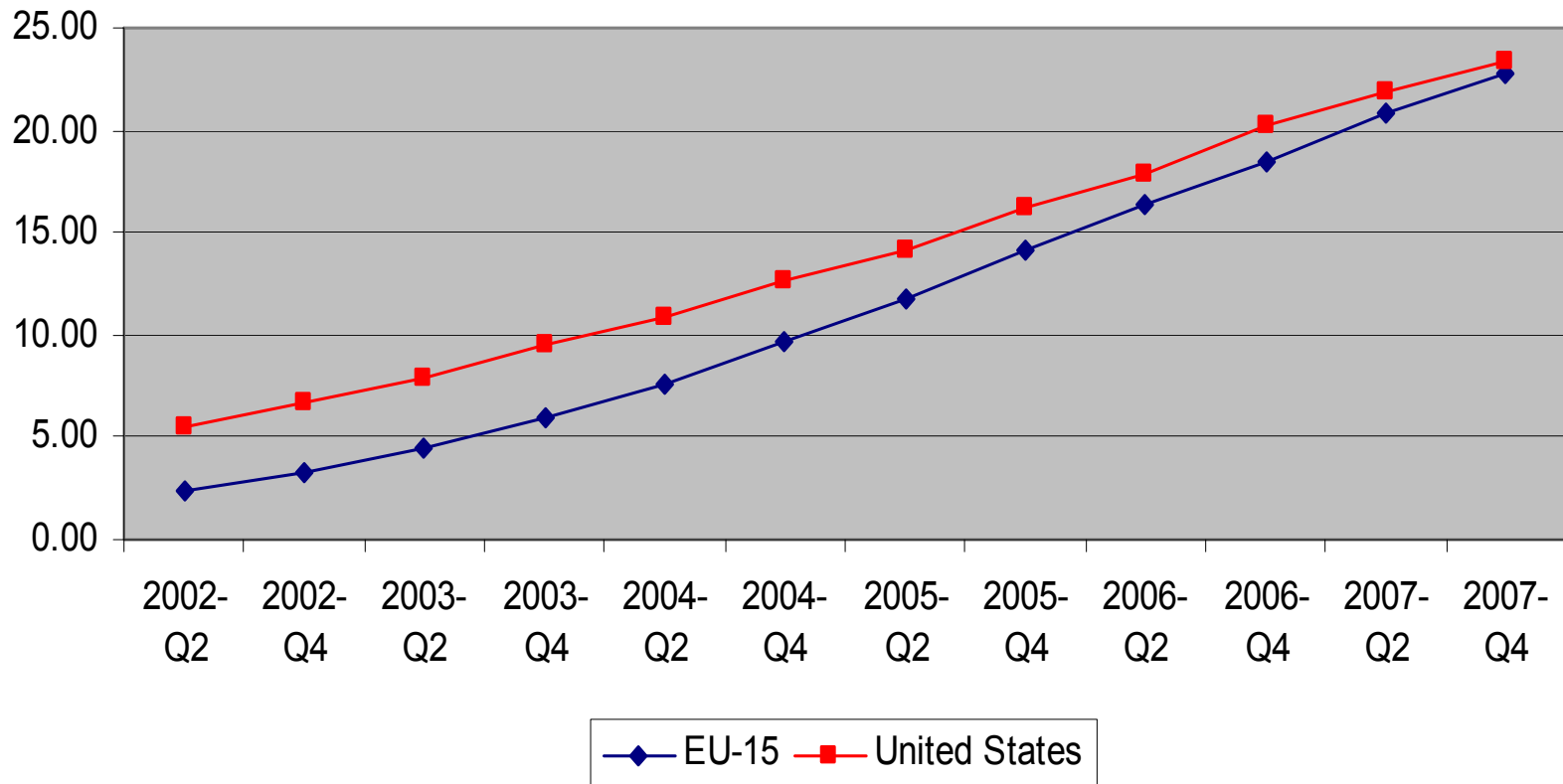
(per 100 inhabitants)



Source: ITU, World Telecommunications Development Indicators

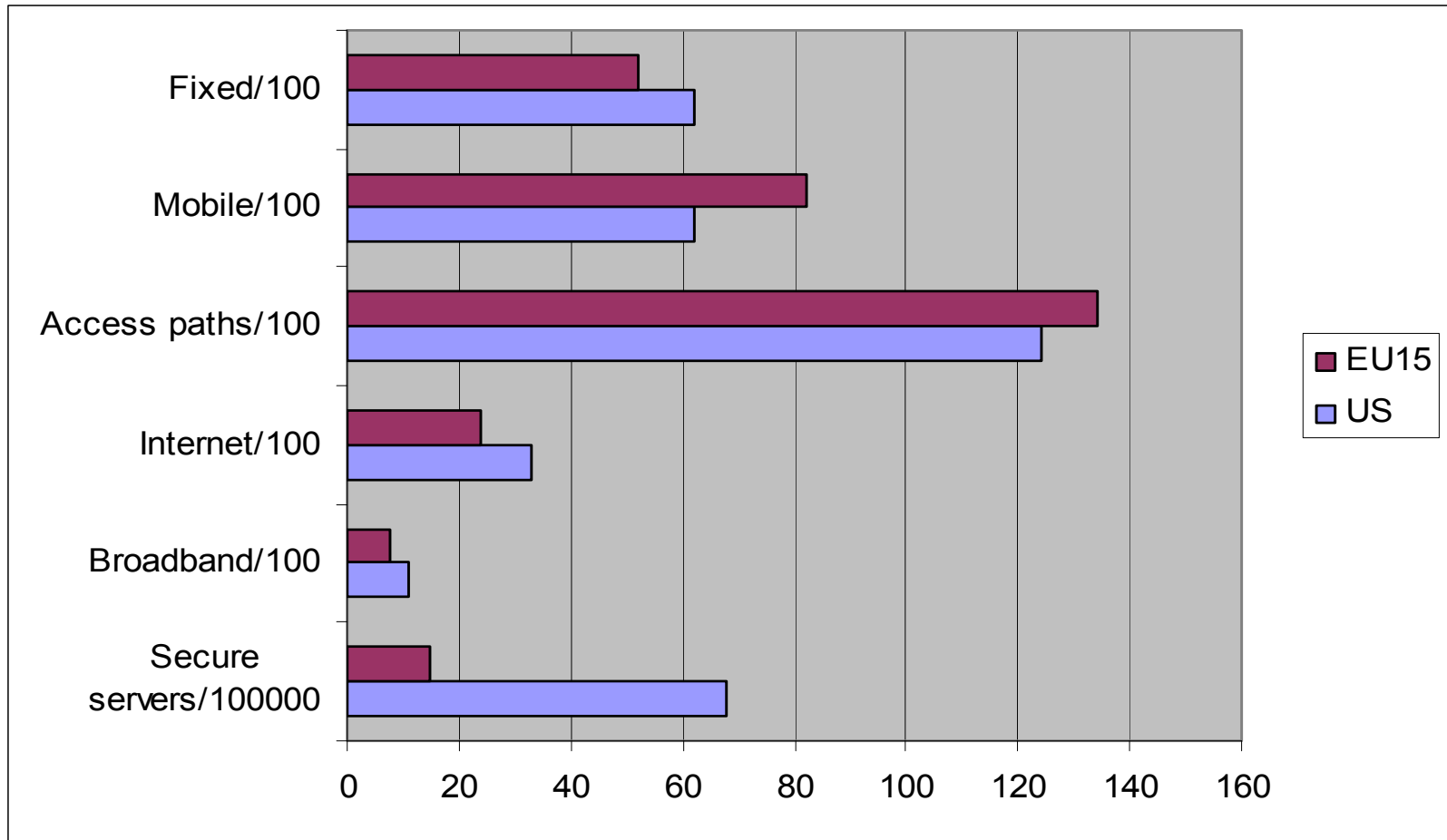
EU-US broadband diffusion

(per 100 inhabitants, 2002-2007)



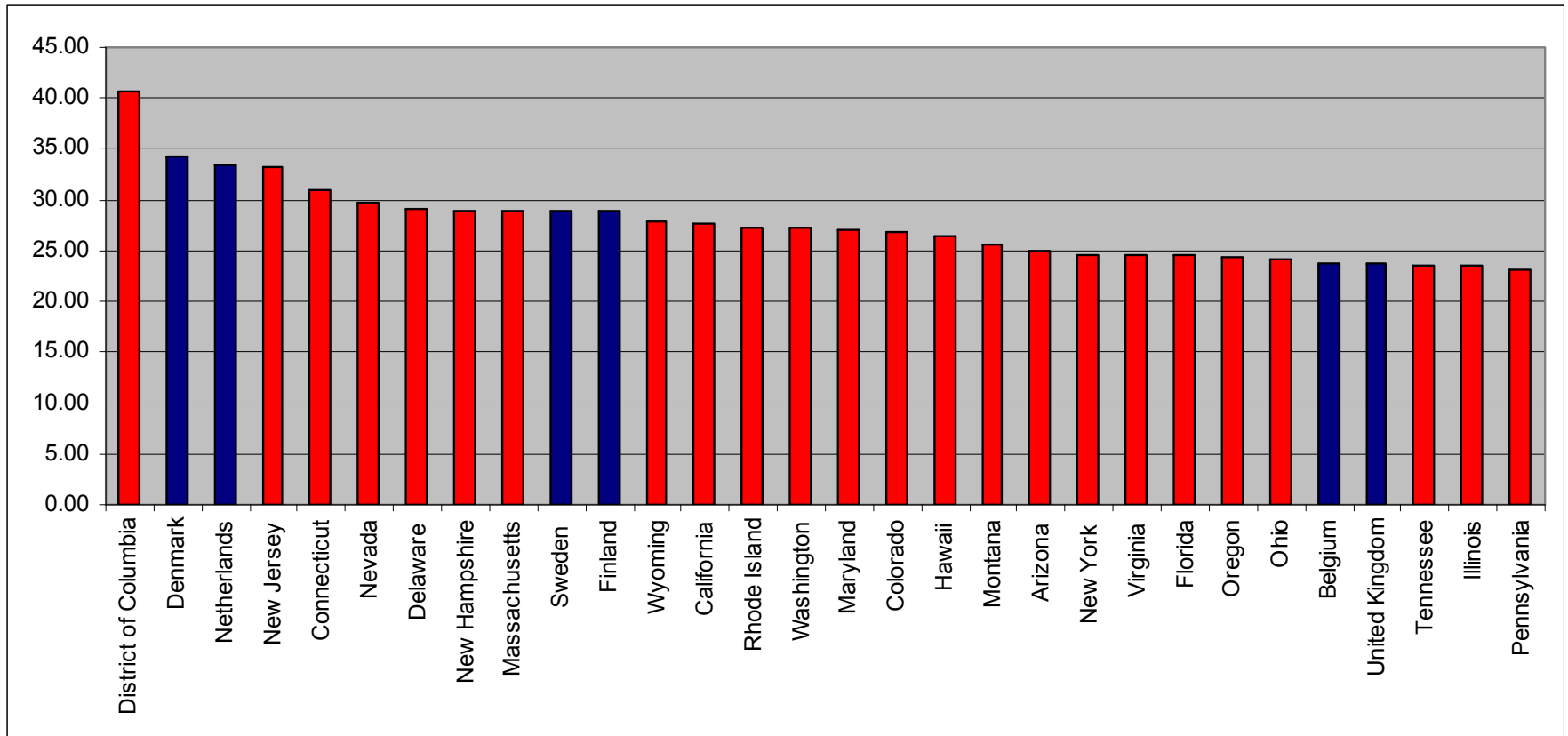
Source: OECD Broadband Portal, 2008

A broader assessment (beginning of 2005)



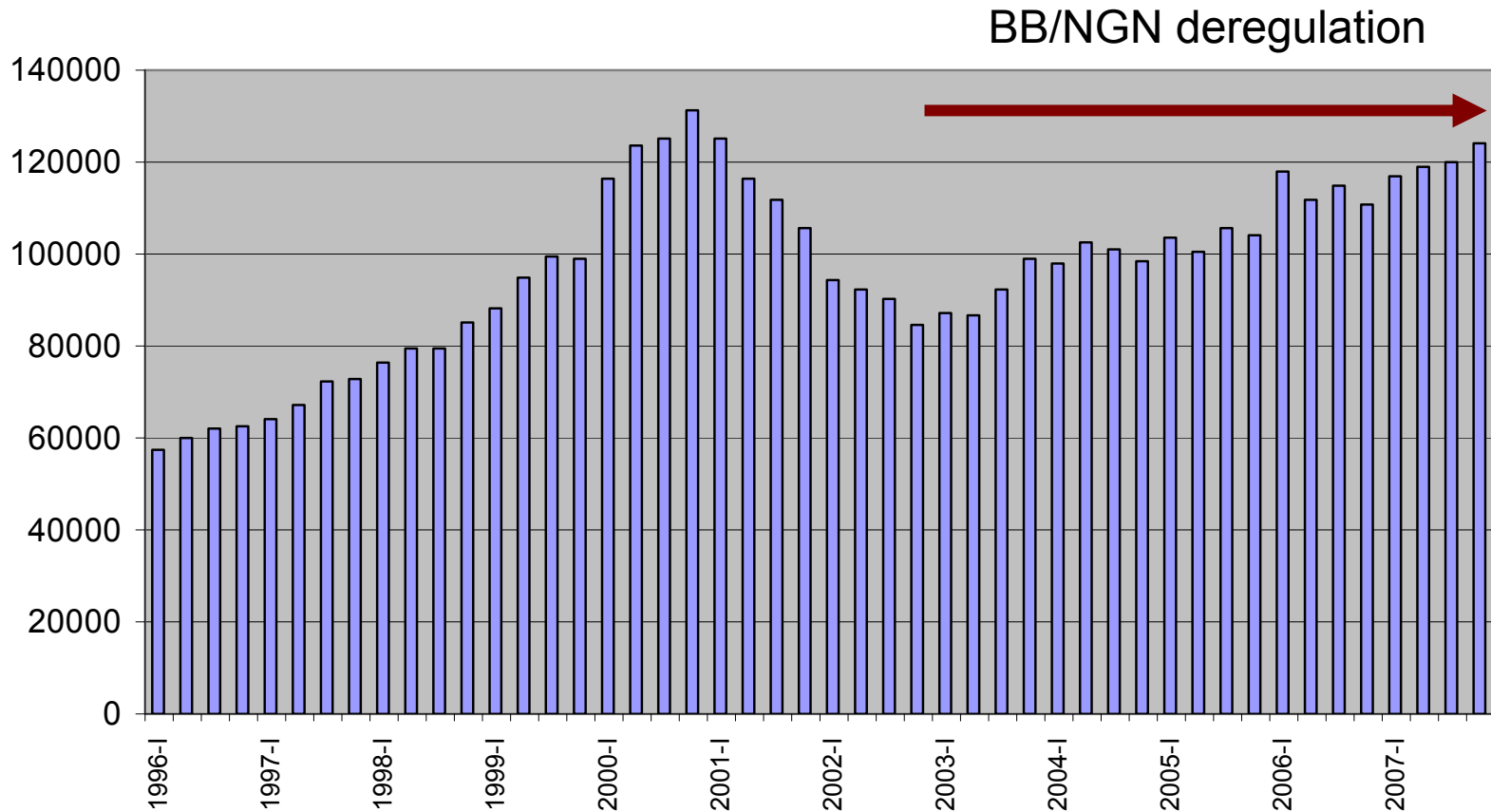
Source: OECD, 2005

State-level broadband access (per 100, June 2007, OECD methodology)



Sources: FCC 2008, OECD 2008

U.S. communications equipment investment (\$ mill)



Source: DoC, 2008

International comparison (2)

(assumption: every HH and business has BB)

Table 2. The Broadband Nirvana

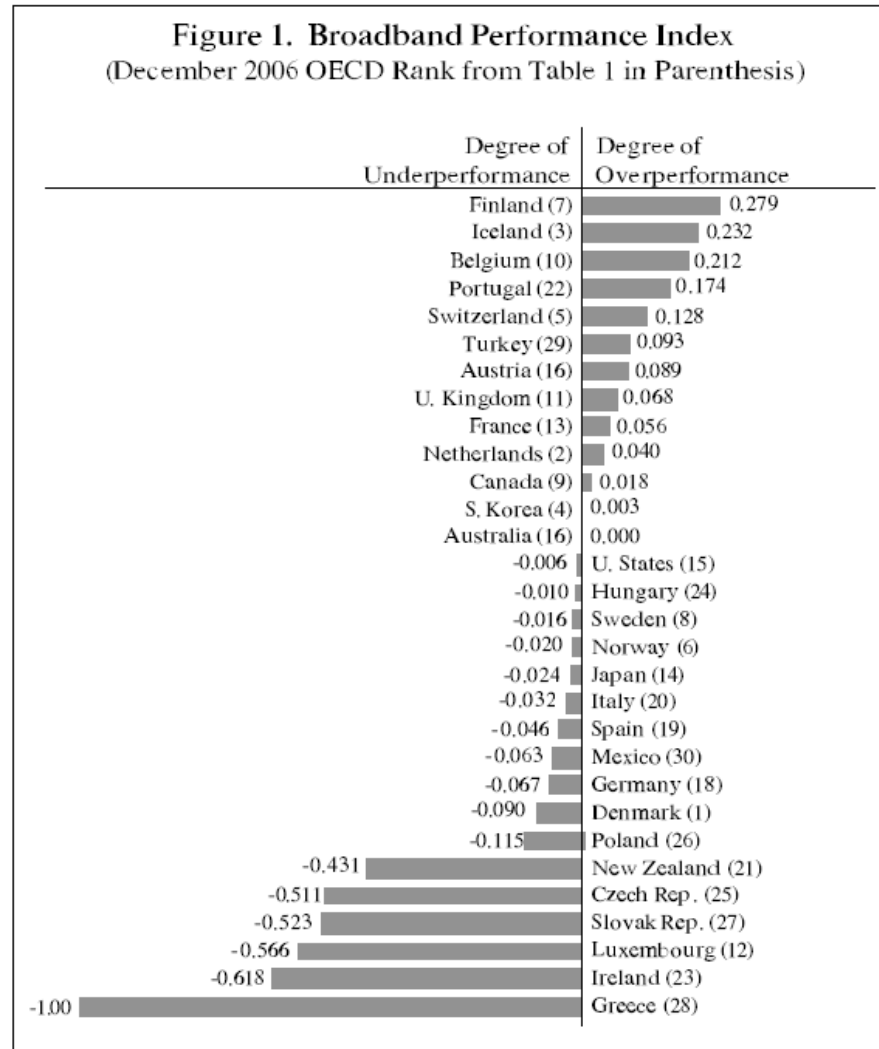
(Every home and business has broadband)

Country	Subscription	Rank	Country	Subscription	Rank
Sweden	54.1	1	New Zealand	39.8	16
Iceland	48.9	2	Portugal	39.2	17
Czech Republic	47.8	3	Japan	39.0	18
Denmark	47.8	4	United Kingdom	38.9	19
Finland	47.7	5	United States	38.0	20
Germany	44.9	6	Luxembourg	37.8	21
Netherlands	43.7	7	Greece	36.2	22
Switzerland	42.9	8	Slovak Republic	35.1	23
France	42.4	9	Ireland	34.7	24
Canada	41.9	10	Poland	34.1	25
Hungary	41.1	11	Spain	33.8	26
Belgium	41.0	12	Australia	31.5	27
Austria	40.6	13	Korea	25.4	28
Italy	40.4	14	Mexico	24.7	29
Norway	40.3	15	Turkey	21.2	30

Source: April 24, 2007 Testimony of George S. Ford before the House Energy & Commerce Committee on Digital Future of the United States: Part IV, Broadband Lessons from Abroad (available at: http://energycommerce.house.gov/emte_mtg/110-ti-hrg.042407.Ford-Testimony.pdf).

International comparison (3)

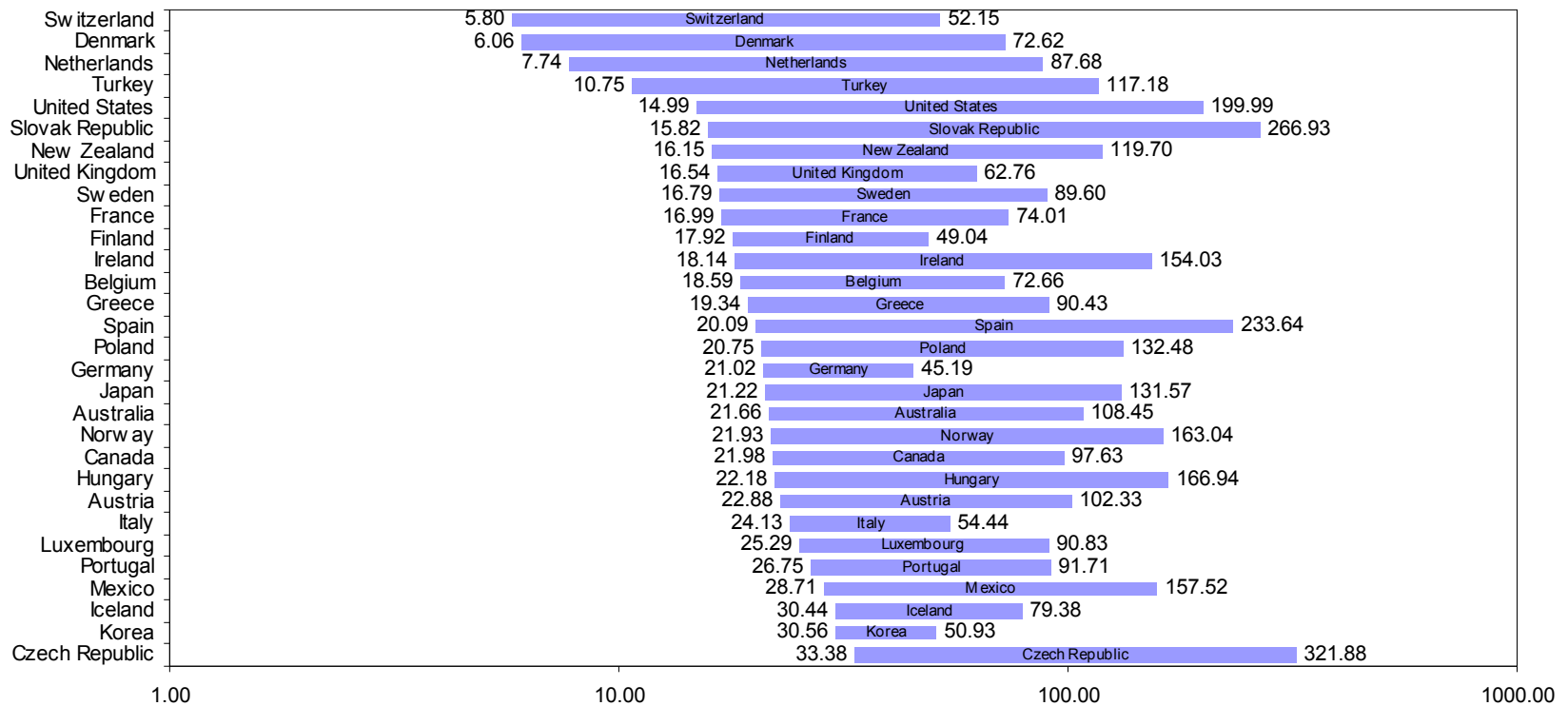
(Phoenix Center Broadband Performance Index)



Source: Phoenix Center, 2007

BB price ranges

Broadband price ranges, October 2007, all platforms, logarithmic scale, USD PPP



Source: OECD 2008

E-Readiness Index (EUI)

2008 e-readiness rank (of 70)	2007 rank	Country	2008 e-readiness score (of 10)	2007 score
1	2	United States	8.95	8.85
2	4	Hong Kong	8.91	8.72
3	2	Sweden	8.85	8.85
4	9	Australia	8.83	8.46
5	1	Denmark	8.83	8.88
6	6	Singapore	8.74	8.60
7	8	Netherlands	8.74	8.50
8	7	United Kingdom	8.68	8.59
9	5	Switzerland	8.67	8.61
10	11	Austria	8.63	8.39
11	12	Norway	8.60	8.35
12	13	Canada	8.49	8.30
13	10	Finland	8.42	8.43
14	19	Germany	8.39	8.00
15	16	South Korea	8.34	8.08
16	14	New Zealand	8.28	8.19
17	15	Bermuda	8.22	8.15
18	18	Japan	8.08	8.01
19	17	Taiwan	8.05	8.05
20	20	Belgium	8.04	7.90

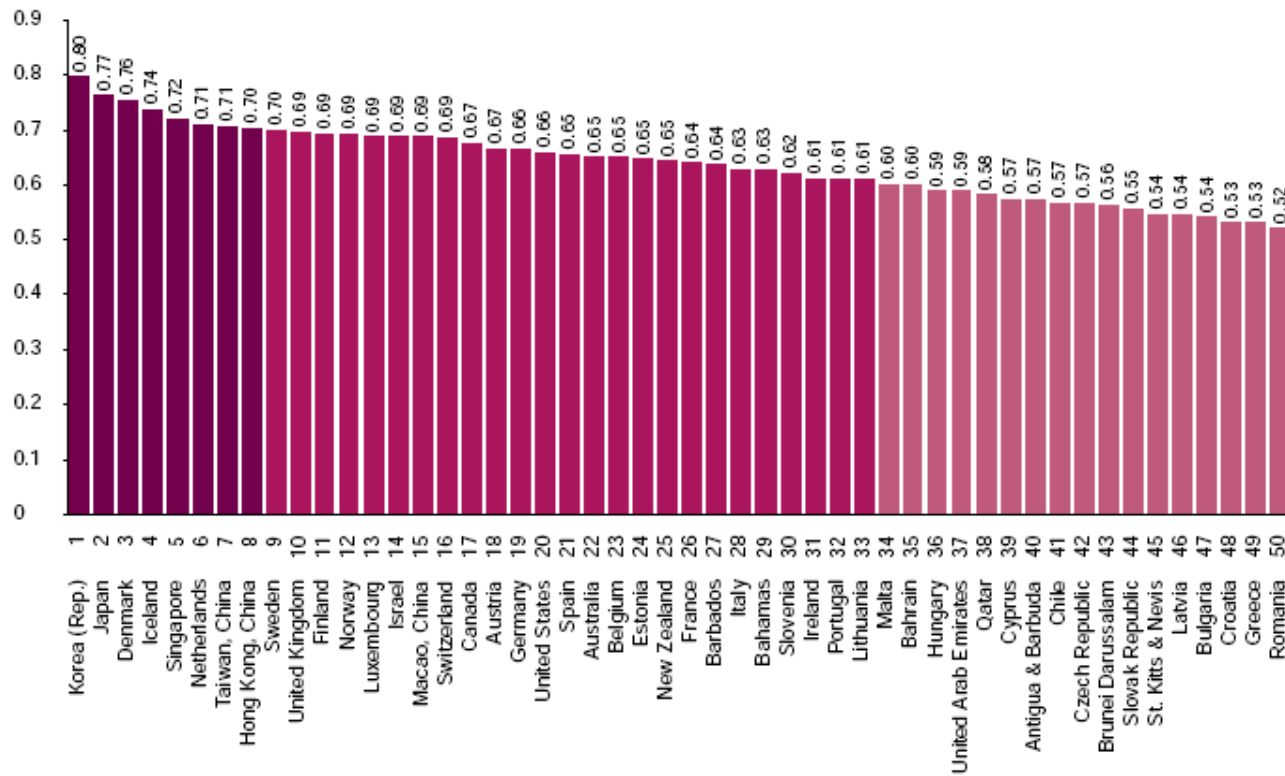
Source: Economist
Intelligence Unit, 2008

Network Readiness Index (NRI)

2007–2008 rank	Country/ Economy	Score
1	Denmark	5.78
2	Sweden	5.72
3	Switzerland	5.53
4	United States	5.49
5	Singapore	5.49
6	Finland	5.47
7	Netherlands	5.44
8	Iceland	5.44
9	Korea, Rep.	5.43
10	Norway	5.38
11	Hong Kong SAR	5.31
12	United Kingdom	5.30
13	Canada	5.30
14	Australia	5.28
15	Austria	5.22
16	Germany	5.19
17	Taiwan, China	5.18
18	Israel	5.18
19	Japan	5.14
20	Estonia	5.12

Source: World
Economic Forum,
2008

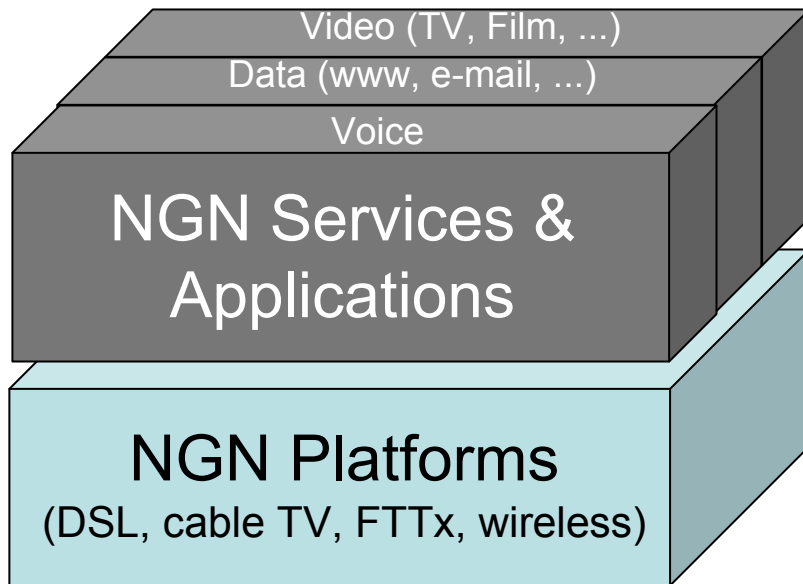
Digital Opportunities Index



Source: ITU, 2007

Next-generation network innovation and investment

Next-generation Networks (NGN)



- Abandon service-specific technology
- Probably separation in platforms and services
- Significant investment requirement
- *Ex ante* regulation or not?

Sources: RTR 2007, ITU 2006, OECD 2005

New conditions in NGN

- Past

- Transition monopoly to competition
- Control of market power
- Infrastructure investment sunk
- One-sided access
- “Static” theory of optimal regulation

- Present/Future

- New forms of inter-modal competition
- Creation of conditions facilitating investment
- New infrastructure investment necessary
- Multi-sided access
- “Dynamic” theory of optimal regulation

The missing link

Traditional view: market structure
determines optimal regulation

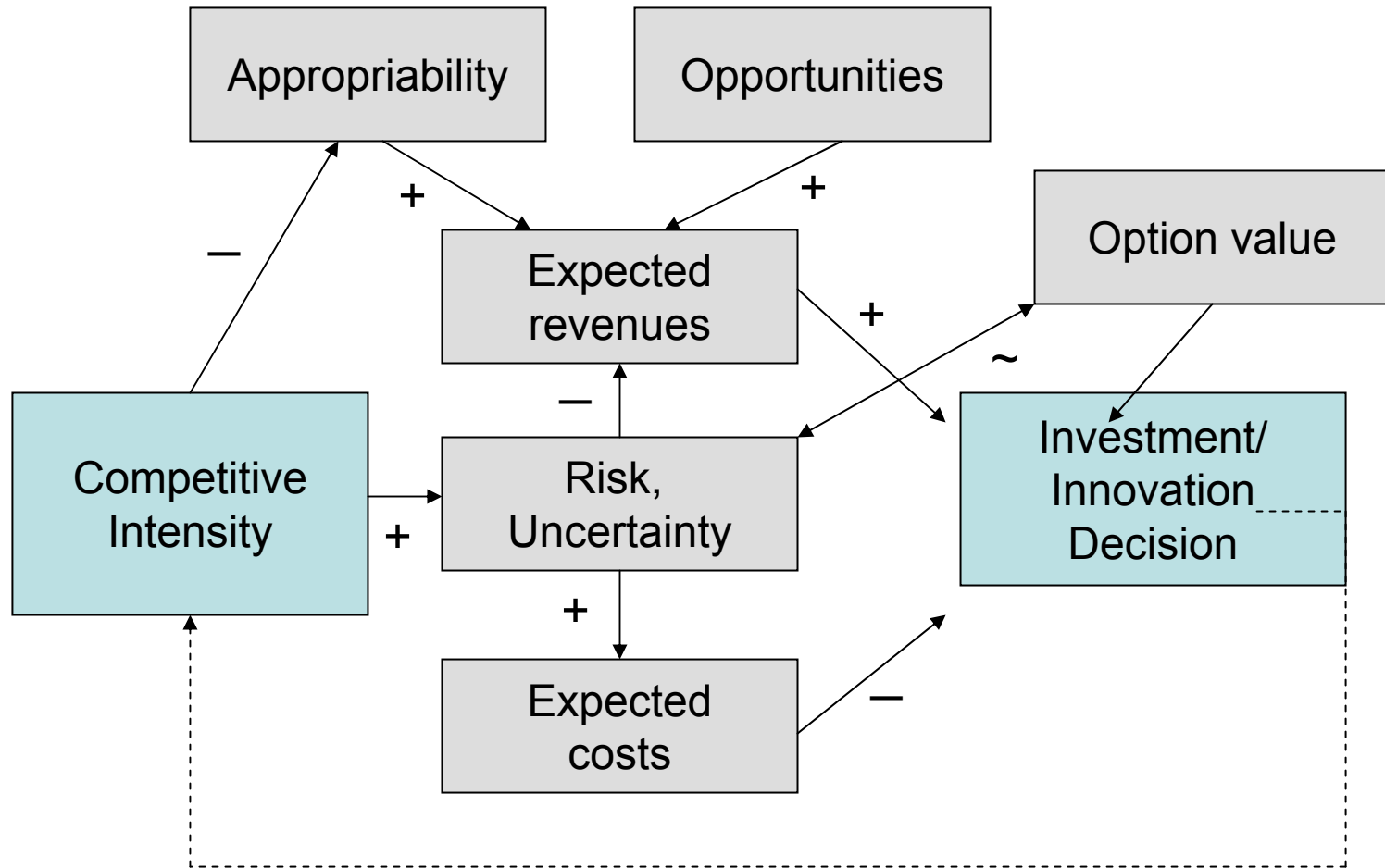


**NGN: Present regulation shapes
future market structure**

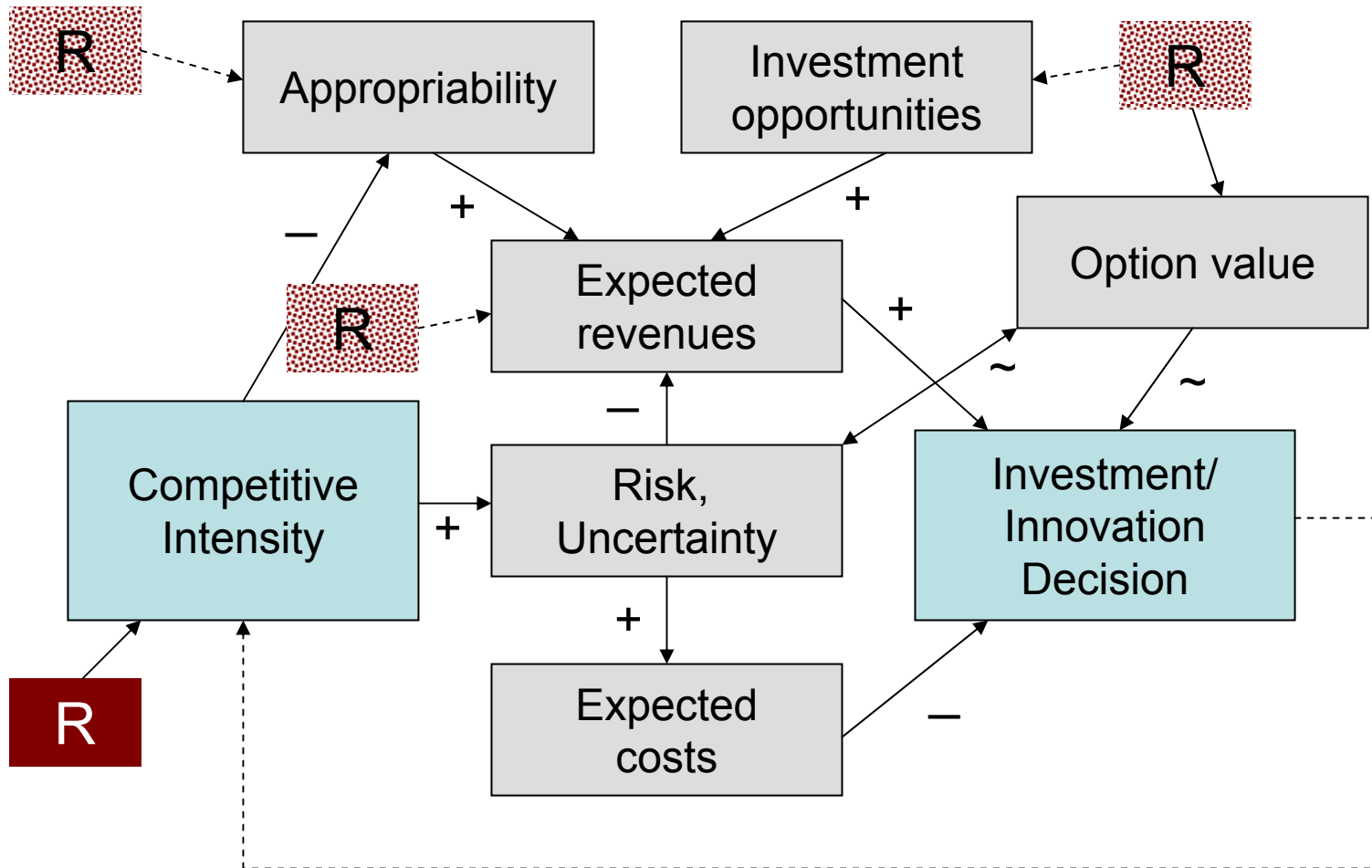
Theoretical frameworks

- Static regulatory theory (until 1980s)
 - Cost-based regulation (e.g., traditional ROR)
 - Averch-Johnson critique (1962)
- Quasi-dynamic regulatory theory (1980s-present)
 - Price cap regulation
 - Forward-looking cost models
 - Ladder-of-investment (LoI) approach
 - Real option theory
- Dynamic investment and innovation theory

A dynamic model



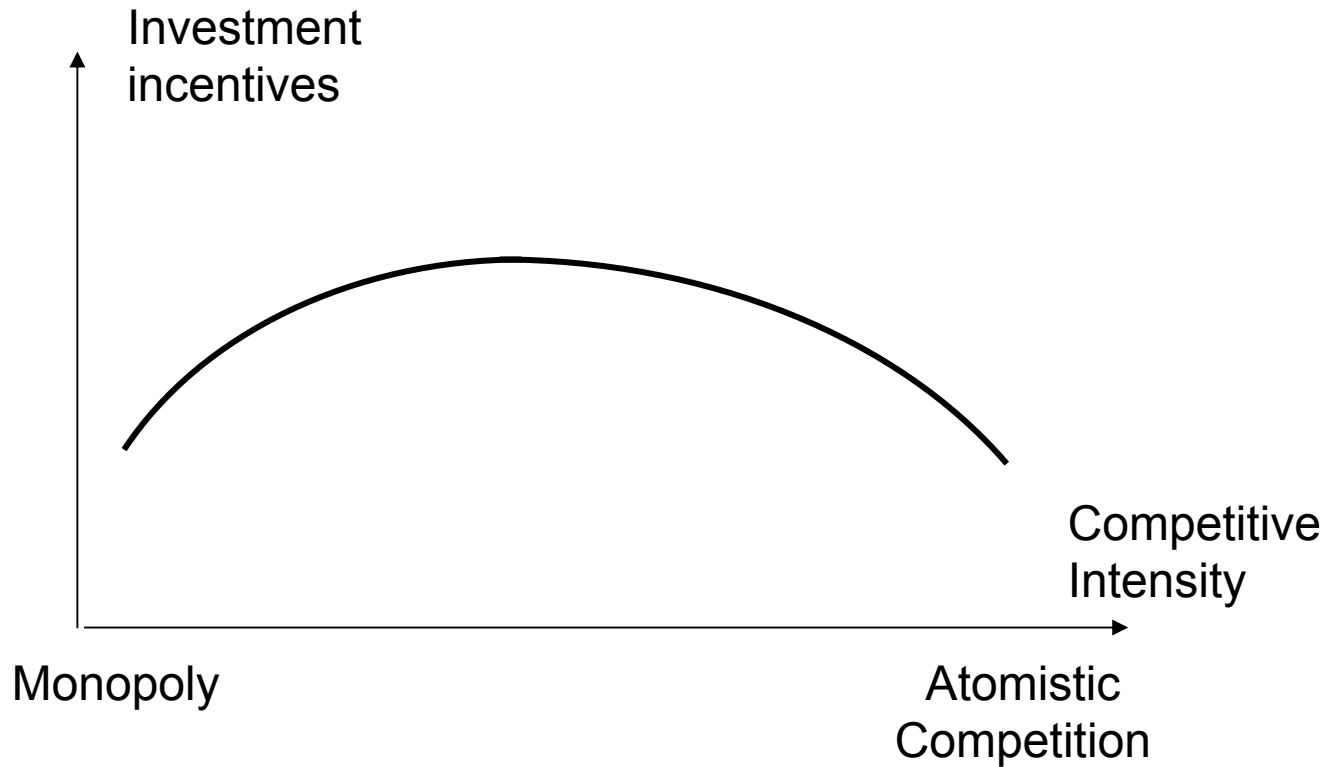
Regulatory interventions



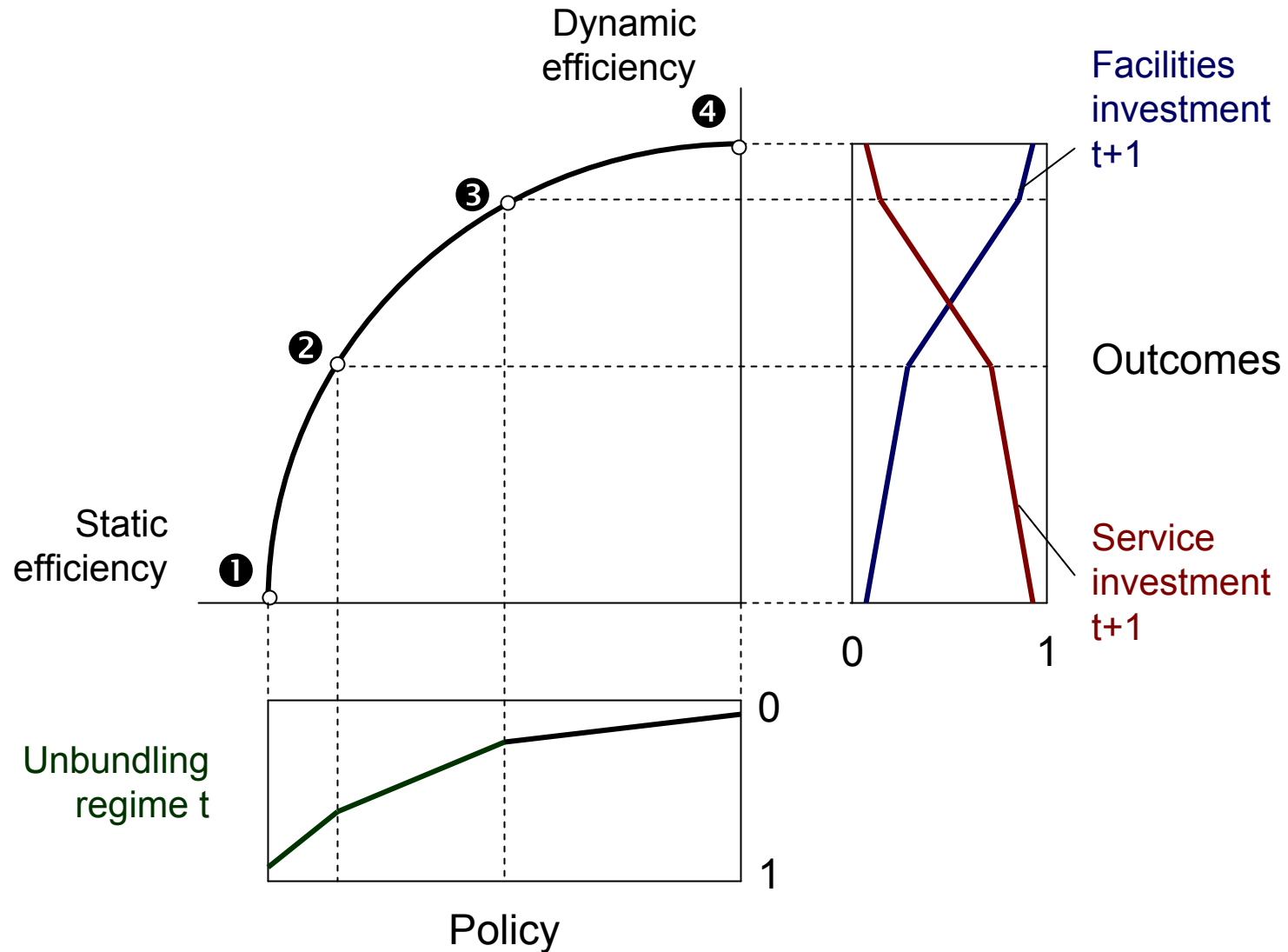
Ladder of investment approach

- One possible scenario but not a general model of network investment
- Weaknesses of regulatory implementation
 - Political economy of regulation (expectations, short-term orientation)
 - Lack of contingencies for retaining low rungs
- Empirical evidence shaky
 - Does not describe sector investment pattern
 - Does not generally describe individual firm investment
- Even more limited when applied to NGN

Competitive intensity and investment



Unbundling and investment

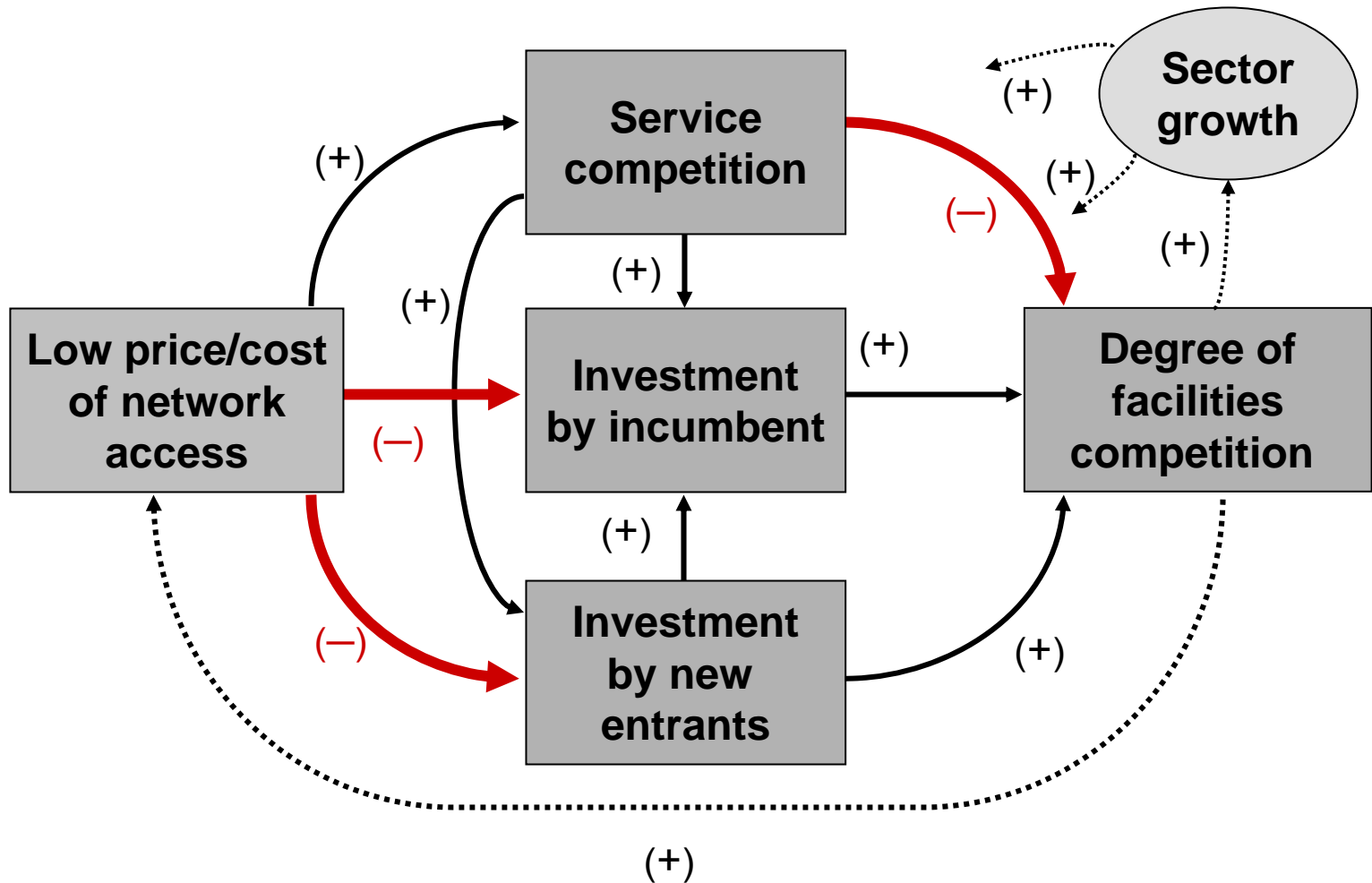


Policy under uncertainty

Policy _t	Actual behavior _{t+1}	
	No inefficient discrimination	Inefficient discrimination
No ex ante regulation	Correct	Error (Type II) Options to correct
Ex ante regulation	Error (Type I) No options to correct	Correct

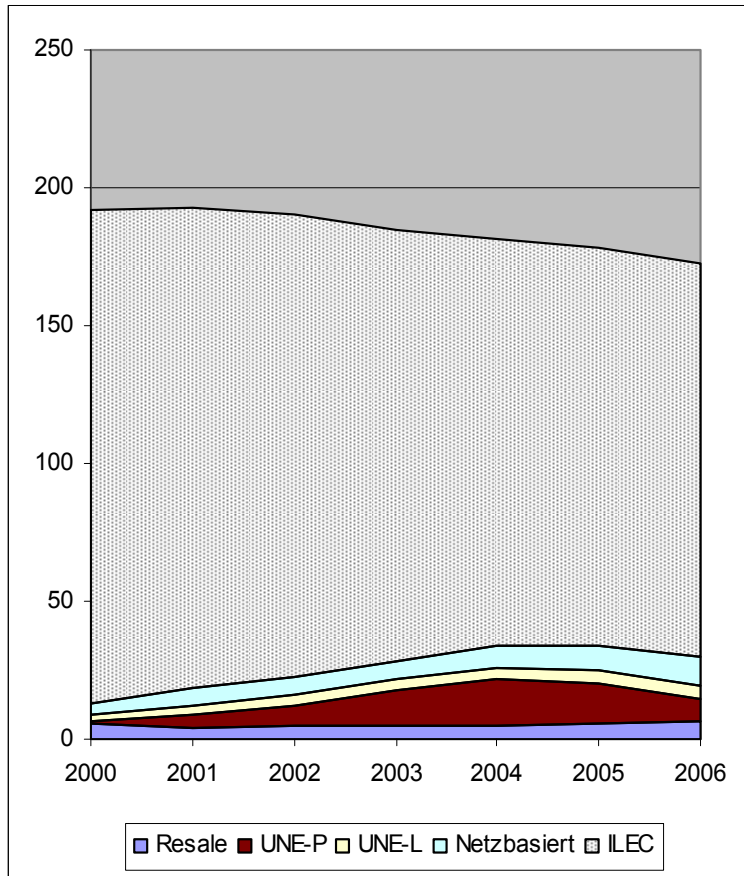
Unbundling

Complex effects of regulation

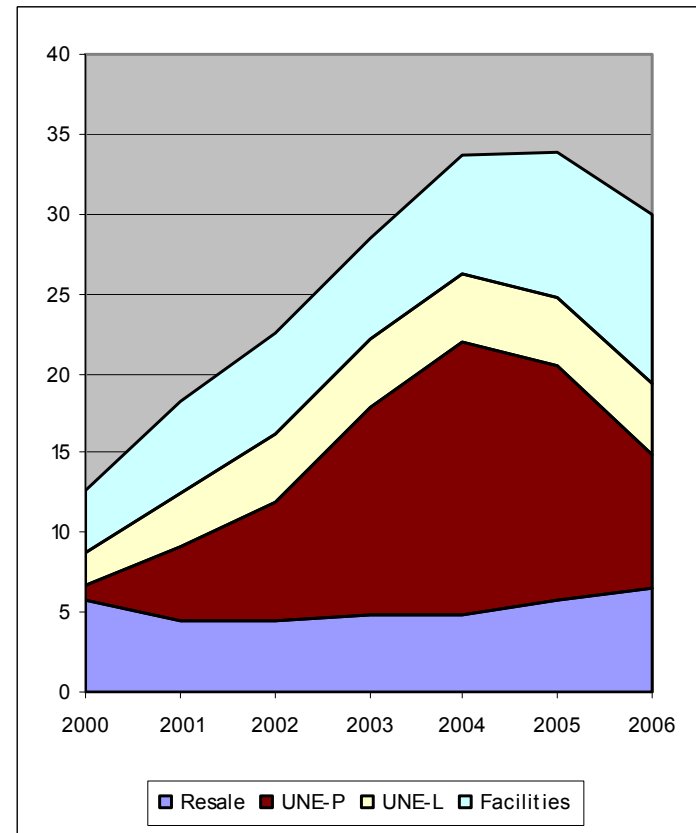


Example LLU in the U.S.

Total market



New subscribers

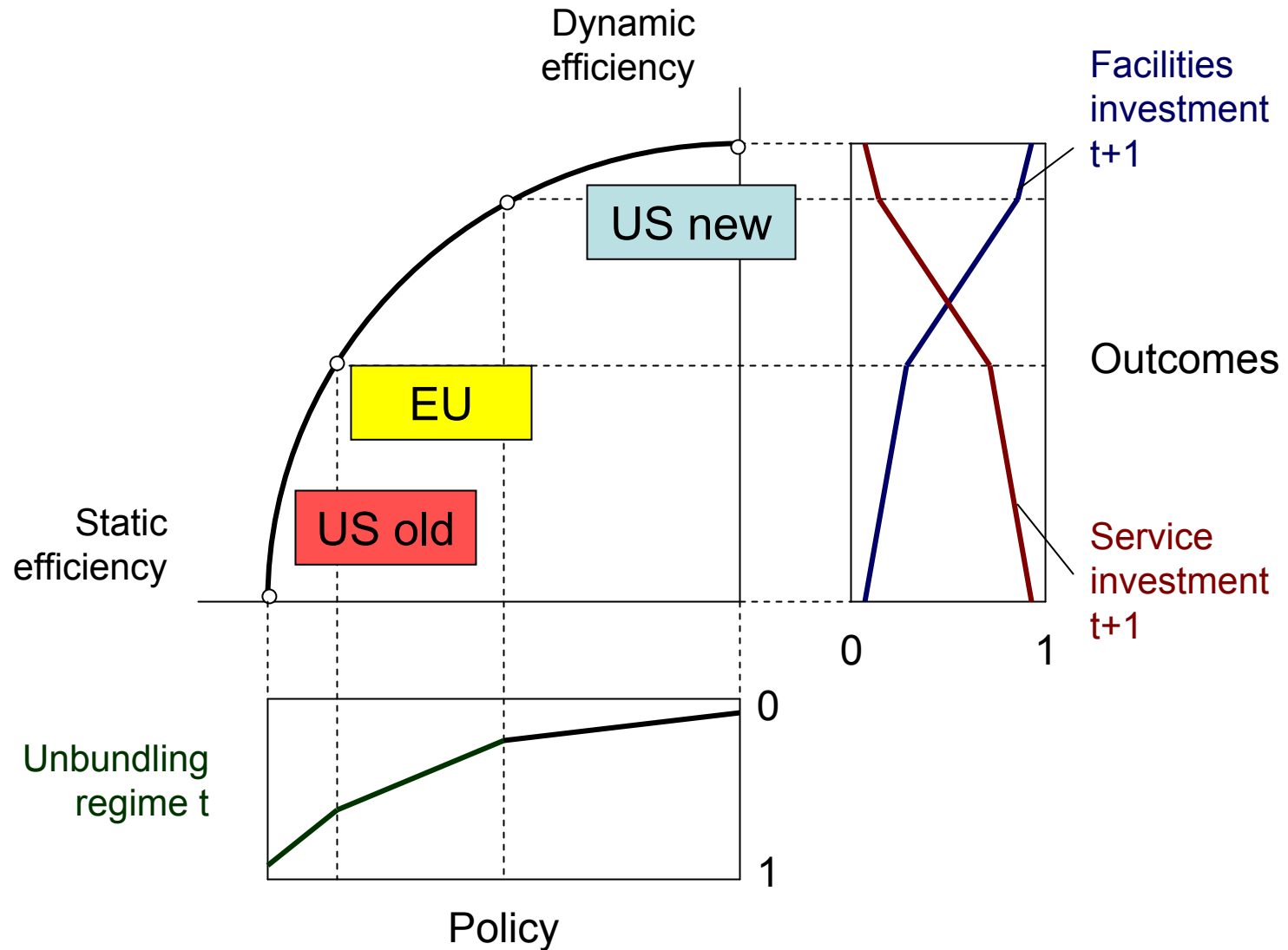


Source: FCC 2007

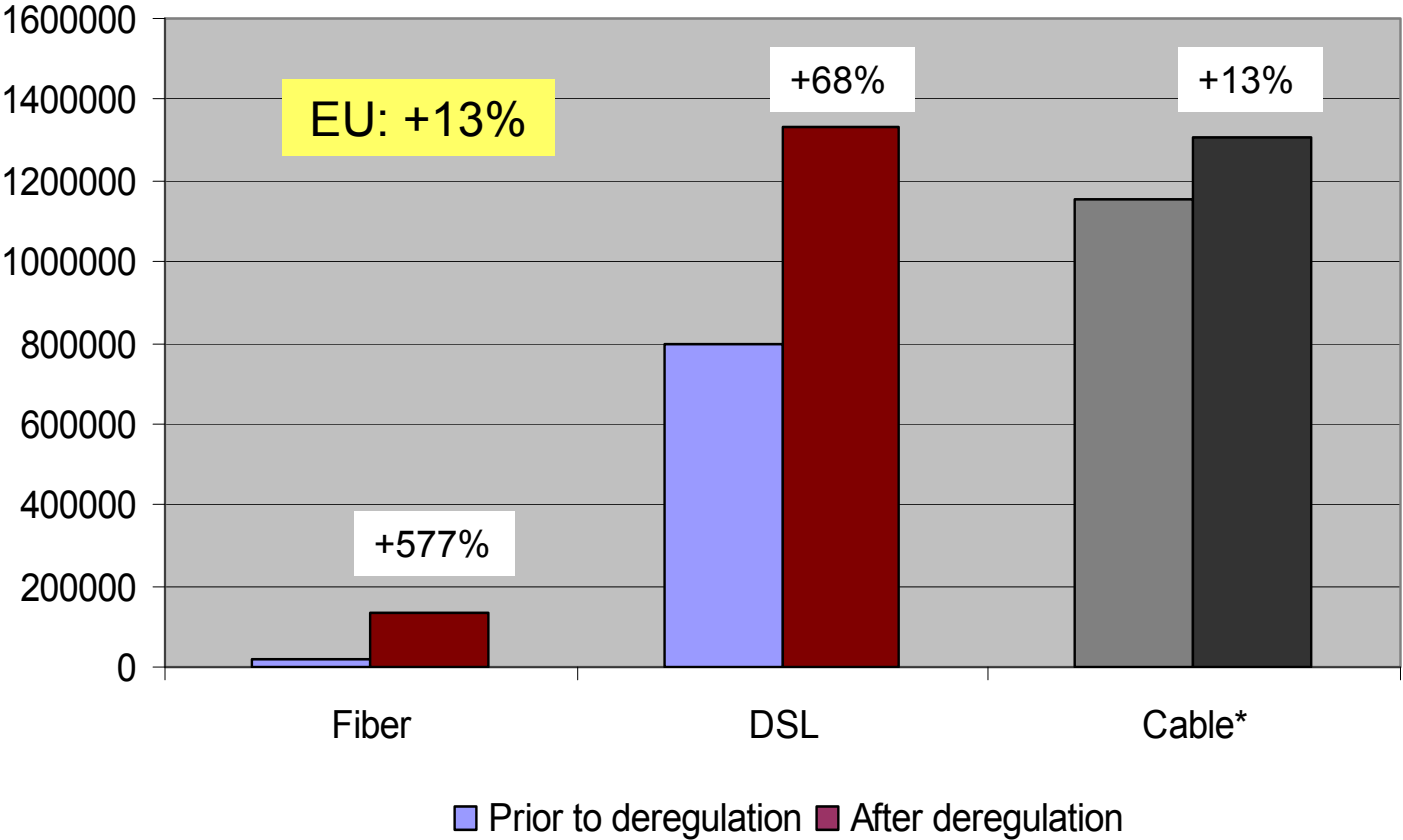
EU-US “natural experiment”

- EU
 - EC Green Paper 1987
 - Gradual liberalization (terminals, services, ..)
 - Periodic reviews
 - 1999 Review
 - 2003 Review
 - 2007 Review
 - Current EU proposal based on continued regulation of NGN
- U.S.
 - Liberalization starting in 1950s
 - AT&T Breakup (1984)
 - TC Act 1996 establishes competition as basic organization principle
 - Periodic reviews and court challenges
 - Since 2003 full deregulation of NGN access networks

U.S. vs. EU market design

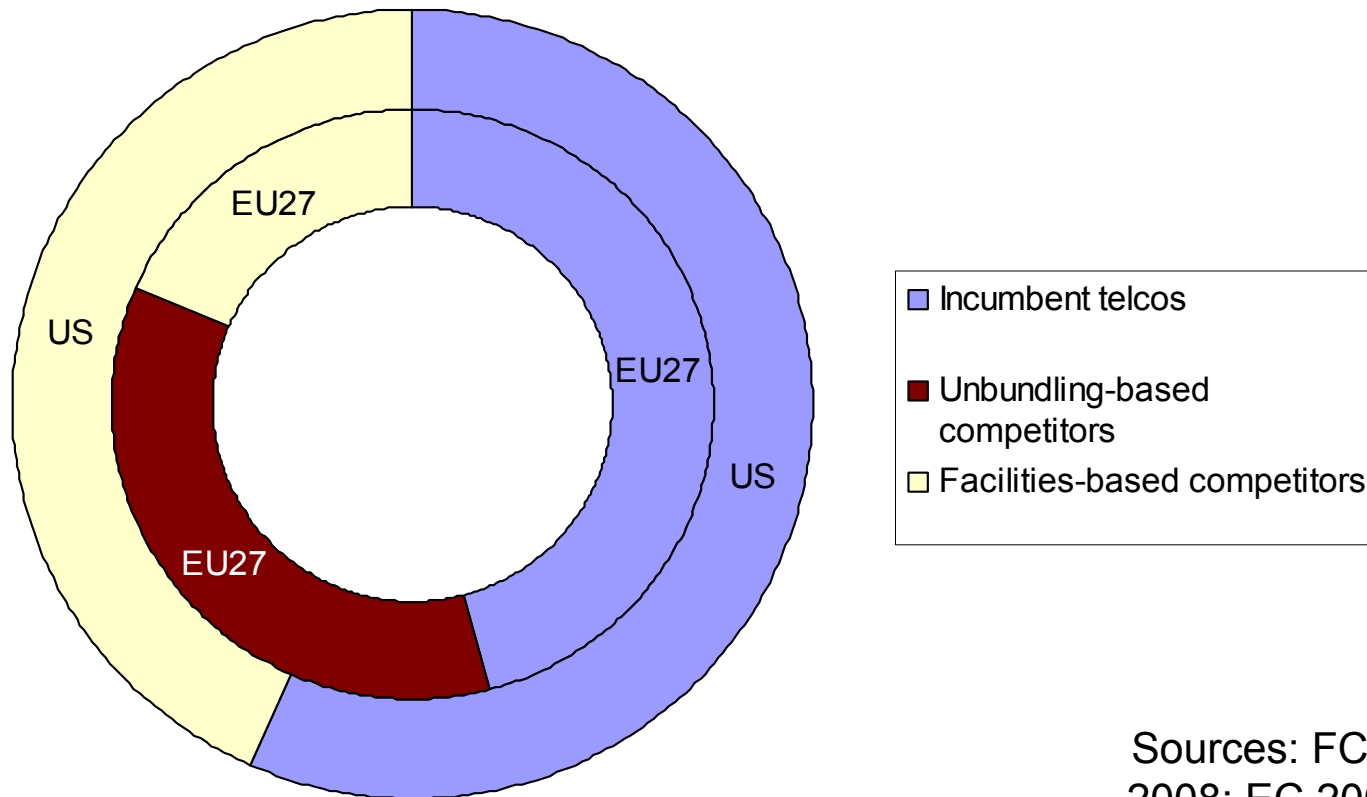


Deregulation and U.S. network investment (lines added per quarter)



Source: FCC 2008, own calculations

Mix of competition in broadband (Status July 1, 2007)



Sources: FCC,
2008; EC 2007

Network neutrality

Decoys vs. the real issue

- Distractions: net neutrality debate is about ...
 - preventing service and price differentiation
 - preventing network owners from charging content providers for (premium) service
 - mandating the roll-out of a dumb network
 - returning to old style, intrusive regulation
 - corporate welfare for dot-com billionaires
- Considerable “Astroturf Lobbying”
- Real issue: to what degree should network owners be allowed to differentiate platforms?

Arguments against neutrality

- Contributions from content and applications providers needed to recover investment cost
- Differentiated service/price tiers will
 - allow content and application service providers to configure higher-quality services
 - help manage congestion caused by bandwidth-intensive applications (e.g., BitTorrent)
- Differentiation is a precondition of innovation
- Net neutrality requirements will inevitably lead to intrusive and detailed, old style regulation

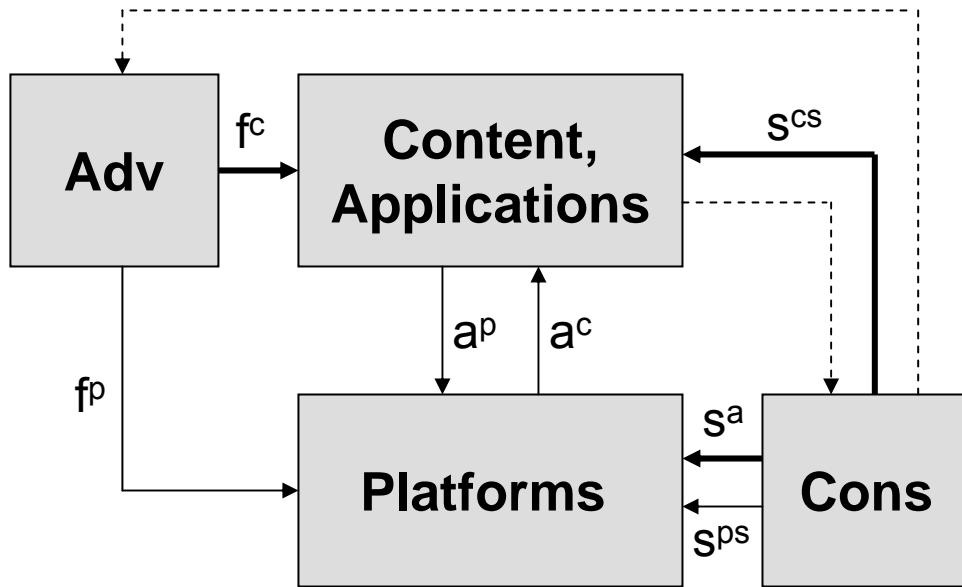
Arguments for neutrality

- Network layer discrimination slows innovation at the application/content layer and in the economy
- A non-neutral network could
 - lead to tipping in favor of inferior applications
 - lock in existing and delay migration to new usages
- Vertically integrated platform owners have incentives to disadvantage competitors
- Neutrality continues end-to-end design principles that have enabled the Internet
- Free speech and democracy require neutrality

Policy scenarios

- No specific openness requirements
 - P will cooperate with CA but attempt to appropriate innovation premium from CA layer
 - Via access, subscribers, or aggressive competition
 - Myopic P could negatively impact I^{CA}
- Non-discrimination rules
 - Reduce ability of P to appropriate innovation premium from P and CA
 - Reduces transaction, adaptation cost of CA
 - P likely to compete aggressively and/or sabotage CA
- Mandated openness and regulation

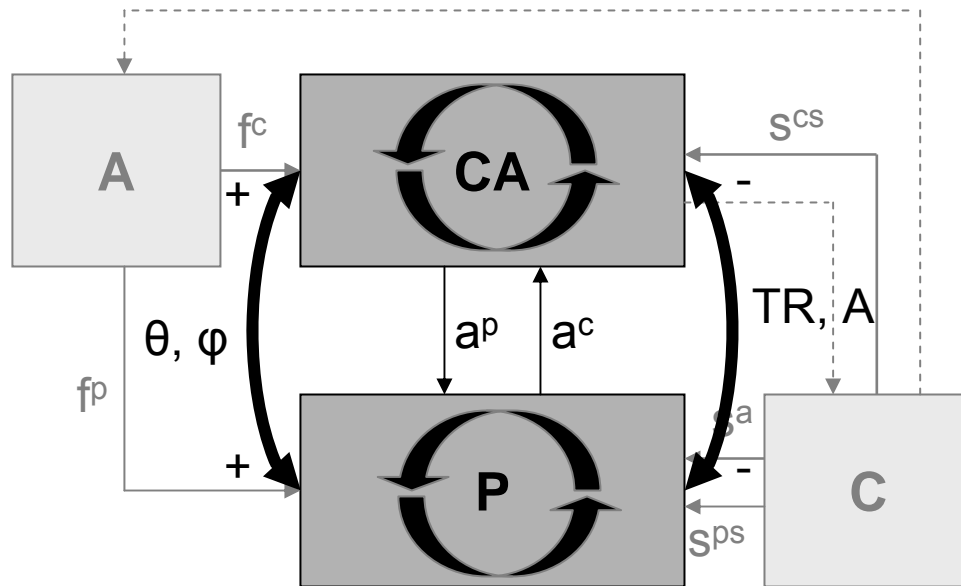
A stylized mobile value net



s^a ... subscriber access prices to P
 s^{ps} ... subscriber service price to P
 s^{cs} ... subscriber service price to C/A
 f^c, f^p ... advertising fees to C/A, P
 a^p, a^c .. platform/content access price

- P, CA, and Adv maximize π
- Cons maximize U
- Multiple, dynamic interdependencies
- Openness arrangements interact with this dynamic system

Innovation in complements



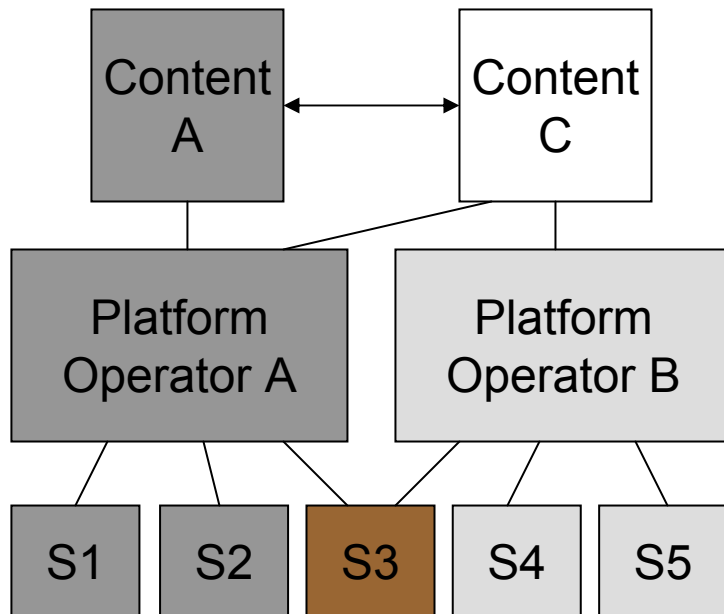
TR ...Transaction costs

A ... Adaptation costs

θ, φ ... Complementarity coefficients

- $|P, |CA$
 - Opportunities (+)
 - Appropriability
 - Concentration (+)
 - Contestability (-)
 - Firm capabilities (+)
- Interdependencies $P \rightarrow CA, CA \rightarrow P$
 - Complementarity (+)
 - Transaction costs (-)
 - Adaptation costs (-)
- Conditions (market organization, user preferences, and alternative options)

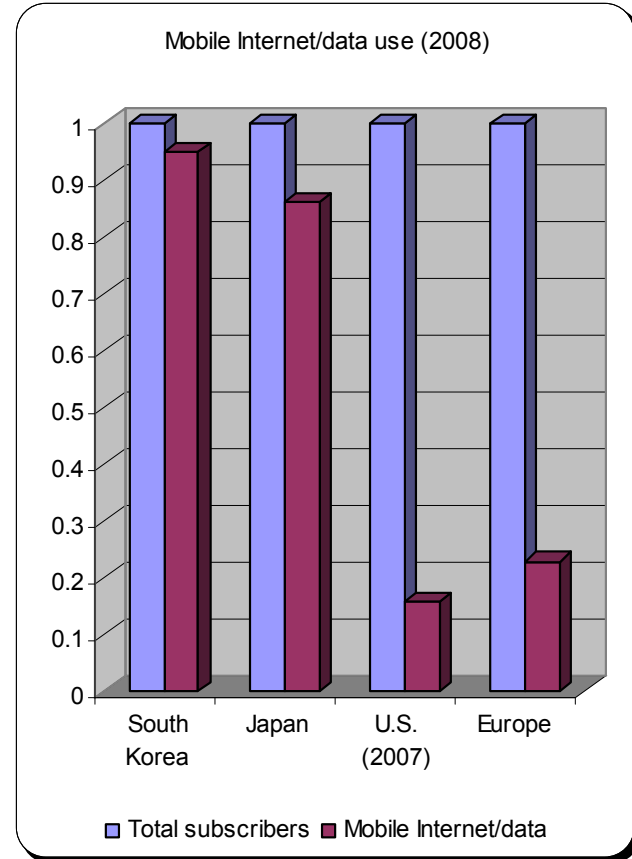
Innovation in substitutes



- Vertically integrated platform operators (A) have incentives to ...
 - ... discriminate against independent content providers (C)
 - ... compete fiercely against independent content providers (C)
- Strengths of incentives
- What is appropriate remedy: antitrust or mandated openness?

International mobile experience

- United States
 - Initial insistence on closed architectures
 - Very limited revenue sharing
 - Public policy and voluntary moves to more openness
- Europe
 - Pursued middle path
 - Standardization but no broadly mandated openness



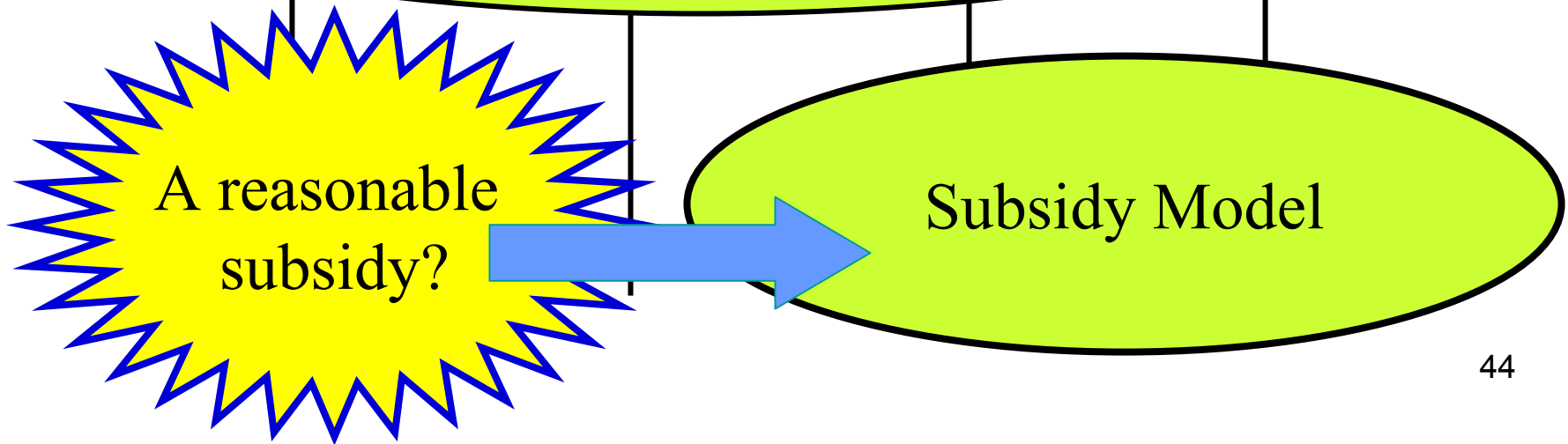
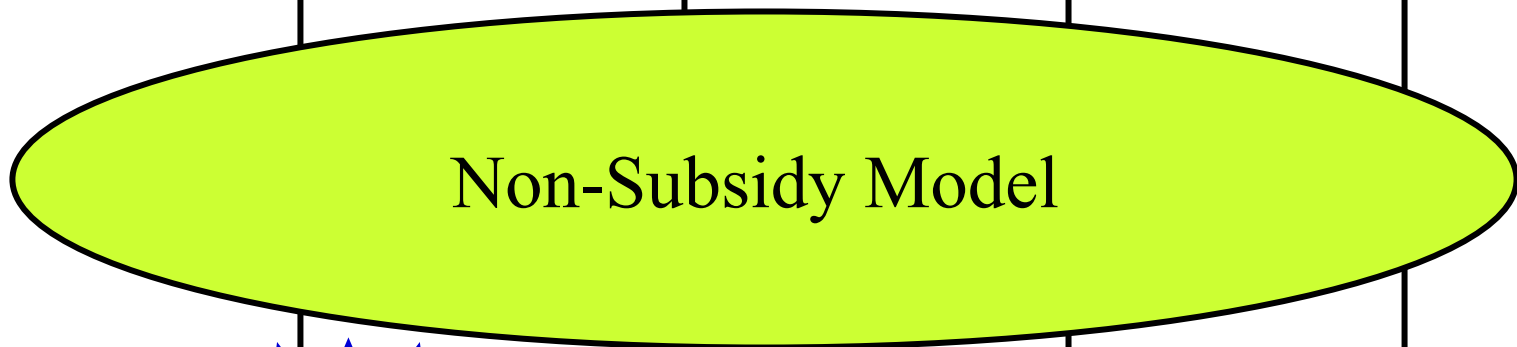
Sources: Carriers, CTIA, GSAM, 2008

Public sector involvement

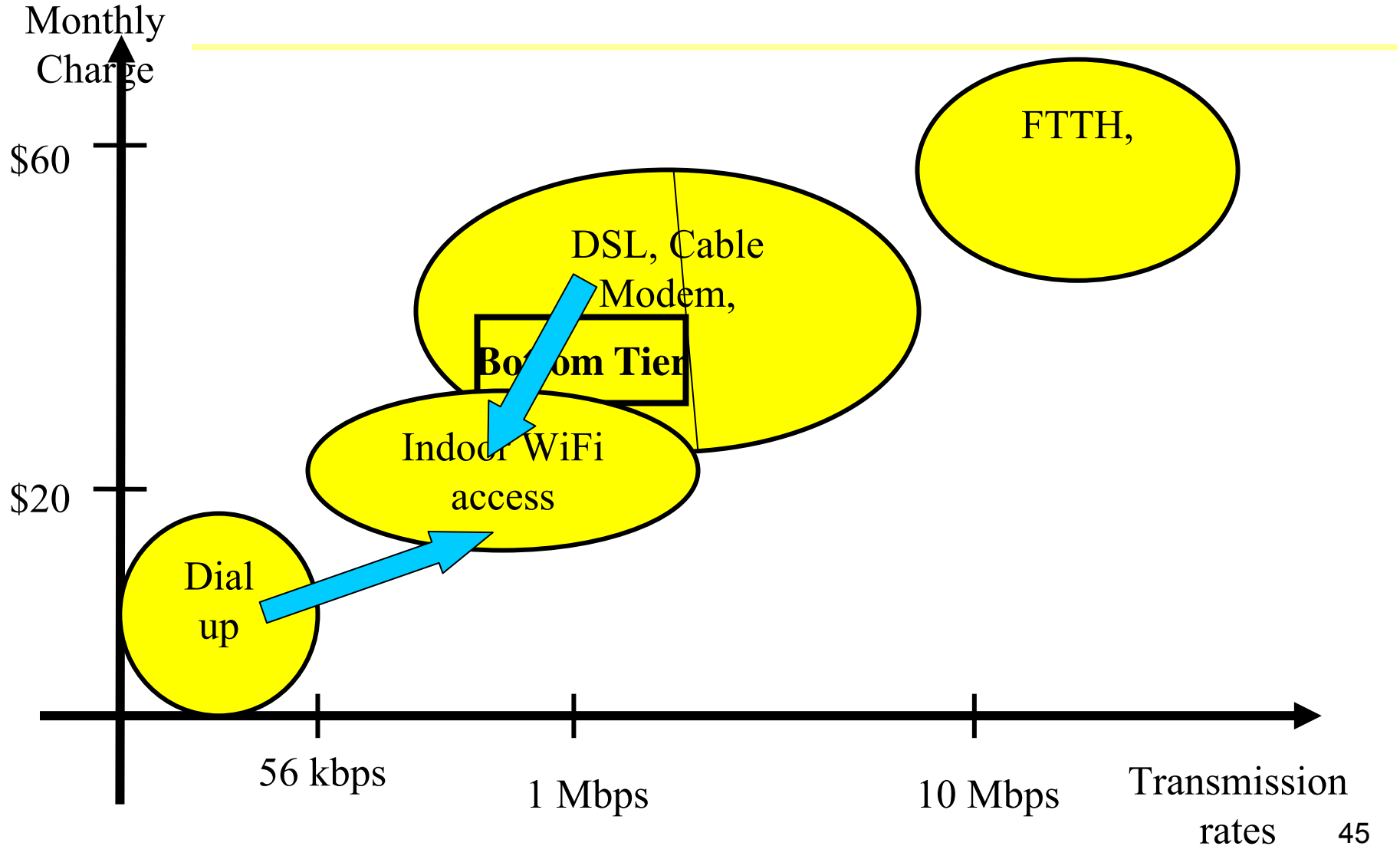
(from K. Huang, “Can Citywide Municipal WiFi be a Feasible Solution for Local Broadband Access in the US? An Empirical Evaluation of a Techno-economic Model”, Dissertation, University of Pittsburgh, 2008)

The Development of Citywide WiFi

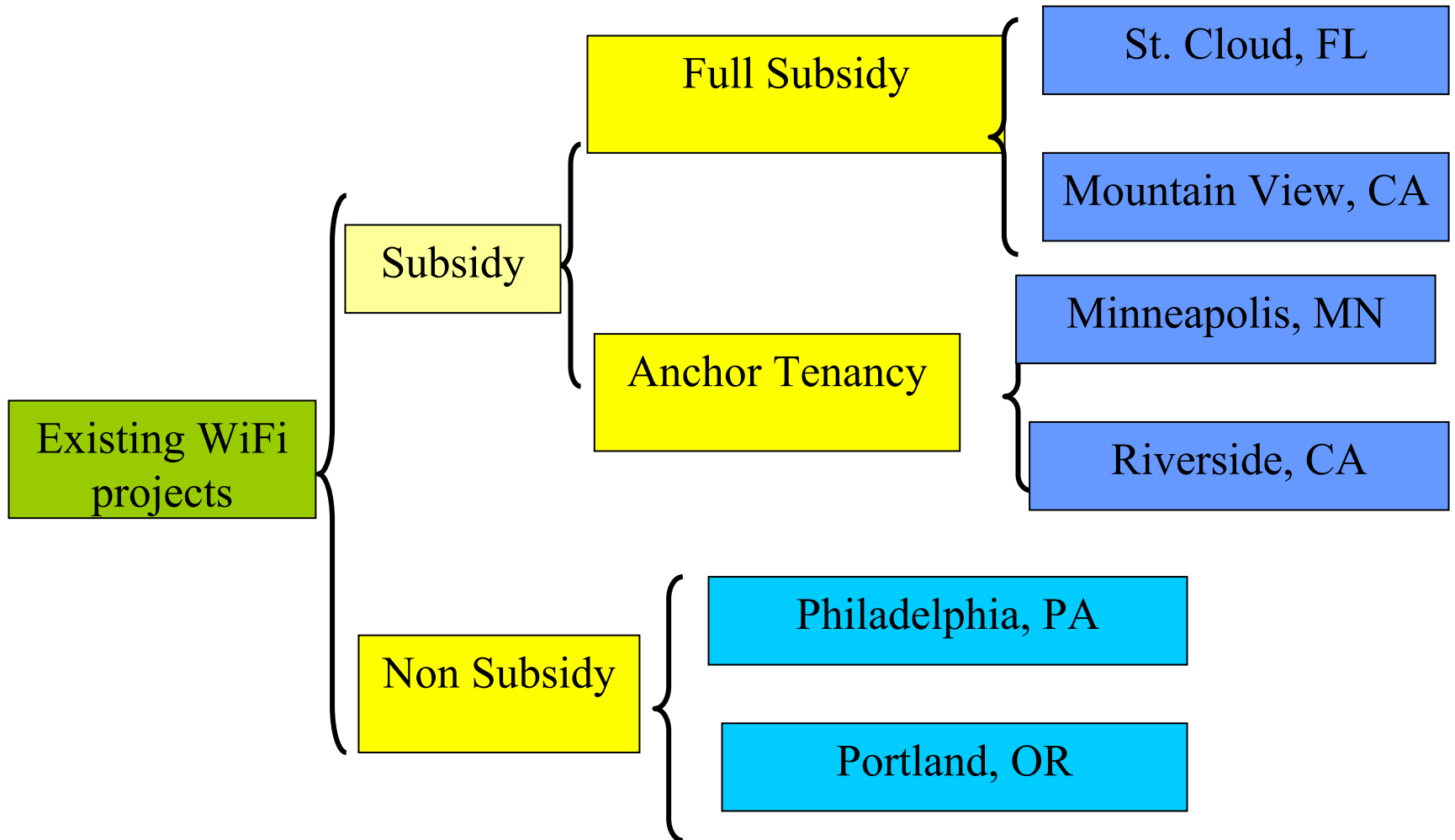
2004 Starting 58	2005 Booming 117	2006 Building 200	2007 Operation 300	2008 Reality
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Potential WiFi Public Access Subscribers



Classification of WiFi Projects



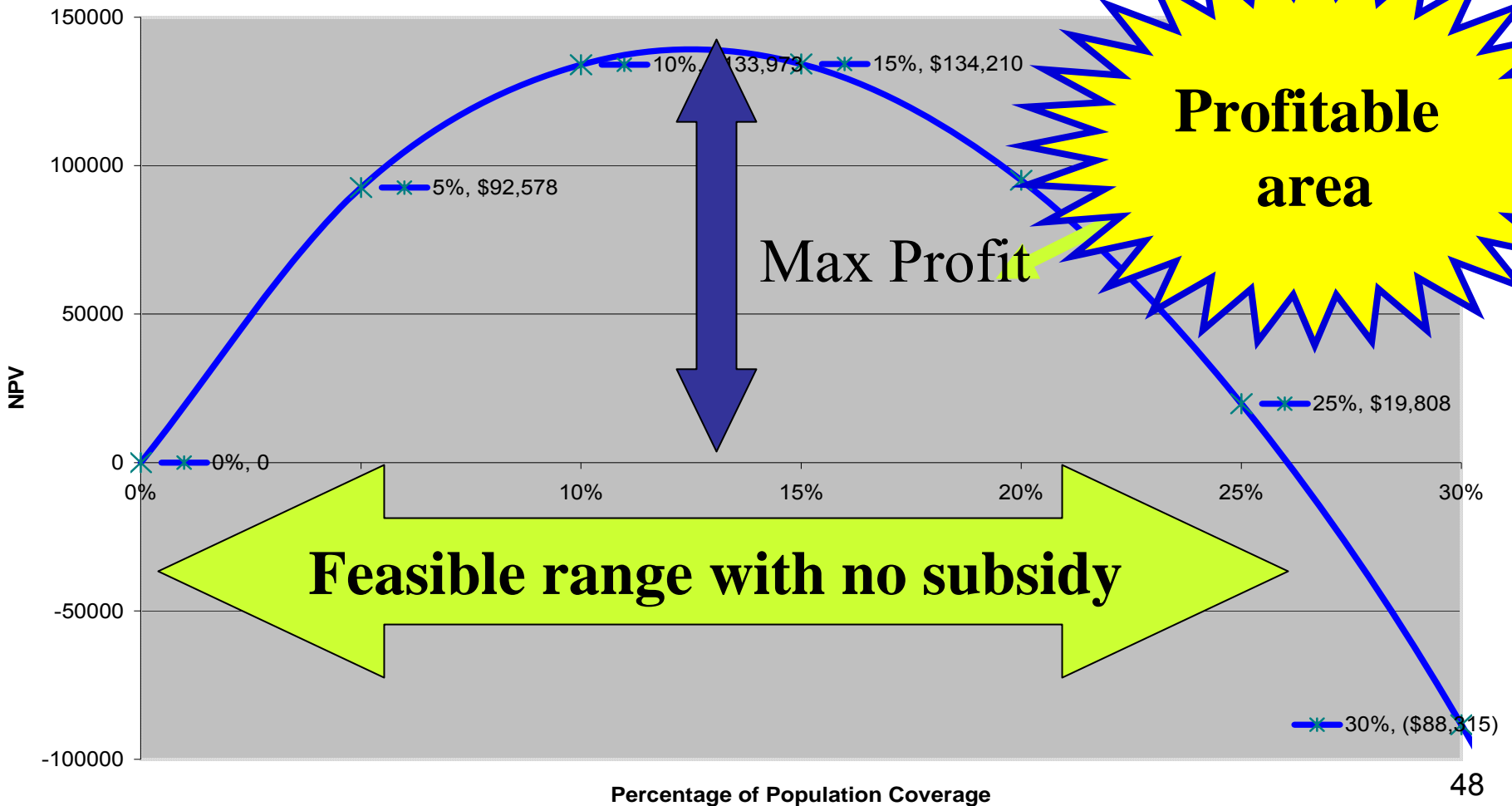
Key Features of WiFi Projects

Group	Municipality	Deployment Scale Square mile	Subsidy	Ownership	Free Service
1	St Cloud, FL	15	Full subsidy	Municipality	Yes
1	Mountain View, CA	11.5	Full subsidy	Google	Yes
2	Minneapolis, MN	54.8	Anchor tenant	USI Wireless	No
2	Riverside, CA	55/85	Anchor tenant	AT&T	Yes
3	Philadelphia, PA	134	No subsidy	Earthlink → NAC	No
3	Portland, OR	135	No subsidy	MetroFi	Yes with AD7

Minneapolis

Profit versus Population Coverage %

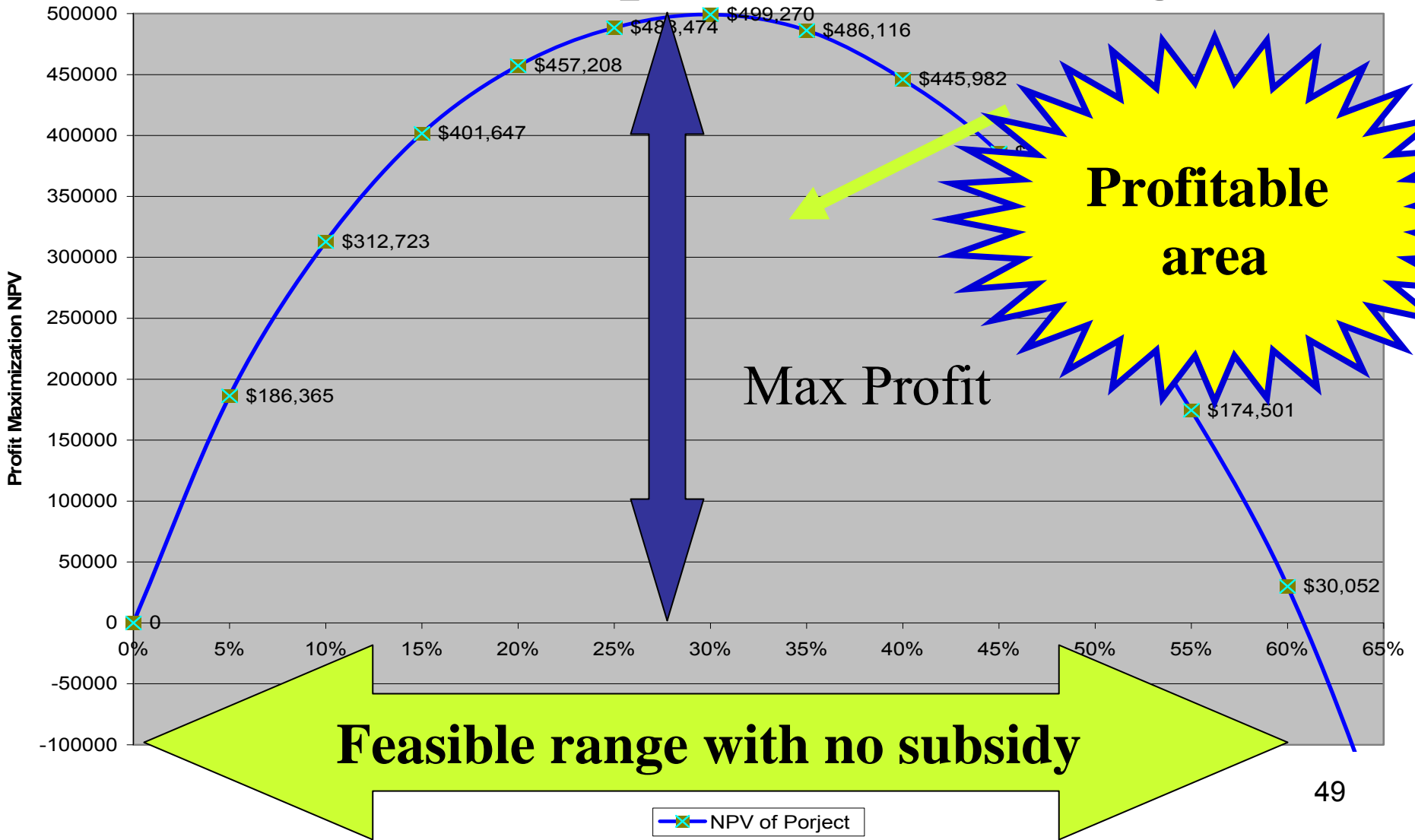
Profit Maximization



NPV with project data

Philadelphia

Profit versus Population Coverage %



What would the Next-
Generation Network Task
Force recommend?

Johannes M. Bauer

Professor, Department of Telecommunication,
Information Studies, and Media
Co-Director, Quello Center for Telecommunication
Management & Law
Michigan State University
East Lansing, MI 48824, USA
bauerj@msu.edu, +1.517.944.4154
<http://www.msu.edu/~bauerj>