Regulating in a Dynamic Industry Environment

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Main points

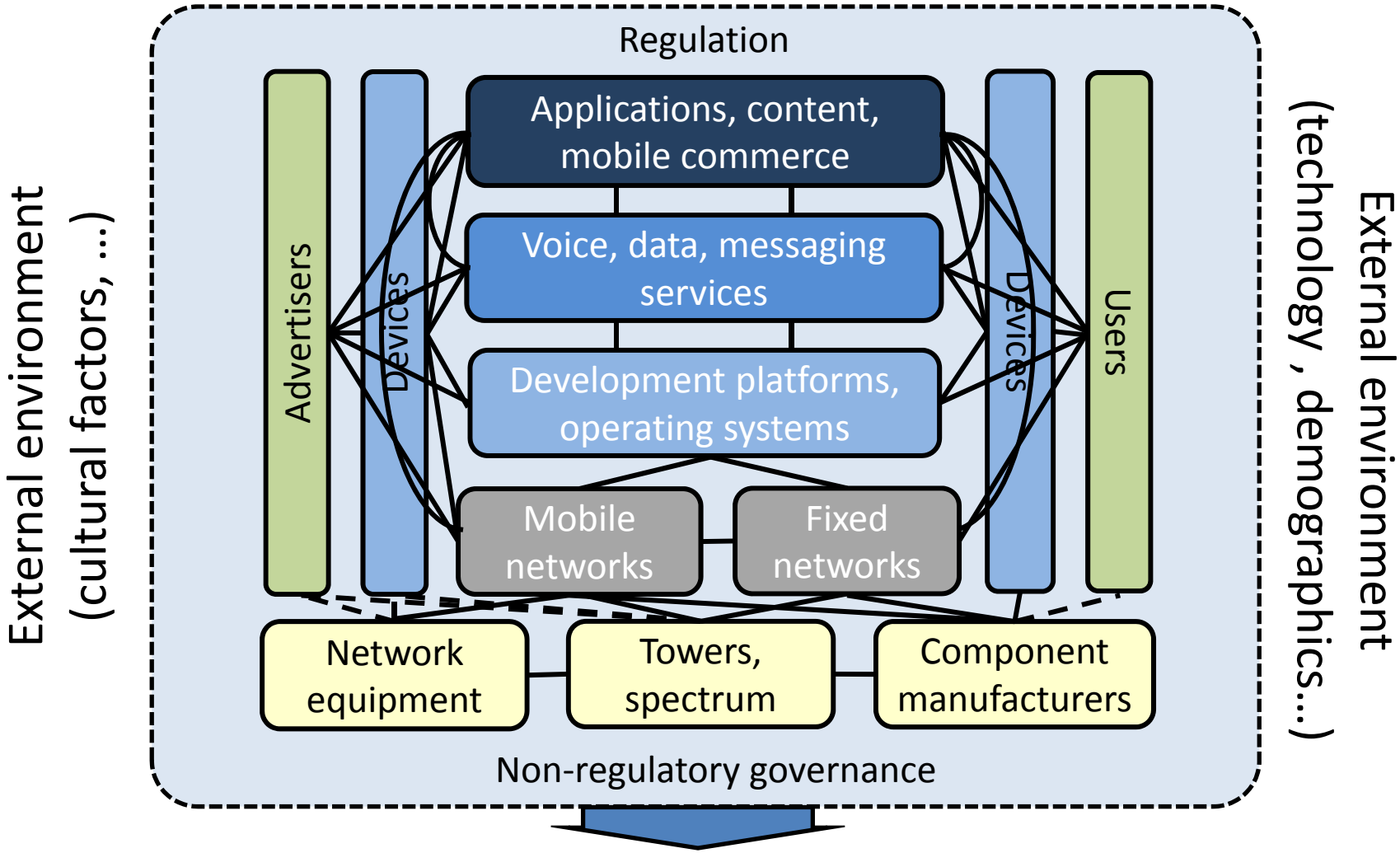
- Much of regulatory theory and practice continues to be rooted in static models of the economy
- In contrast, the communications sector is a dynamically evolving highly interrelated (eco)system of continuous change
- In this dynamic industry environment several stable policy approaches coexist alas with different performance characteristics
- Forward-looking infrastructure regulation needs to understand how it “tunes” the sector

Overview

- Regulation in a dynamic system
- A snapshot of national responses
- Regulation and infrastructure investment
- Regulation and innovation
- Implications for regulatory theory and practice
- Take away

Regulation in a dynamic system

The IP (eco)system



Performance (mobile broadband adoption, infrastructure quality, innovation rate, prices, overall economic and societal impact

Changing sector conditions

- Continued rapid technological and economic change
- Growing interdependence among players in proliferating two- and multi-sided market relations
- Plasticity of digital technology, contributing to accelerating innovation and intensifying competition
- High fixed/near-zero incremental cost technology necessitating pervasive price differentiation and leading to increasing market concentration
- Recognition of the importance of investment and innovation
- More realistic view about the prospects and limits of unregulated markets in realizing the benefits of ICT

Balancing multiple goals

- Multiple objectives of infrastructure regulation
  - Least-cost provision of infrastructure
  - Ubiquitous coverage at reasonable prices
  - Continuous infrastructure investment and upgrades
  - Infrastructure innovation (processes, services)
  - Innovation in complementary products and services
- Regulation affects the development trajectory
  - Recognition of trade-off between “static” and “dynamic” efficiency somewhat misleading
  - Regulatory choices determine the path of the system and the specific pattern of performance attributes
- Coherence between regulation and sector technology is critical (e.g., Finger et al. 2005)

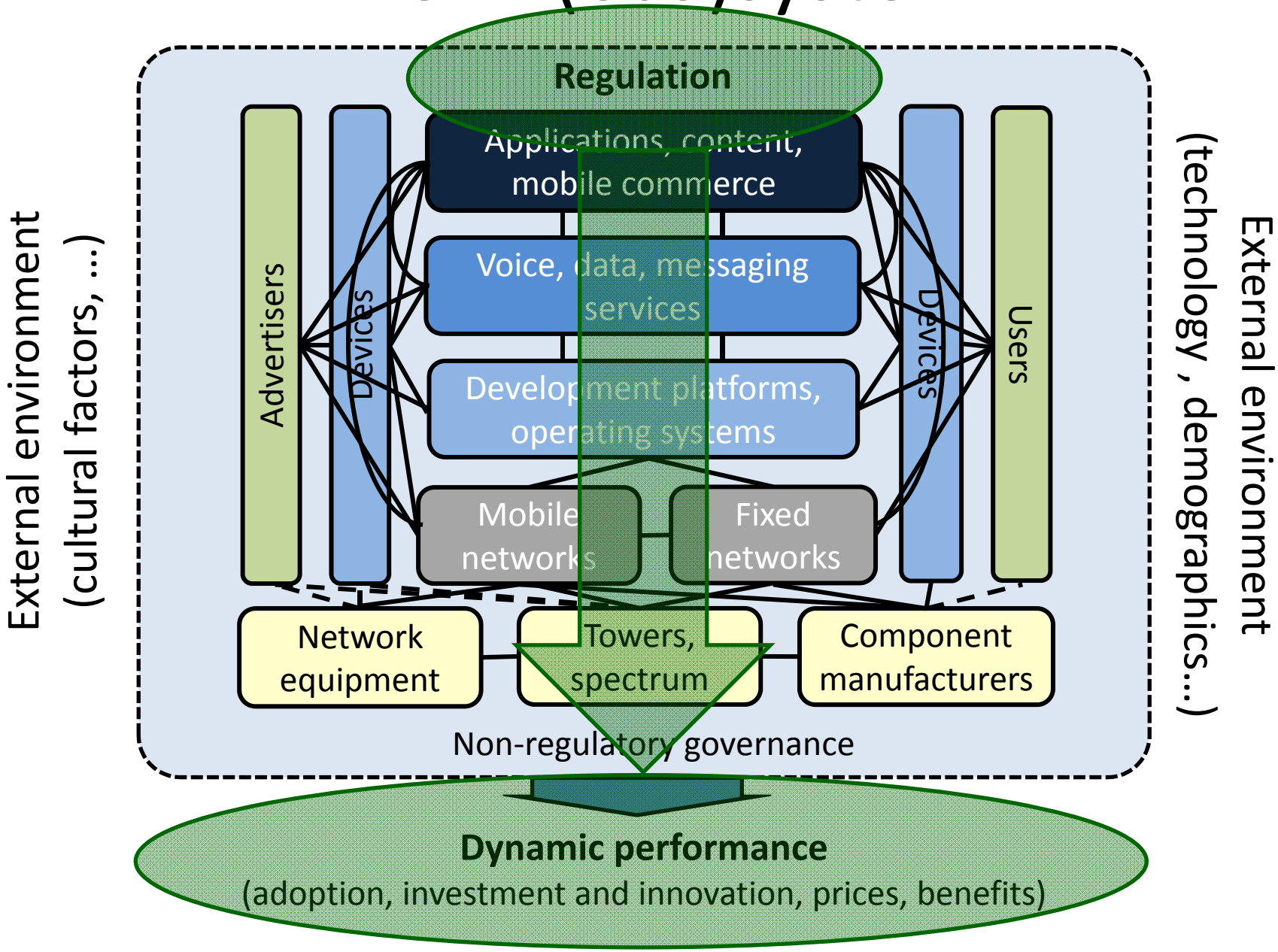
Need for new foundations

- Innovation was not neglected during earlier eras of regulation (monopoly, transition to competition, regulated competition)
- But standard regulatory model does not incorporate an explicit theory of innovation; it seeks to mimic competitive equilibrium (e.g., P=AC, P=LRIC)
- This has long been recognized (e.g., Schumpeter's critique of 1942) but is now urgent (Bauer, 1997)
- Developing dynamic foundations requires
  - Clear understanding of the forms of performance deficiency that can be improved by regulation
  - A comprehensive understanding of the effects of interventions on the performance of the sector

Possible deficiencies

- Market power and dominance
  - Bottlenecks in the system (e.g., local access)
  - Horizontal market concentration
  - Vertical integration across layers of some players
- Coordination requirements (public goods)
  - Numbering (e.g., Domain Names)
  - Interoperability (e.g., standards, roaming)
- Externalities and spill-over effects
  - Overall innovation dynamics of the system
  - Economic effects on communities
  - Instability and volatility of the sector (e.g., security, reliability of equipment supply)
  - Quality of infrastructure platforms

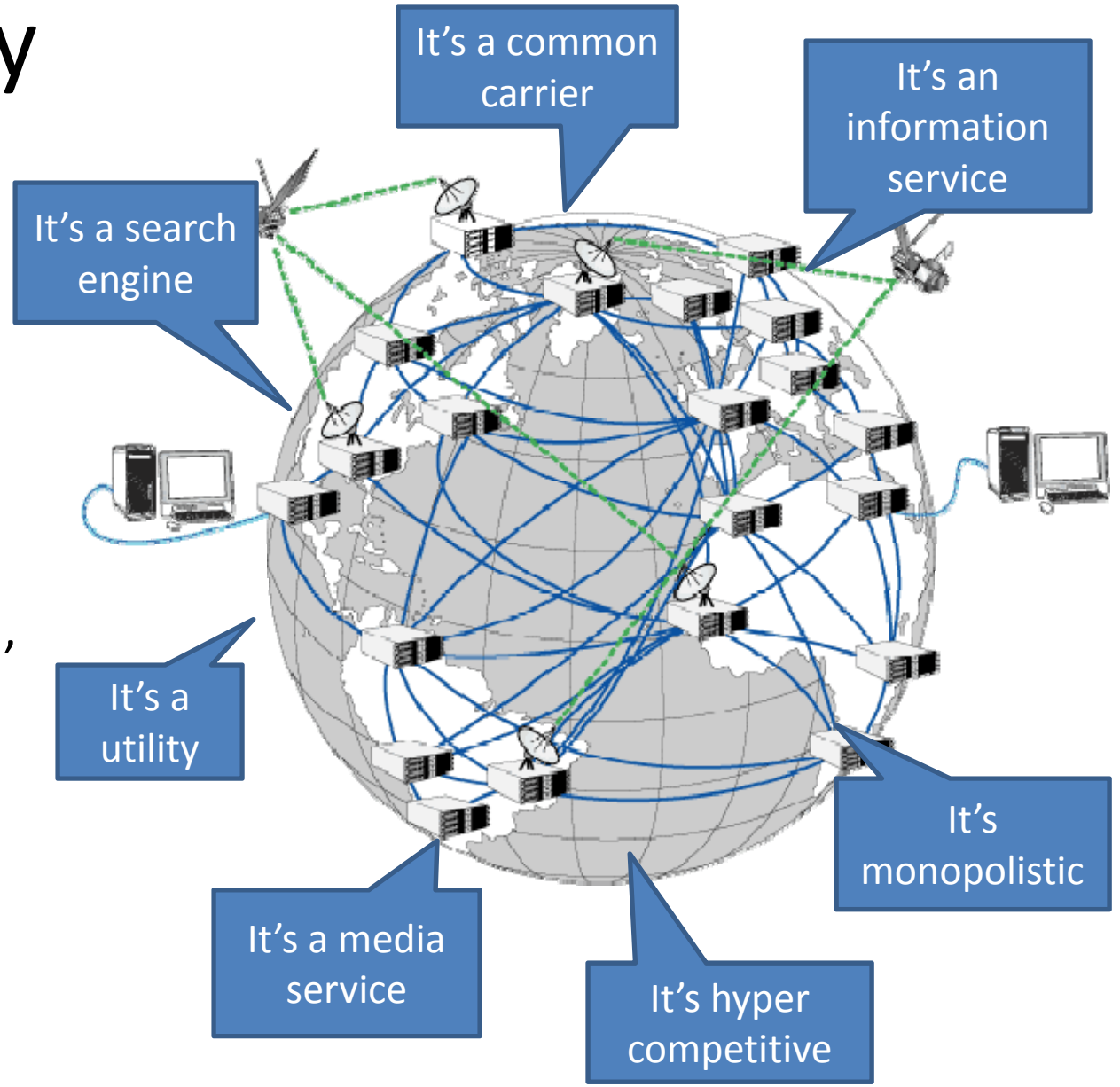
The IP (eco)system



A snapshot of national responses

Complexity

"Innovative uses of that copper pair (e.g., DSL) and advanced technologies such as hybrid fiber-coax (HFC), fiber and wireless, have led to definitional confusion, litigation and a dauntingly complex poorly understood networked ecosystem" (Claffy & Clark, 2013, p. 1)



United States

- Very large high-income nation with low population density (89 per square mile)
- Bold move toward market-based framework since early 2000s
- Large number of private service providers but local market concentration (78% of households served by 3 or more fixed providers, 21% by two, 1 % by only one)
- LLU and civil infrastructure unbundling, but no broadband or NGN unbundling

Switzerland

- Small high-income nation with high population density (490 per square mile) and challenging topology
- Main player Swisscom 57% owned by confederation; high market shares (70% fixed broadband, 60% mobile)
- Modest unbundling requirements, not including NGANs
- Partnerships between PTO, utilities, and municipalities to reduce civil engineering costs of network upgrades

United Kingdom

- Large high income country with high population density (650 per square mile)
- Pioneer of privatization and liberalization
- Since 2006 BT's local access network managed by Openreach on a non-discriminatory basis
- Unbundling applies to existing network and NGNA (virtual, fiber unbundling)
- £2.5 billion to deploy fiber to 2/3 of households by 2014, £850 of subsidies to connect rural areas

France

- Large high-income country with medium population density (289 per square mile)
- Orange 27% state-owned
- Stringent unbundling policy, encompassing
  - Asymmetric regulation of existing infrastructure (e.g., local loops, sub-loops, bitstream access, civil engineering infrastructure)
  - Symmetric regulation planned for newly developed FttH networks
- Public initiative networks (PINs) and digital regional development blueprints (SDTANs) complement private initiative

National performance patterns

	US	Switzerland	UK	France
Fixed BB/100	29.8	44.9	35.2	36.7
Mobile BB/100	100.7	64.2	77.2	55.9
Fiber/100	2.4	3.4	3.7	0.8
Investment per access path (US$)	137.1	161.4	62.6	106.2
Price level	Medium	Medium	Low	Low
Peak download speed (mbps)	41	44	42.1	26
Average download speed (mbps)	11.1	12.7	9.3	6.6
Global Innovation Index (GII) 2014 rank	6	1	2	22
GII 2014 online creativity rank	15	8	4	18

Legend: ■ top 10; □ 10-20; ■ >20

Sources: OECD (2014); Akamai (2014), WIPO (2014)

Recap

- After decades of regulatory convergence, national approaches are again diverging
- Differences between models are in part an outcome of the national politics of regulation
- They also indicate that no self-evident “best practice” approach exists in a dynamic setting
- A comparison reveals that no single model scores high on all performance dimensions
- However, strengths and weaknesses can be explained coherently from a systems perspective

Regulation and infrastructure investment

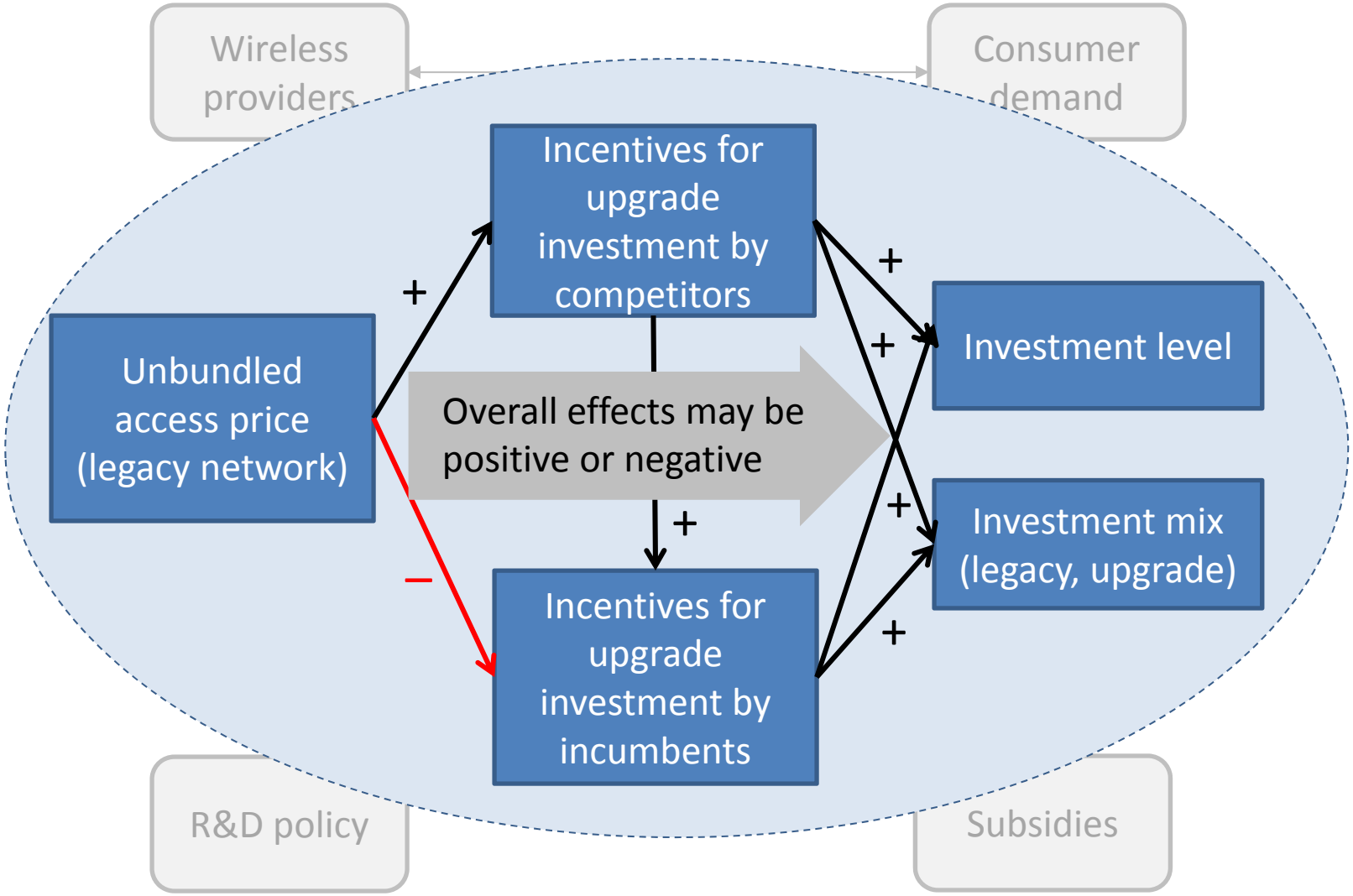
Forms of access regulation

- Access to bottleneck facilities
  - Local loops (LLU)
  - Civil engineering infrastructure
  - Broadband platforms (e.g., bitstream access)
- Access to wholesale network infrastructure
  - Privately-owned wholesale network needs incentives to internalize spill-over effects
  - Publicly-owned network could principally internalize such effects (but few actual examples)
- Interconnection, interoperability are generic and symmetric forms of access regulation
- Vertical access regulation (“net neutrality”)

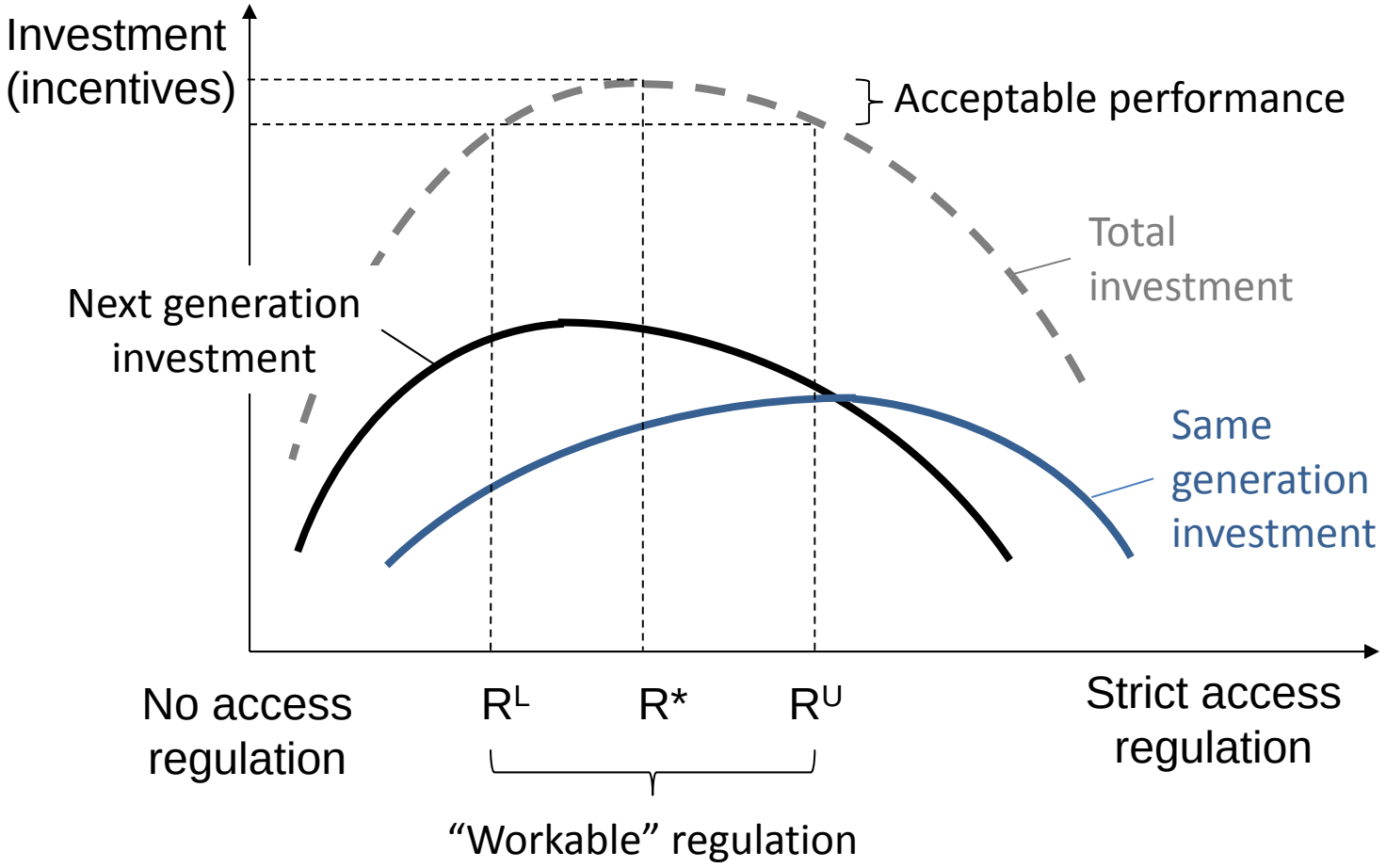
Experience with access regulation

- Different national approaches
  - Unbundling (ladder of investment, reverse LoI, forbearance)
  - Geographically differentiated regulation (e.g., Austria)
  - Vertical separation (e.g., UK, Italy, Australia)
- Pattern of empirical findings
  - LoI works from resale to LLU but does not stimulate network facilities-based competition (e.g., Bourreau et al. 2010, Bouckaert et al. 2010)
  - Stringency of unbundling stimulates complementary investment by new entrants but depresses investment by incumbents (Grajek & Röller, 2012)
  - Stringency of unbundling stimulates the diffusion of broadband within one generation (e.g., Distaso et al., 2008)
  - Stringency of unbundling retards the transition to more advanced generations of broadband (e.g., Briglauer et al. 2013)

Network investment



Keeping the system within acceptable performance



Lessons

- Another look at the four countries
  - Low level of US intervention positions it near the lower bound of high-performance zone
  - Strict French regulation positions it above the upper bound of the high-performance zone
  - UK and Switzerland have adopted more balanced policy combinations; strong role of public player can internalize spill-overs and public good effects of infrastructure investment
- Lessons for regulation
  - Need to take direct and indirect effects into account when defining access policy and prices
  - Access prices are powerful instrument to keep system within high-performance zone
  - Separate access frameworks for existing and next-generation networks are likely unstable with ambiguous effects on investment

Recap

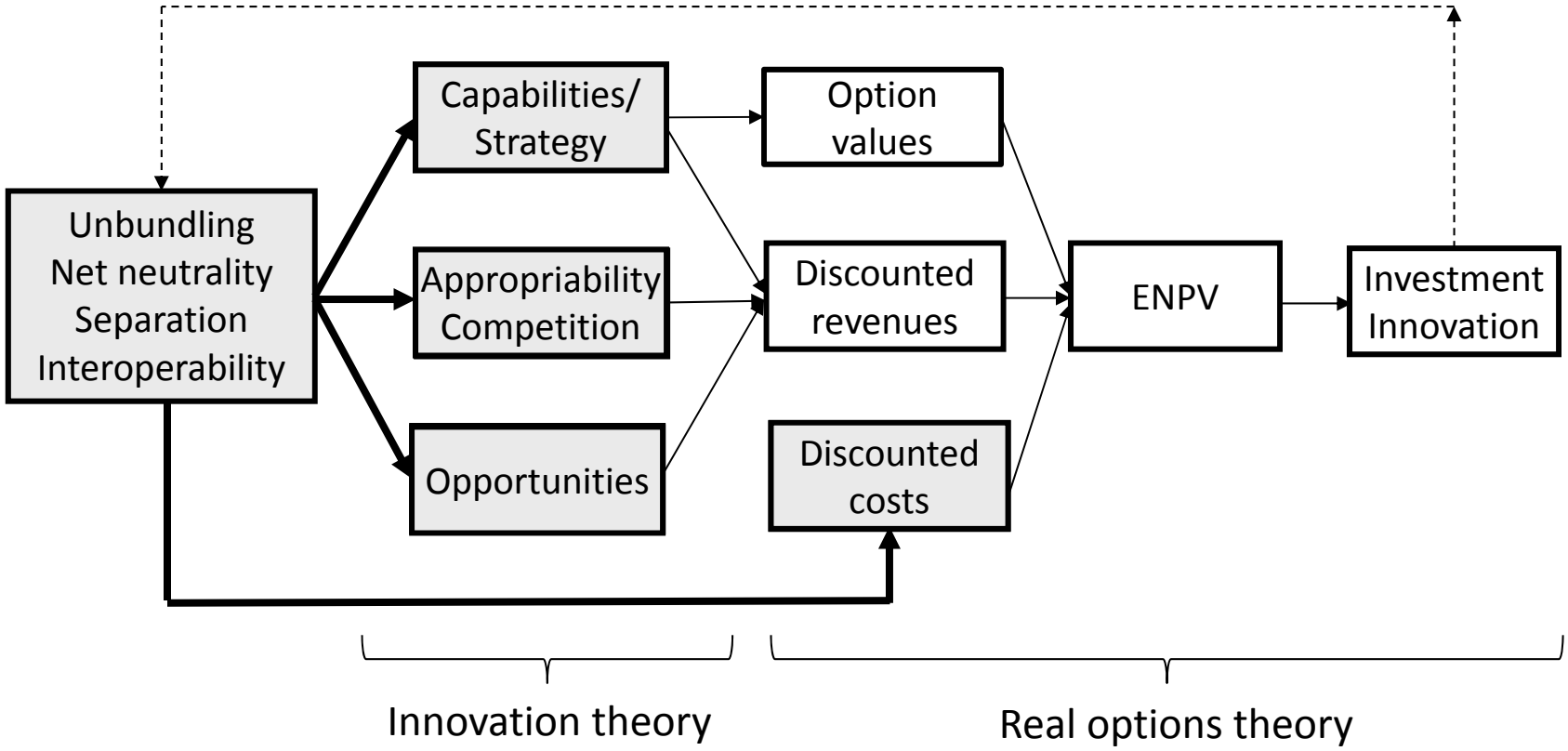
- Access regulation has repercussions for the entire network of interrelated competitors
- Traditional tools of regulation, focusing narrowly on addressing bottlenecks, risk sending the wrong signal to market players
- If indirect effects are non-negligible, they need to be taken into account
- Failure to do so may counteract well-intended goals and reduce performance overall

Regulation and innovation

Innovation in the ICT system

- Innovation is the implementation of a new
  - Production process (e.g., digital networks, LTE)
  - Product or service (e.g., broadband Internet access, WhatsApp)
  - Marketing method (e.g., self-selection pricing)
  - Organizational method (e.g., unbundling)
  - Design, “soft” innovation (e.g., look and feel)
- Multiple, intertwined processes of innovation
  - Network infrastructure (e.g., speed)
  - Logical platforms (e.g., iOS, Android, …)
  - Applications and services (e.g., HD video, MMORPGs)
  - Enable, shape and constrain each other
- Investment and innovation are closely related

Single firm innovation decision



Effects on the innovation system*

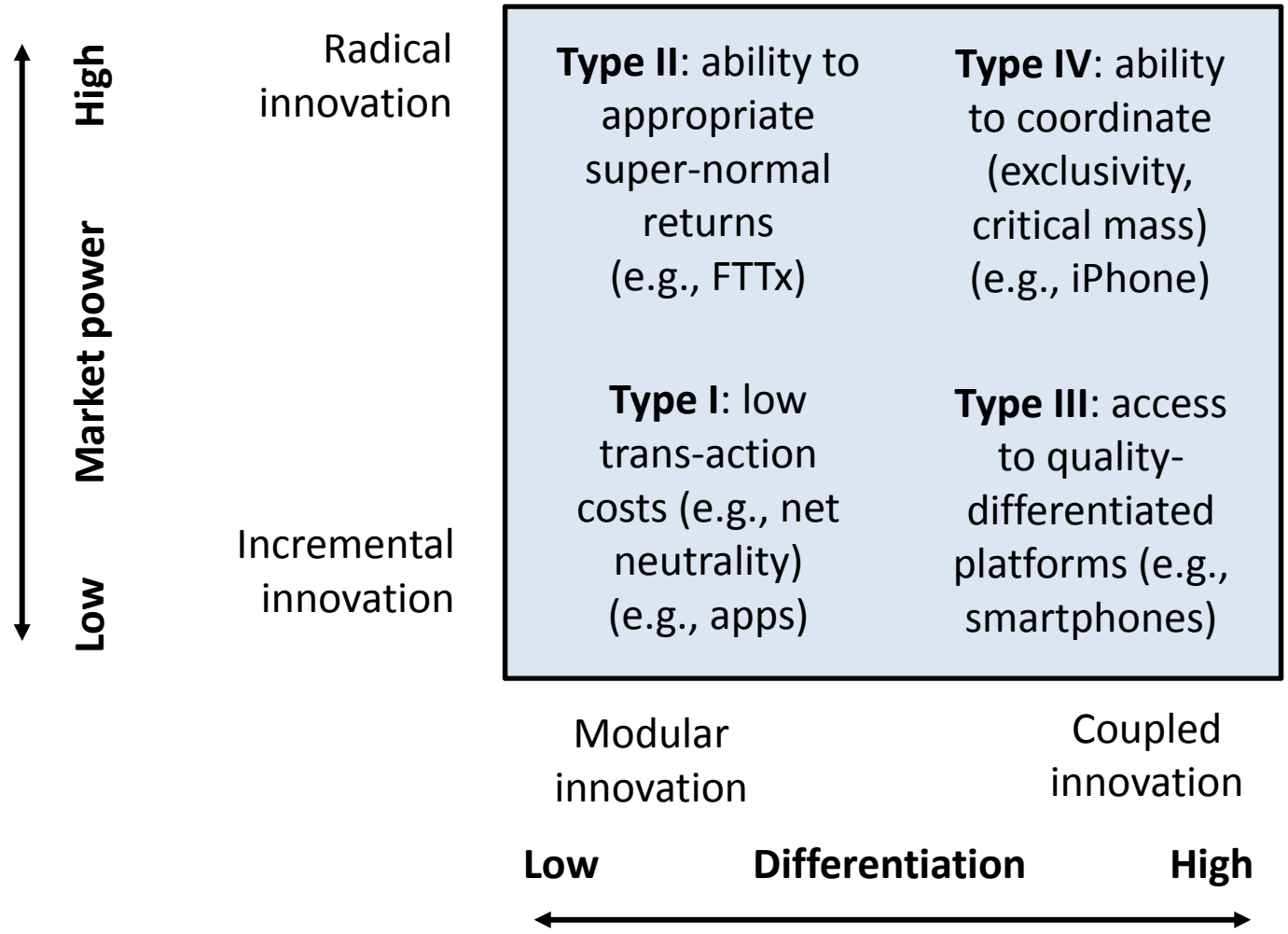
	Platforms			Content, applications	
	Incumbent	Service entrant	Facilities entrant	Complement	Substitute
Horizontal regulation					
Stringency of unbundling	–	+	–	+	+
Vertical regulation					
Stringency of non-discrimination	–	+	–	+/–	+
Lower transaction costs	+	+	+	+	+
Other policy					
Investment tax credit	+	+	+	+	+
Subsidies	+	+	+	+	+
State ownership	–/+	+	–	+	–

* *Ceteris paribus* (all other things being equal) first-round effects, see Bauer (2010, 2014) for more details

Types of innovations

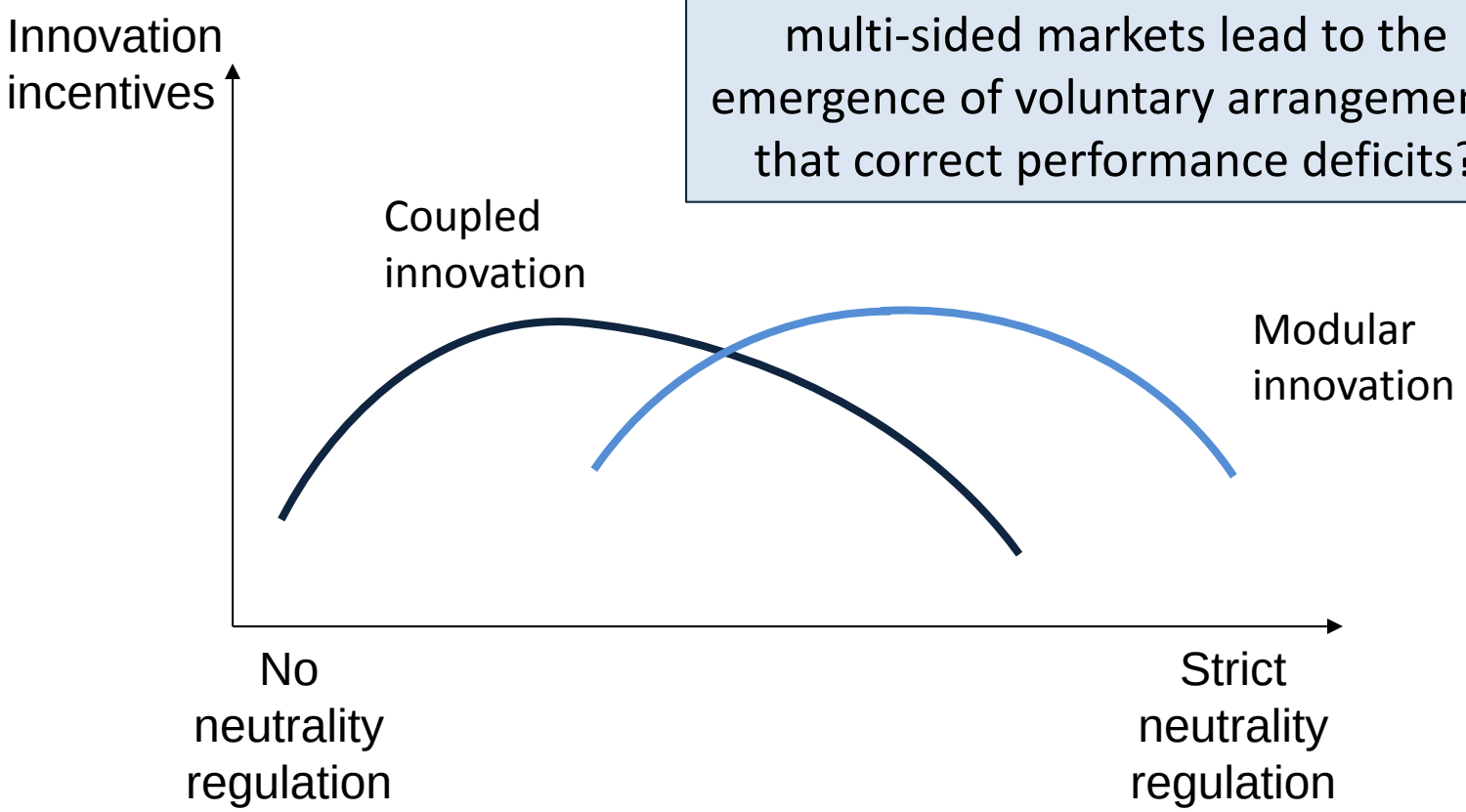
- Innovation types well known in IO research (e.g., Malerba and Orsenigo, 1996; Aghion et al., 2005)
- Coordination among players
  - Modular innovations (e.g., apps): coordination can effectively be achieved via interface (e.g., APIs)
  - Coupled innovations (e.g., mobile Internet) require cooperation beyond definition of an interface (e.g., security, synchronization of many players)
- Magnitude and riskiness
  - Incremental innovations (affecting limited attributes of a product or service)
  - Radical innovations (change many attributes or alter them in more extensive ways)

Varying enabling conditions



Network neutrality and innovation

Will repeated player interactions in multi-sided markets lead to the emergence of voluntary arrangements that correct performance deficits?



Lessons

- Another look at the four countries
  - High quality of ICT infrastructure in the US, Switzerland, and UK associated with high GII rank
  - US leader in coupled types of Internet innovation
  - More open ICT infrastructures in Switzerland and UK also conducive to high Internet creativity
- Implications for regulation
  - Because of the interrelated nature of innovation in multi-sided markets, the ICT system will endogenously “heal” temporary problems
  - Ex post regulation within a pre-specified enforcement framework can when such self-healing does not take place
  - Only strong evidence of spillover and other public good effects of ICT innovation warrants ex ante regulation

Recap

- Several types of innovation processes (modular, coupled) coexist in the ICT ecosystem
- Innovations at the level of physical networks, logical platforms, and content and applications mutually enable and constrain each other
- Regulation (deliberately or inadvertently) affects the outcomes of this system
- “Workable” regulation will try to keep the system within an acceptable performance range

Take away

Implications for regulatory theory

- Reassessing market failure
  - In the ICT ecosystem, traditional notions of market failure need to be reexamined
  - Because of the prevalence of multi-sided markets, some forms may self-heal and not require intervention
  - However, new forms of systemic failures (e.g., spillovers, public goods) may become more relevant
- Choice of appropriate modeling approach
  - Most of current regulatory theory is based on static equilibrium models (that is a special case)
  - Not necessarily wrong but whether it is an acceptable approximation needs to be carefully examines
  - If this is not the case, a more general dynamic framework needs to be employed

Implications for regulatory practice

- Employment of new methods
  - Systematically consider the direct and indirect repercussions of regulatory intervention
  - Explicitly explore the full range of possible consequences (including initially unexpected effects)
  - Computational techniques (e.g., numerical simulation, agent-based modeling, system dynamic simulation)
- Take actual and potential costs of regulation into consideration
  - Need to go beyond assumptions of omniscient, omnipotent and benevolent policy makers
  - Not every performance deficiency can be improved by regulatory intervention

Adaptive regulation

- A dynamic view of regulation places renewed emphasis on the “constitution” of ICT markets
- De-emphasizes ex ante and discretionary intervention except in very exceptional cases
- Suggests stronger reliance on ex post regulation within predefined performance objectives
- Requires consistent monitoring, possibly using data harvested by the infrastructure itself
- Regulation is an important tool to improve performance in dynamic industry environments
- However, it needs to be adaptive and based on a dynamic understanding of the system to be regulated

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