

***Lectures on
Regulatory Problems in Network Industries***

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Lecture No. 2:

***Regulation and Infrastructure Investment:
The Case of Broadband***

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Review Lecture 1

Monopoly


- **Welfare-maximizing prices**

Vertical separation from competitive stages

Theory of incentive regulation

- **Bayesian vs. non-Bayesian mechanisms**
- **Subsidy mechanisms vs. price caps**

Overview

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- **Introduction: Broadband and Regulation**
 - **Infrastructure Investment and Competition**
 - **Regulation and Infrastructure Investments**
 - **Evaluation and Conclusions**

What is Broadband?

- **High-capacity access to telecommunications networks/Internet (>250 kbps)**
- **DSL**
 - Uses high-frequency portion of traditional copper access lines (ADSL)
 - Requires not too long lines, network upgrades and splitters (at main distribution frame)
 - Dominant in most countries outside US
- **Cable modem**
 - Uses coaxial cable
 - Cable network usually not built for two-way communications (exception: UK Siamese cable)
 - Requires substantive network upgrades and network capacity
 - Limited by cable penetration
- **Relationship between penetration and cable market share follows inverted 'U'**
- **Other technologies emerging: Wireless, power lines and FttH**

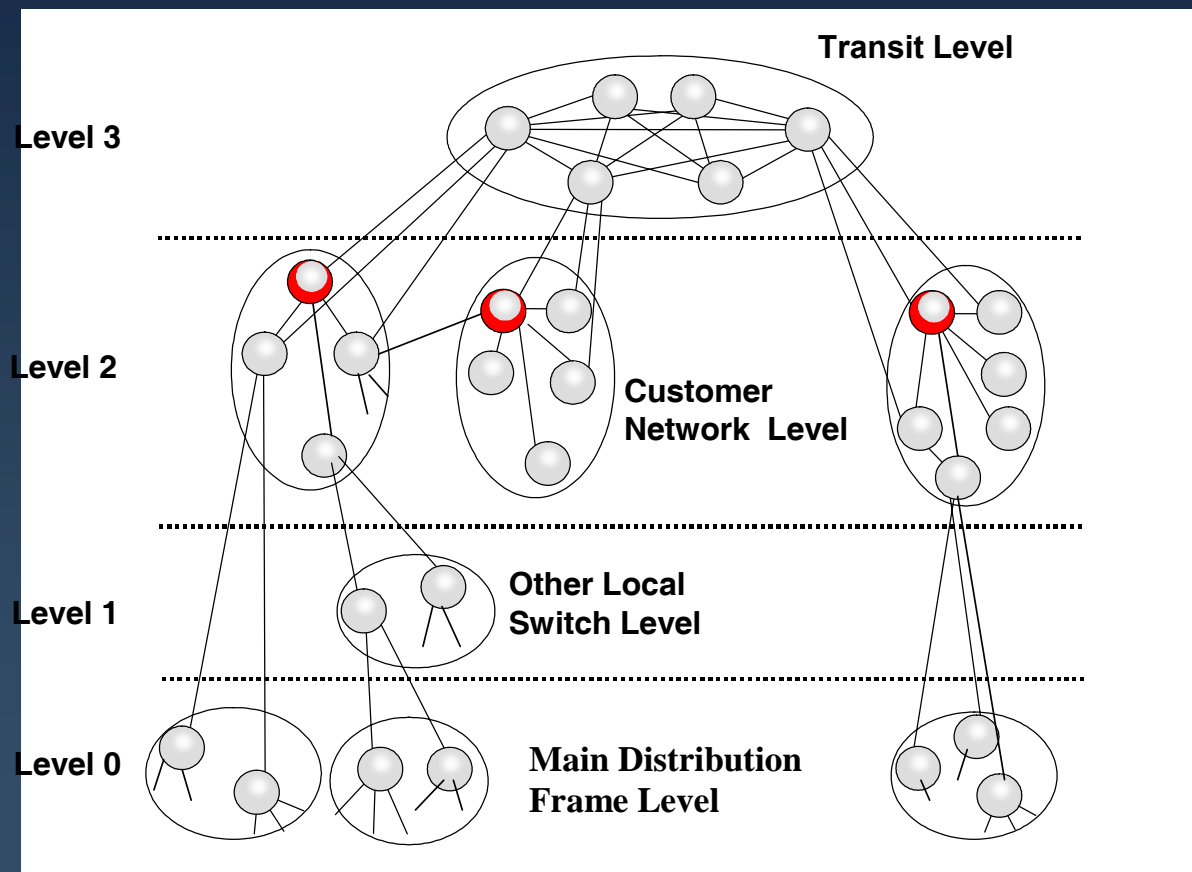
Importance of broadband for the economy

- **Direct effects:**
 - **Growth effect through increased broadband penetration revives telecom sector**
 - **Increase in broadband access, packet switching, backbone usage**
 - **Reduction of narrowband (POTS and ISDN usage)**
 - **Counteraction to decline in fixed telephone subscription**
- **Indirect effects could dwarf direct effects in the long run:**
 - **Increase in contents programming and development of new applications**
 - **Vehicle for convergence:**
 - **Platform competition**
 - **New competition through triple play and VoIP**

Telephone Network

Figure 1: Phone Network Hierarchy

Source: WIK



Broadband and infrastructure investments

- **Network hierarchy**
 - **Contents**
 - **Access**
 - **Packet switching**
 - **Backbone network**
- **Vertical integration of incumbent providers (Telco and cable TV)**
- **Focus on access network**
 - **Penetration**
 - **Upgrading (triple play)**
 - **Collocation**
- **Investment is not an end in itself but a means to an end: better and more affordable services.**
- **Broadband investment and broadband penetration: Investment push or demand pull? [If we build it will they come?].**
- **No reasons for government investments or subsidies**

Potential reasons for regulation of broadband access

- **Market power: economies of scale/sunk costs of access → Asymmetric regulation (costs and incentive distortions)**
 - Competition policy preferred
 - Vertical integration/separation: vertical economies (of scope) vs. restriction of rivals
 - Possible natural monopoly properties of broadband access
 - Bottleneck (access) regulation
 - End-user regulation
- **Network effects → Symmetric regulation**
 - Pecuniary and real externalities
 - Interconnection (any-to-any)/open access
 - Standardization (proprietary, non-proprietary)
 - Universal service regulation (extended to broadband?)

Competition preferable to regulation

- **End-user regulation (that keeps prices low) reduces competition: Substitute for competition**
 - **Can reveal natural monopoly property**
- **Access regulation (bottleneck regulation): Motor for competition**
- **Conditions for access regulation**
 - **No spontaneous and effective competition in wholesale and downstream retail markets**
 - **Call termination has no downstream retail market under calling-party-pays principle (Lecture #3)**

Telecommunications Regulation

US

- **Federal vs. state regulation**
- **Telecommunications Act of 1996**
- **Regulation otherwise developed by regulators**

EU

- **EU Commission vs. NRAs**
- **EU Framework of 2002 based on**
 - **Competition law principles**
 - **Convergence of different parts of the telecommunications industry**

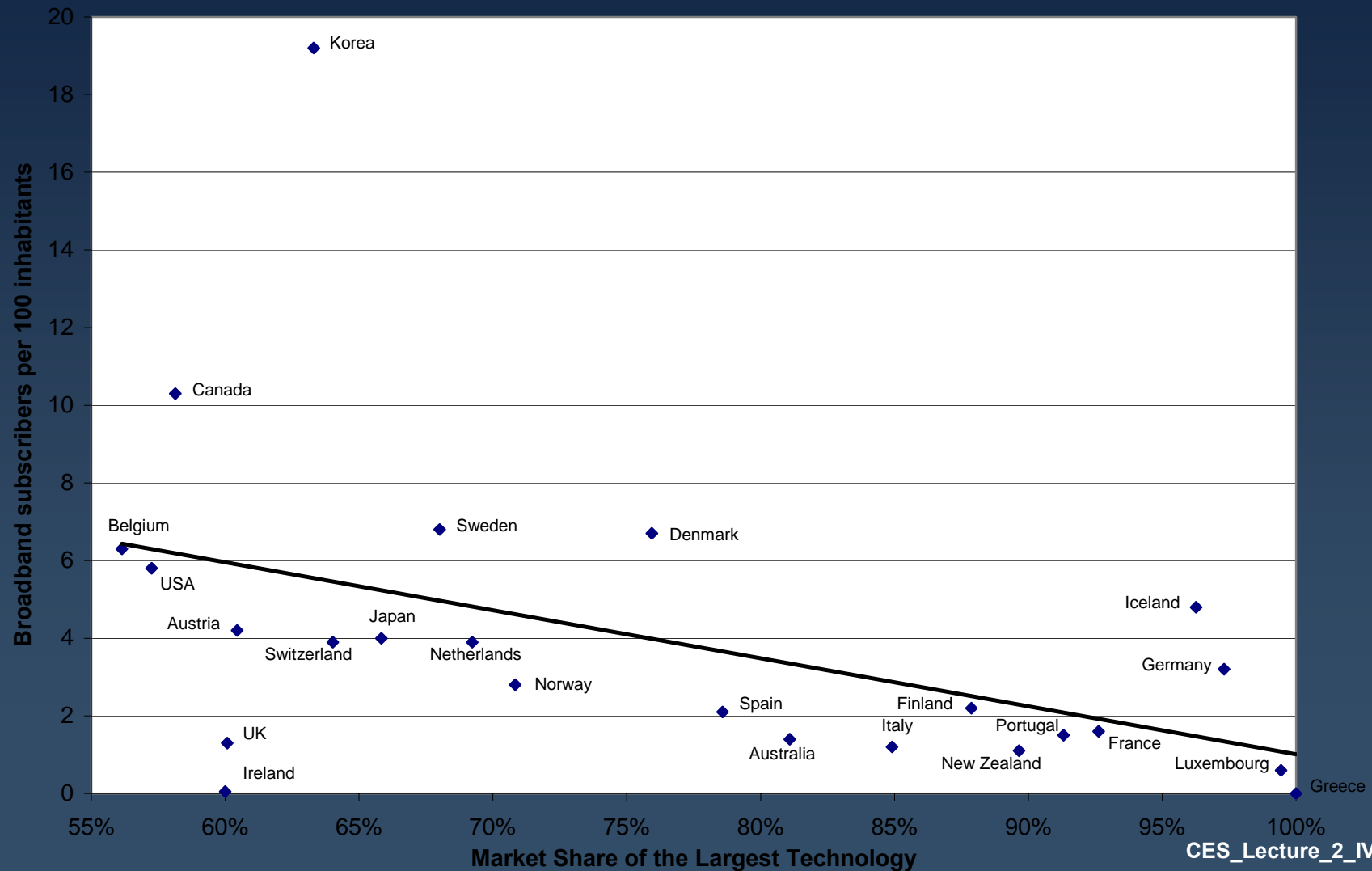
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Infrastructure competition vs. service competition

Figure 1: Infrastructure competition works

Source: OECD (2002), CRA (2003)



Infrastructure competition vs. service competition

- **Advantages of infrastructure competition:**
 - Innovative services and higher penetration
 - New technologies
 - Product differentiation
 - Enduring competition
 - Obsolescence of regulation
- **Drawbacks of infrastructure competition:**
 - Risks
 - Excess capacity (Telecom meltdown, fiber optics)
 - Theory of free entry competition with fixed costs
 - Shrinking subscriber base (fixed telephone)
 - Bankruptcies
 - Sub-optimal scale (wasteful duplication)
 - Höffler results
- → **Service competition necessary for and complementary to infrastructure competition**
- **Path dependence: Past duplications are sunk**

Path dependence: US vs. Germany

- **US**

- 100 years of flat rates
 - Favors narrowband usage
- Separation of telecommunications and information services in computer inquiries
- ISPs as information service providers (no access charges)
- Early separation of telephone and cable networks
- Cable expansion in 1990s → >60% of broadband via cable

- **Germany**

- High local call charges (no longer)
- High ISDN penetration (cannibalization by DSL)
- Cable TV network until recently largely owned by Deutsche Telekom
- Neglected cable network

Infrastructure competition vs. service competition

- **Virtuous cycle: Competition → investment → higher penetration (or new application) → more competition**
 - VoIP as killer application in the literary sense of the word?
- **Vicious cycle: Competition → investment → excess capacity → more competition**
 - The vision and building of the “information superhighway” of the 1990s ended in the telecom meltdown

Inter-modal vs. intra-modal competition

- **Fundamental tradeoff:**
 - **Presence of inter-modal competition substitutes for intra-modal competition.**
 - **Absence of inter-modal competition requires facilities-based intra-modal competition or regulation of service competition.**
- **Broadband inter-modal: DSL, Cable modem, satellite, 3G (USTM), powerline**
- **Path dependence: US vs. Germany**
- **Broadband intra-modal: 3G carriers; line sharing, bitstream, resale of access service (DSL resale)**

Inter-modal vs. intra-modal competition

- **Inter-modal competition:**

- Always facilities based
- Innovation and sequential monopolies: pothesis developed for Microsoft antitrust case → Access holidays (\approx patents)
- The most efficient technology should win

- **Intra-modal competition**

- Facilities based or service based
- Facilities based: 2G and 3G
- Service based: Last mile problem
- The most efficient firm(s) should win

Intra-modal competition: Bottleneck access

- **Essential Facilities Doctrine from Antitrust**
 - **Essential Input**
 - **Controlled by Monopolist**
 - **Denial of Access Harms Competition**
 - **No Valid Business Reason for Denial**
 - **No Pricing Rule ⇒ Regulatory pricing**
- **US: “Necessary” vs. “impair” standards**

Intra-modal competition: Bottleneck access

- **Vertical economies**
 - **Between network levels**
 - **Avoid collocation costs**
 - **Between network and retail**
 - **Customer care (OSS)**
 - **Between network, retail and contents**
 - **Vertical economies reduced by electronics**
- **Access regulation vs. competition for the bottleneck: short-term vs. long-term**
 - **Can essential facilities be circumvented**
 - **by competitors?**
 - **by consumers? (inter-modal competition)**
 - **Are new technologies in sight for replacing essential facility?**
 - **In absence of regulation, does bottleneck access develop by itself?**

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How can regulation promote competition and efficient investment?

- **Regulatory governance and regulatory incentives (*pricing*)**
- **Regulatory governance**
 - **Unified regulation across networks (convergence)**
 - **Consistency: Similar objectives and yardsticks**
 - **Competitively and technologically neutral**
 - **Predictable and constrained**
 - **Safeguards against arbitrary changes**
 - **Due process**
 - **Contents**
 - **Predictable criteria for deregulation**
 - **Independence (credibility)**
 - **Private ownership of incumbent**
- **Discretion and commitment power needed for self-adapting regulation**
- **Strong administrative and judicial procedures to protect the public from regulatory discretion**

Regulatory pricing principles (mostly for bottleneck regulation)

- **Cost-based Pricing**
 - Pricing close to efficient costs
 - LRAIC or TSLRIC (Total Service Long-Run Incremental Costs)
 - Time-of-use sensitivity, capacity-based pricing
 - Risk adjustments for sunk assets (technical obsolescence, declining input prices, declining demand, increasing replicability): Mark-ups on cost of capital, risk sharing, long-term contracts
 - Efficient costs in shrinking vs. expanding markets
- **Ramsey markups or non-linear pricing to cover common costs**
 - Inverse Elasticity Term
 - Competitive Interaction
 - Differential Efficiency
 - Final Demand Substitution
- **Efficient Component Pricing Rule (ECPR or Baumol-Willig rule): Avoid price squeeze**
 - Simple vs. Sophisticated (demand substitution and types of competition)
 - Ex Ante vs. Ex Post
 - ECPR vs. imputation
 - Depends on final goods prices

Regulatory pricing principles (mostly for bottleneck regulation)

- **Price Cap Options**
 - **Separate price caps (baskets) for bottlenecks and end-user charges**
 - **Avoid anticompetitive strategies**
 - **Impose rigidities regarding rebalancing**
 - **Global Price Caps**
 - **Not compatible with EU framework**
 - **Idealized weights based on Ramsey-optimal quantities**
 - **Input demands as derived demands \Rightarrow autarkic Ramsey optimum**
 - **Freedom to foreclose rivals \Rightarrow imputation rule (ECPR) as safeguard**
 - **Chained Laspeyres weights**
 - **Built-in insurance against predation**
 - **Regulatory Commitment**
 - **Price caps for access only**
- **Conclusion on Vertical Integration: Hard to Regulate**
- **Long-run pricing: Price caps vs. rate-of-return regulation**
- **Increasing replicability: 20-20 hindsight: Heads I win, tails you lose**

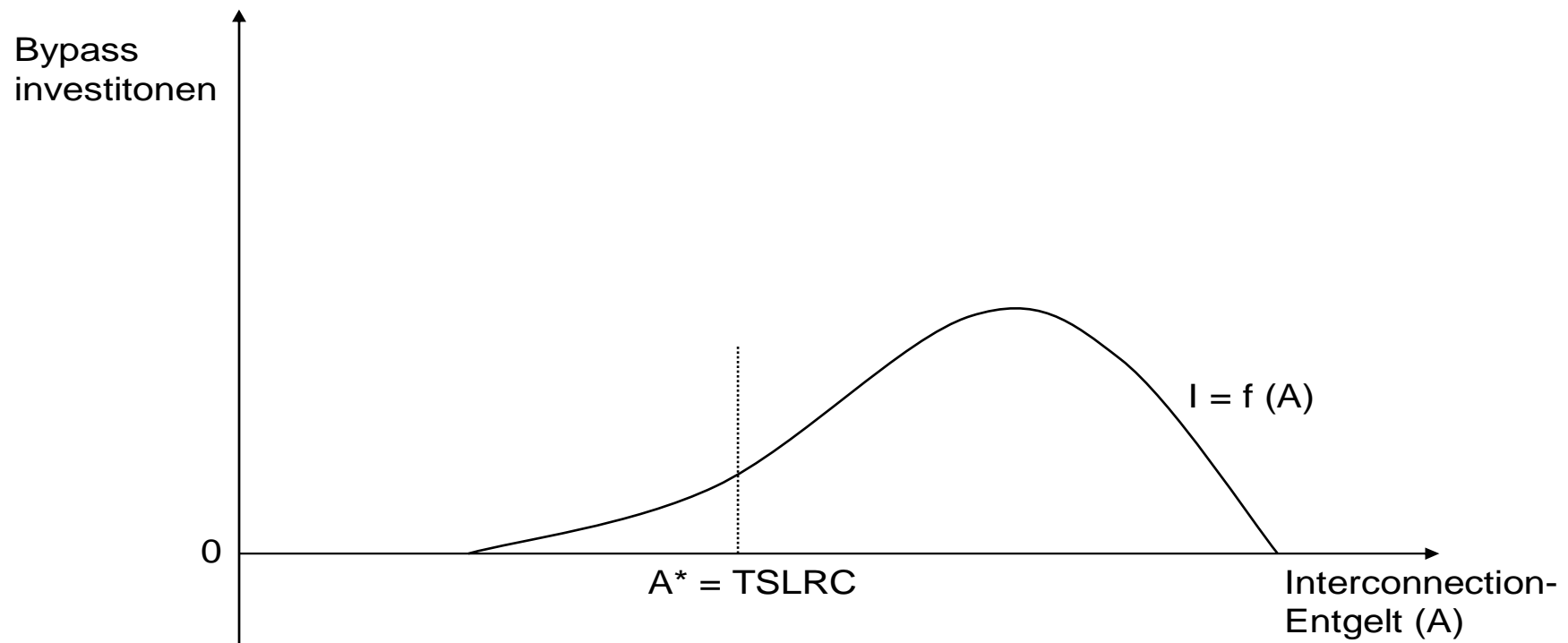
End-user regulation and investments

- **End-user regulation only if access regulation unsuccessful**
- **The stricter end-user regulation of incumbent**
 - the lower quality of service
 - the higher cost of capital of incumbent
- **Incumbent's output/investment first increases then decreases as end-user regulation becomes stricter (leading to non-price rationing)**
- **Entrants' investments and outputs decrease in stricter end-user regulation of incumbent**

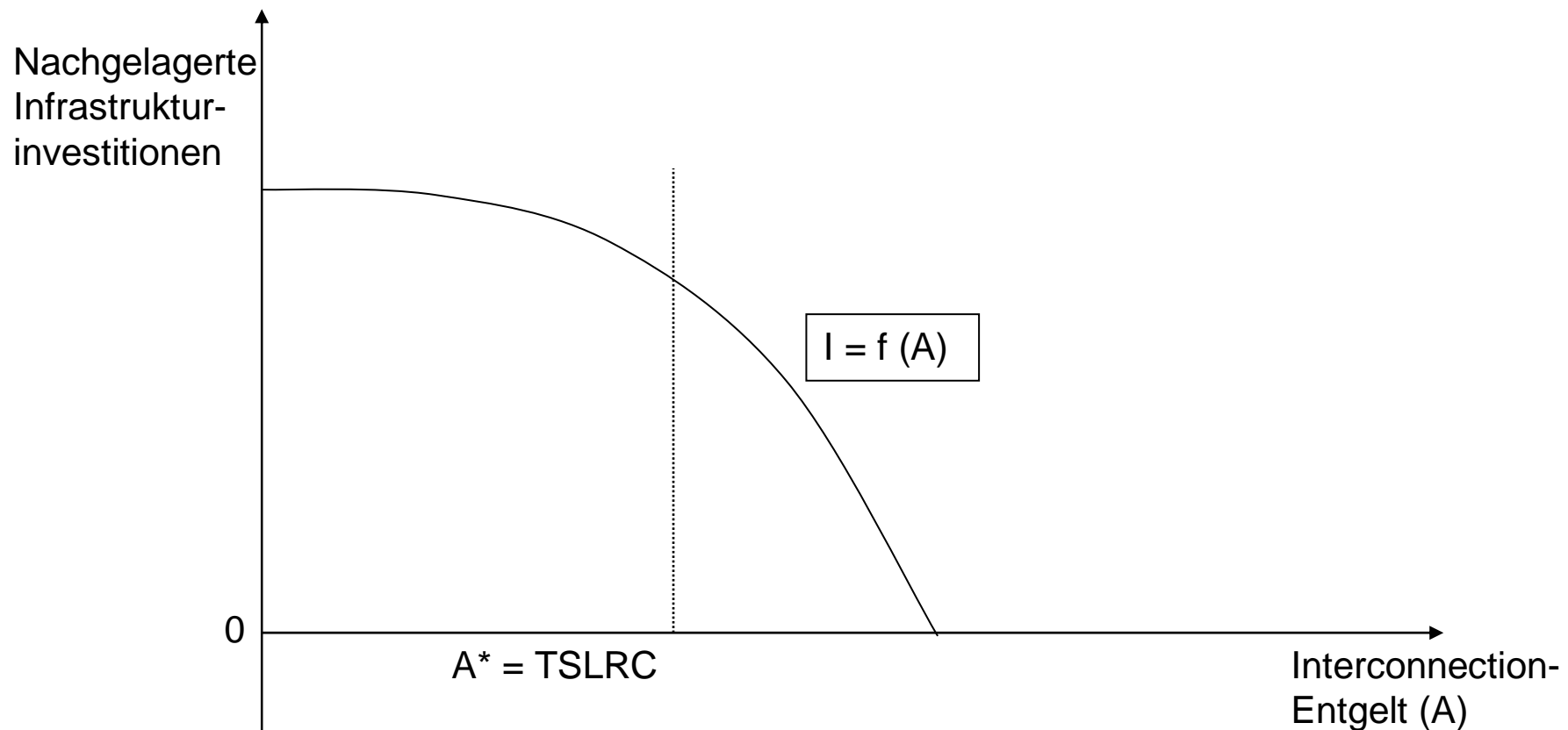
Telecom infrastructure investments

- **Incumbents vs. entrants or non-replicable vs. replicable investments?**
- **Incumbents:**
 - Last mile bottlenecks
 - Shrinking
 - Expanding
 - Inter-modal competition in access technologies
- **Entrants:**
 - Ladder approach
 - Investments in replicable parts of networks
 - Ladder hypothesis does not hold for inter-modal competition (Höffler, 2005)
 - Access-related investments
 - Investments in bottleneck bypass: Tradeoff between unbundling and bypass

Bypass Investments as a Function of Interconnection Prices



Downstream Infrastructure Investments as a Function of Interconnection Prices



Bottleneck regulation and investment

- **The stricter bottleneck regulation (for given replicability of bottleneck)**
 - **the less entrants invest in bottleneck bypass: High access prices for US long-distance carriers in the 1980s created competitive access providers (CAPs)**
 - **the more entrants invest in replicable network assets that are complementary to bottlenecks (downstream)**
 - **the less the incumbent will invest in replicable network assets that are complementary to bottlenecks**
 - **the higher the incumbent's cost of capital**
- **Incumbent's output/investment of bottleneck services first increases than decreases as bottleneck regulation becomes stricter (leading to non-price rationing)**

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Policy conclusions

- **Stable regulatory framework: Consistent content and due process**
- **Subsidies only for social reasons (not to enhance investments)**
- **Desirability of competing infrastructures is path dependent**
- **Inter-modal competition → competition policy preferred over bottleneck regulation and end-user regulation**
- **No inter-modal competition → bottleneck regulation preferred over end-user regulation**
- **Vertical separation under weak economies of scope**
- **Since high bottleneck charges risk strangulating competition and low bottleneck charges (below economic costs) reduce bottleneck bypass investments, regulator should aim at charges slightly above costs (knife edge problem).**
- **Cave ladder: The more replicable the higher the price of bottleneck service (relative to costs) → Investment incentives for entrants, not necessarily for incumbents**