Competition, Regulation, and Broadband Access to the Internet

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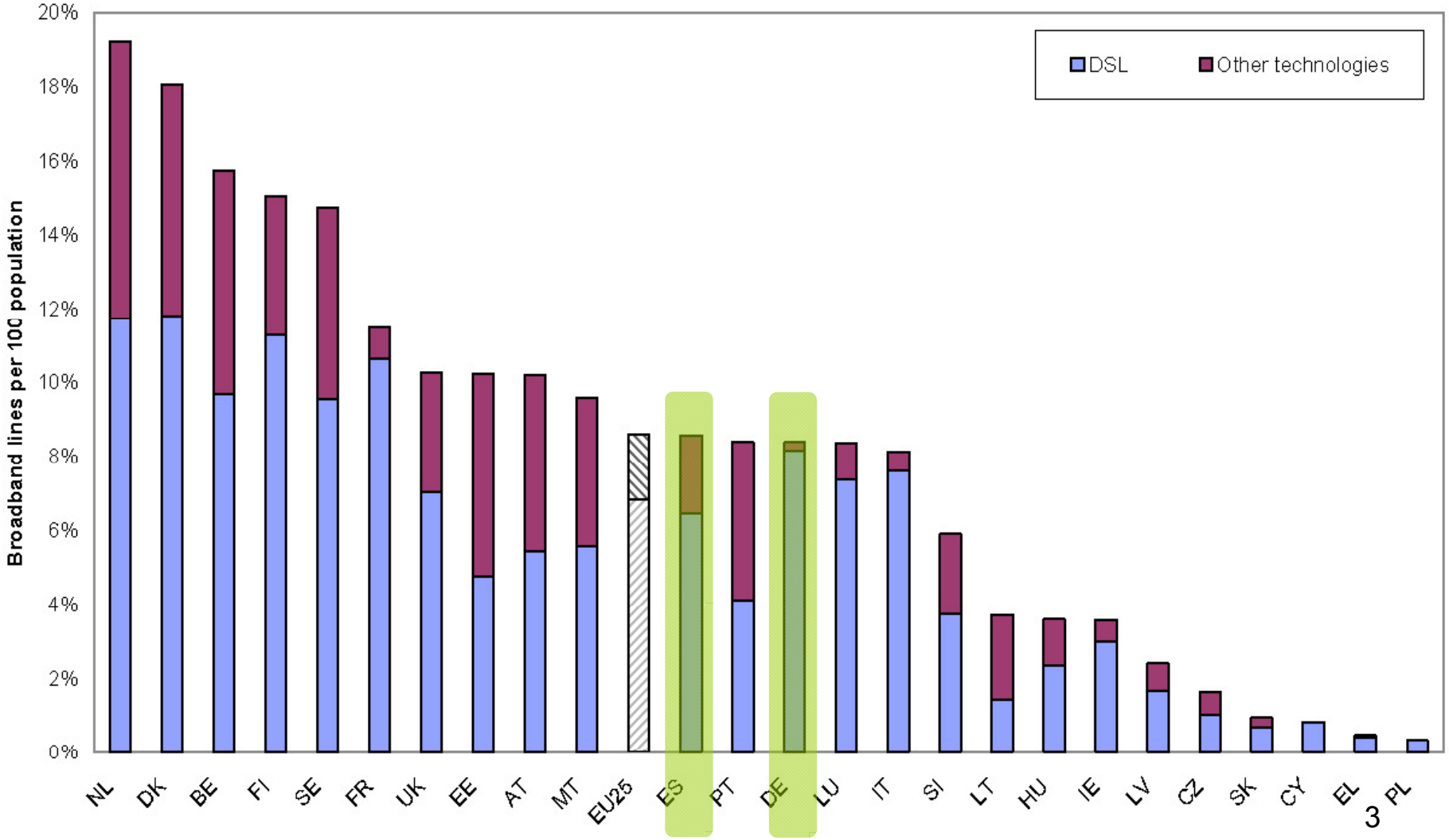
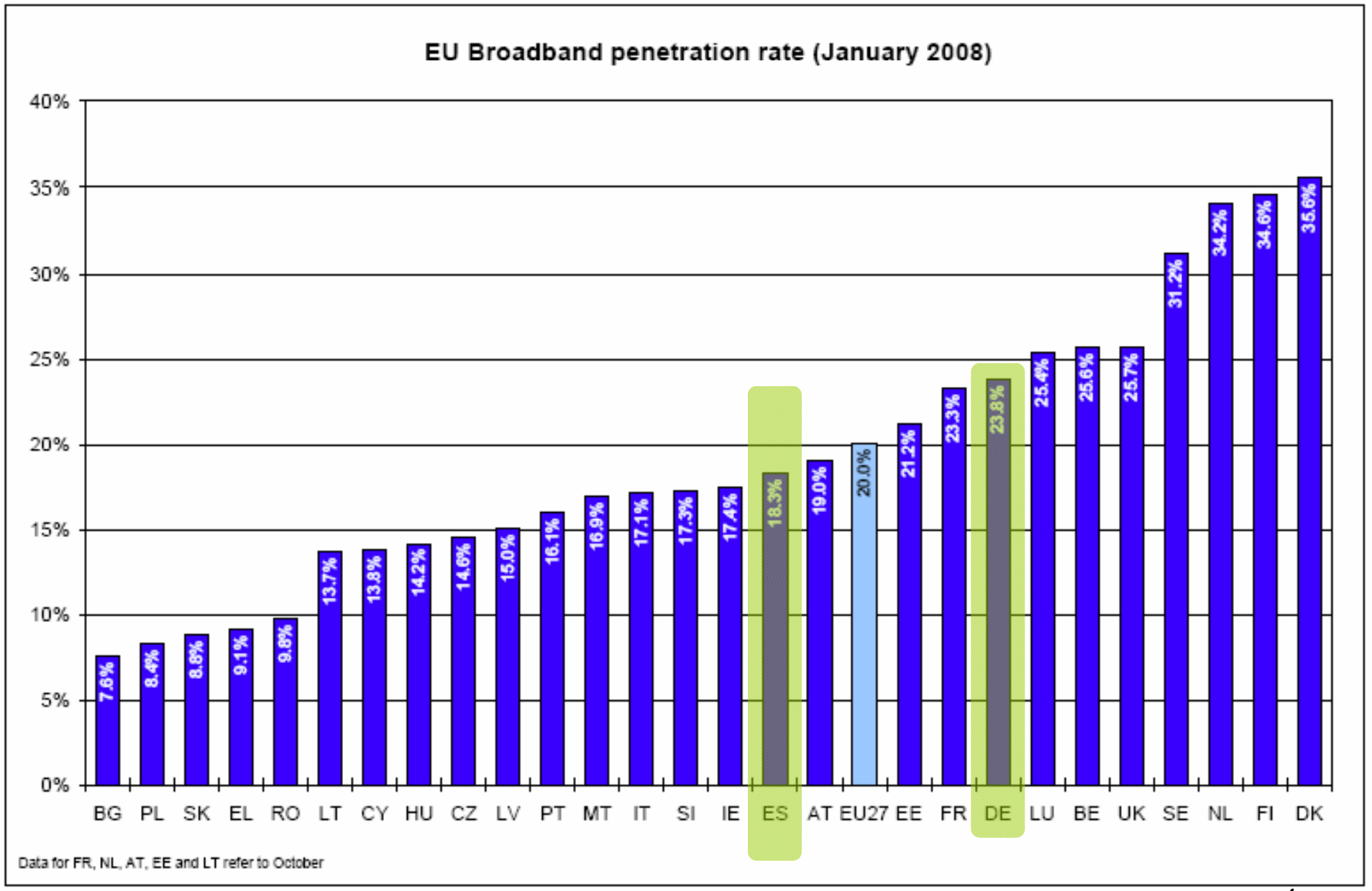
Basics

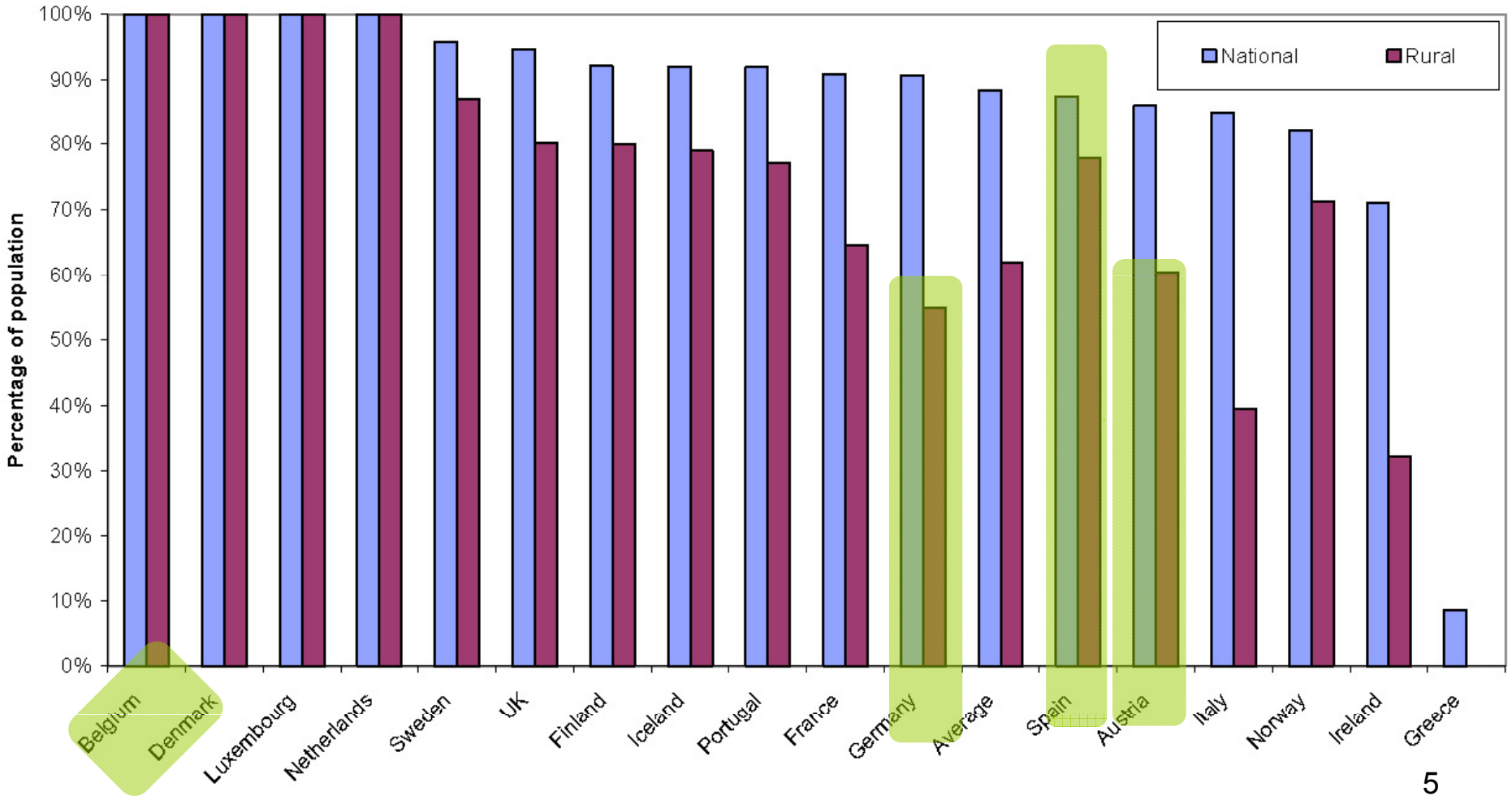
- Broadband internet access
  - Speed > ISDN (2*64kbit/s)
  - Always online
  - ADSL (Asymmetric Digital Subscriber Line)
  - Cable modem
- (Geographic) Coverage
  - “DSL Coverage” refers to the percentage of the population depending on a Local Exchange equipped with a DSLAM
- Penetration
  - subscribers per 100 inhabitants

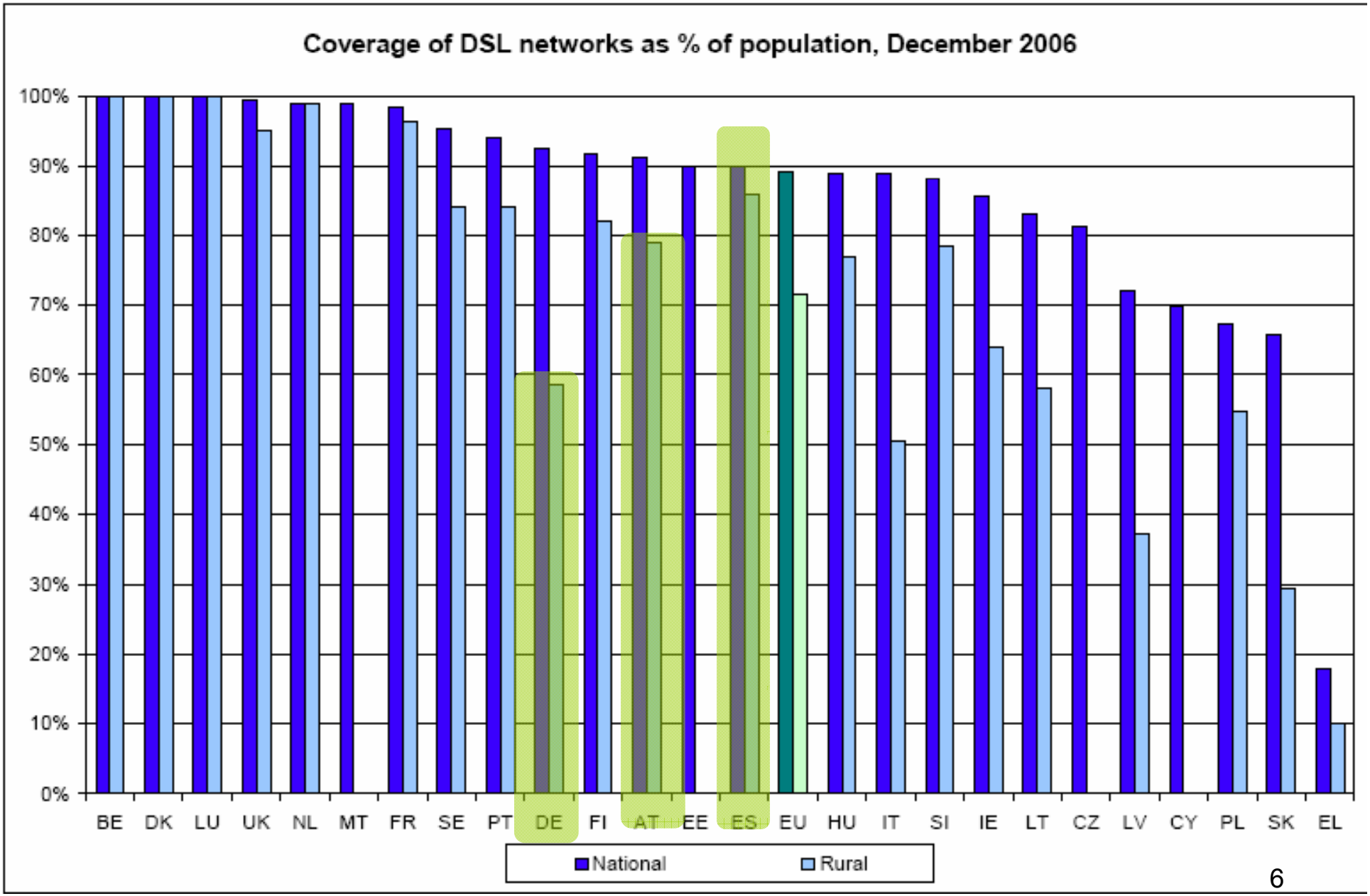
EU 25 Broadband penetration rate (January 2005)

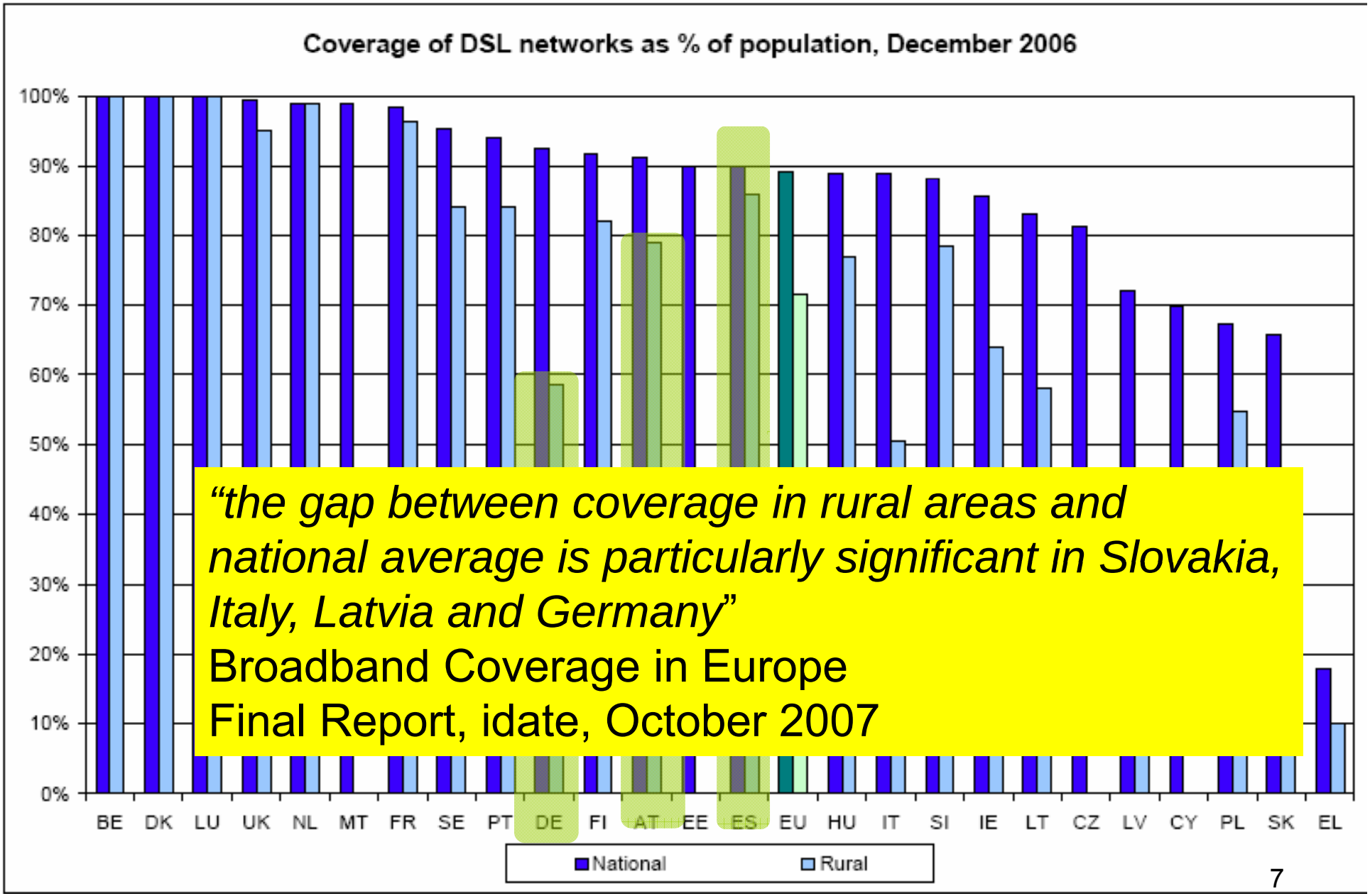



EU Broadband penetration rate (January 2008)
40%
35%
30%
25%
20%
15%
10%
5%
0%
BG PL SK EL RO LT CY HU CZ LV PT MT IT SI IE ES AT EU27 EE FR DE LU BE UK SE NL FI DK
7.6% 8.4% 8.8% 9.1% 9.8% 13.7% 13.8% 14.2% 14.6% 15.0% 16.1% 16.9% 17.1% 17.3% 17.4% 18.3% 19.0% 20.0% 21.2% 23.3% 23.8% 25.4% 25.6% 25.7% 31.2% 34.2% 34.6% 35.6%
Data for FR, NL, AT, EE and LT refer to October

Coverage of DSL networks as % of population, January 2005




Coverage of DSL networks as % of population, December 2006
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
BE DK LU UK NL MT FR SE PT DE FI AT EE ES EU HU IT SI IE LT CZ LV CY PL SK EL
National
Rural



"the gap between coverage in rural areas and national average is particularly significant in Slovakia, Italy, Latvia and Germany"
Broadband Coverage in Europe
Final Report, idate, October 2007

Regulation and Competition

- Very different market shares of the various technologies
  - D: ¼ of of connections via ULL, Penetration 20% of households, Coverage < 90 %, cable ~ 2,5%
  - CH: no ULL, Penetration 45 % of households, Coverage 98 %, cable ~ 40%
- D: Regulatory holidays for VDSL?
  - Commissioner Viviane Reding
    - "I welcome that in spite of considerable political pressure, the German regulator has proved its independence by proposing to the Commission, as required by EU law, to remedy the well-known competition problems on the German broadband market (…)
    - To open the German broadband market to competition will lead to better services and lower internet access prices for consumers. (…)
    - I therefore urge the German regulator to implement this remedy [bitstream access] now without any further delay to ensure that both competitors and consumers can profit from fairer competition also in Germany."Viviane Reding

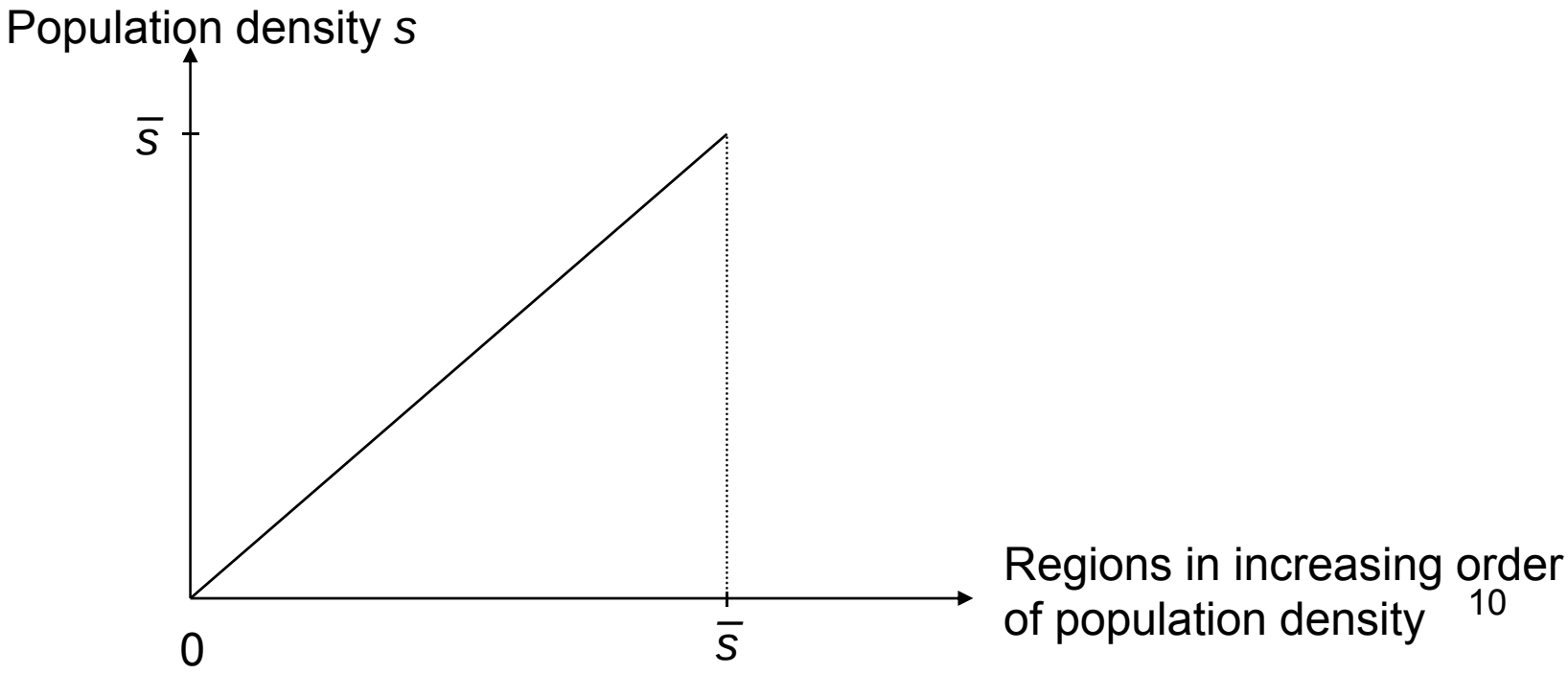
Economic analysis

Problem: Build a model that

- Explains penetration and coverage endogenously
  - Taking into account competition
  - Taking into account differences in population density
- Allows evaluation of regulatory regimes
  - Welfare effects of geographically uniform prices
  - Effect of (compulsory) opening up of incumbent‘s network on decision to invest (by incumbent)

The model

- Many regional markets with different population densities
  - $\Rightarrow$ Continuum of “cities/regions”, ranked according to population density s
  - $\Rightarrow$ linear relation between “number” of cities and their population density

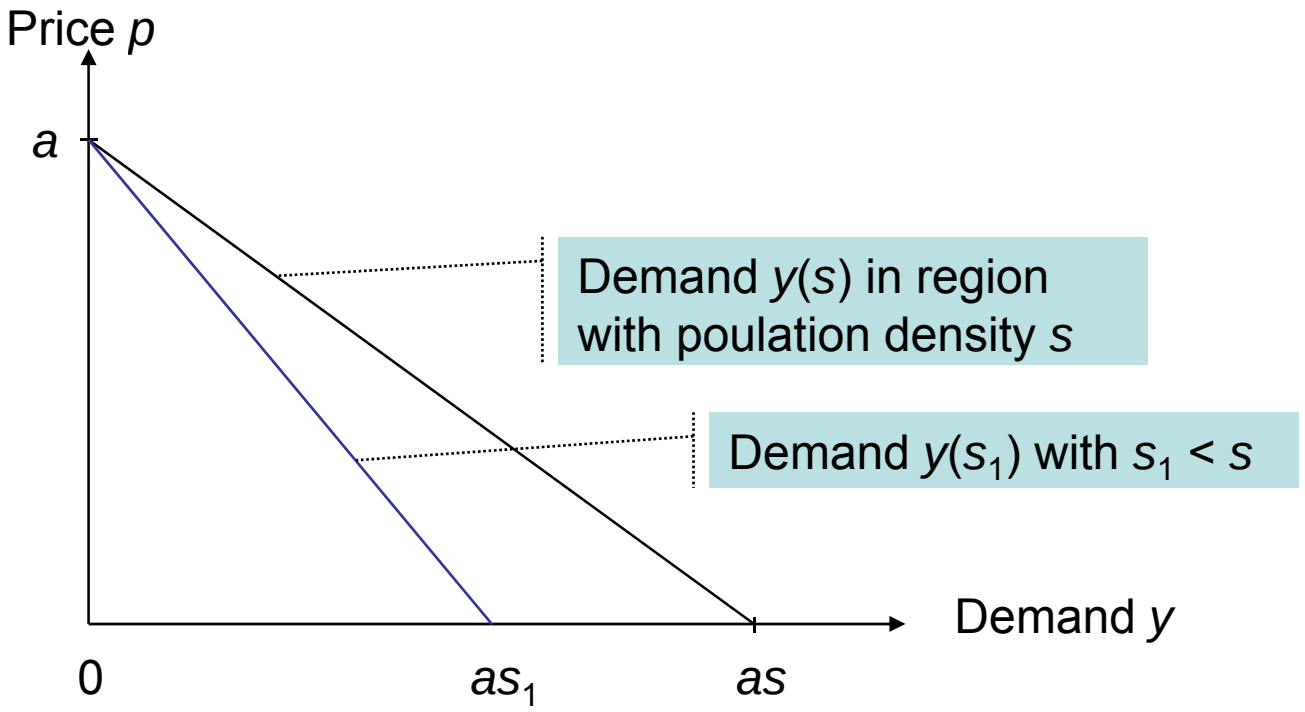


The model

- Demand $y(s)$ in regional market s:
  - Each household has unit-demand for broadband access, households differ w.r.t willingness to pay

  $\Rightarrow$ Maximum willingness to pay: a, number of households: $a\,s$

  $\Rightarrow$ Linear demand function: $y = s\,(a - p)$



The model

- Further assumptions:
  - fixed investment *f* necessary to allow for DSL at a certain exchange
  - Costs per subscriber: *c*
  - Regional market structure: no, one or two providers
  - Duopoly case: linear demand functions with differentiated products (linear-quadratic utility function)
  - Two-stage game:
    - investment (=coverage) decision (all firms)
    - Bertrand price competition

Valletti, Hoernig, Barros, J Regulatory Ec, 2002

Benchmark: Coverage and penetration in unregulated monopoly

- Pricing in covered markets
  - $\Rightarrow$ Monopoly price $p^M = (a + c)/2$
  - $\Rightarrow$ Profit in market s: $\Pi^M(s) = s(a - c)^2 / 4$
- Decision to invest:
  - $\Rightarrow$ Build network $\Leftrightarrow \Pi^M(s) \geq f$
  - $\Rightarrow$ Smallest covered market $\underline{s}$: $\underline{s}^M = 4 f / (a - c)^2$
- Broadband penetration Y
  - $\Rightarrow$ $Y^M = \overline{s}^2 (a - c) / 4 - 4 f^2 / (a - c)^3$

Regulated monopoly: price cap and service-based competition, resp.

- Regulator determines price cap/wholesale price p

  $\Rightarrow$ Profit im Markt s: $\Pi^R(s) = s(a - p)\,(p - c)$

- Incumbent‘s decision to invest:

  $\Rightarrow$ Invest $\Leftrightarrow \Pi^R(s) \geq f$

  $\Rightarrow$ Smallest covered market $\underline{s}$:

  $$\underline{s}^R = f / ((a - p)\,(p - c)) \geq \underline{s}^M$$

- Penetration level Y

  $\Rightarrow$ $Y^R = \bar{s}^2\,(a - p) / 2 - f^2 / (2(a - p)\,(p - c)^2)$

Regulated monopoly: price cap and service-based competition, resp.

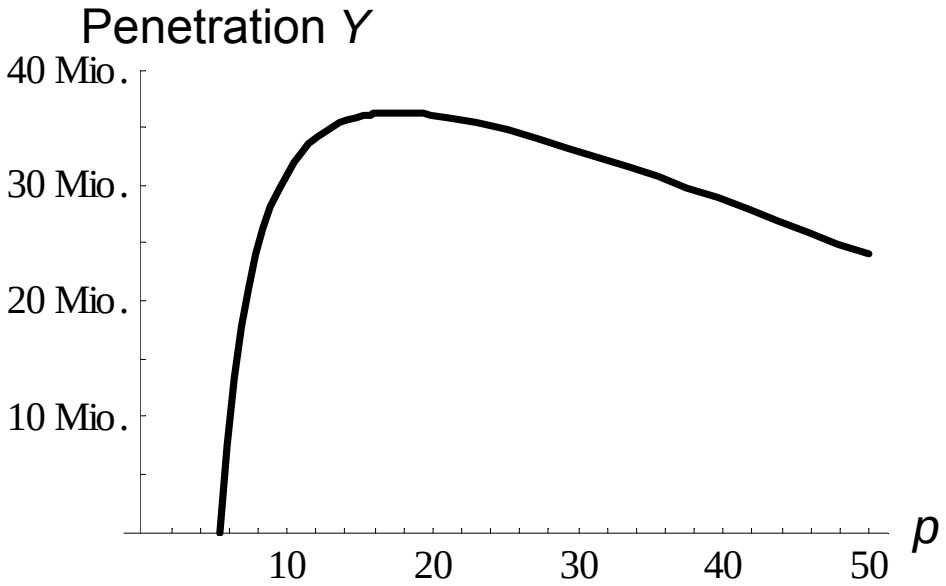
- Regulator determines price cap/wholesale price p
  - $\Rightarrow$ Profit im Markt s: $\Pi^R(s) =$ $(a$ $)$
- Incumbent‘s decision to
  - $\Rightarrow$ Invest $\Leftrightarrow$ $\Pi^R(s) \geq$ f
  - $\Rightarrow$ Smallest covered market:
    $\underline{s}^R = f /((a - p)($
- Penetration level Y
  - $\Rightarrow$ $Y^R = \bar{s}^2 (a - p) / 2 -$ $f^2 / (2(a -$ $p)$ $-$ $c^2)$

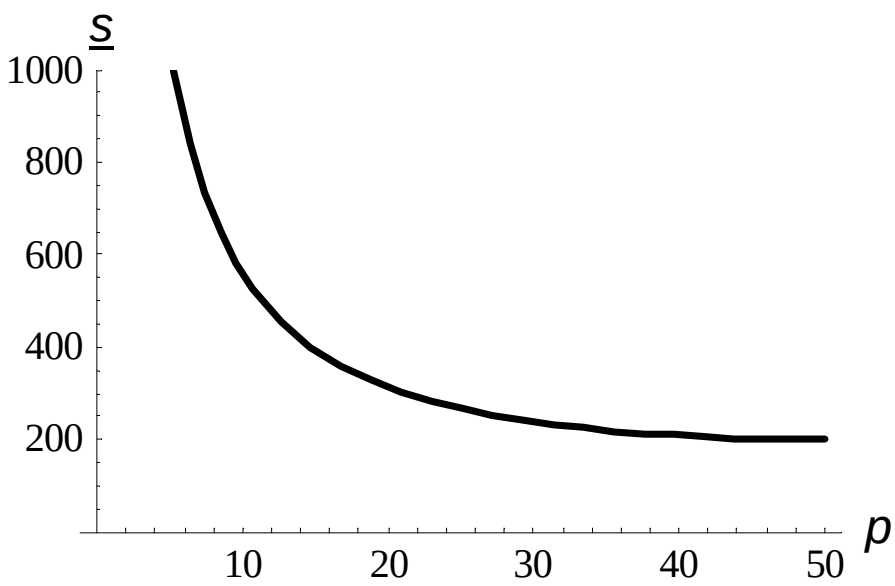
Coverage at max under monopoly
$\Rightarrow$Schumpeter!

Unregulated vs. regulated monopoly: An example

- $a = 100$, $c = 0$, $\bar{s} = 1000$, $f = 500\,000$
  - $\Rightarrow$ Potential market: 50 000 000 HH and users, resp.
- Unregulated monopoly
  - $\Rightarrow$ $p^M = 50$, $\underline{s}^M = 200$, $Y^M = 24\,000\,000$,
  - $\Rightarrow$ Penetration: 48%, Coverage: 96% of HH

Penetration and coverage as a function of price cap *p*



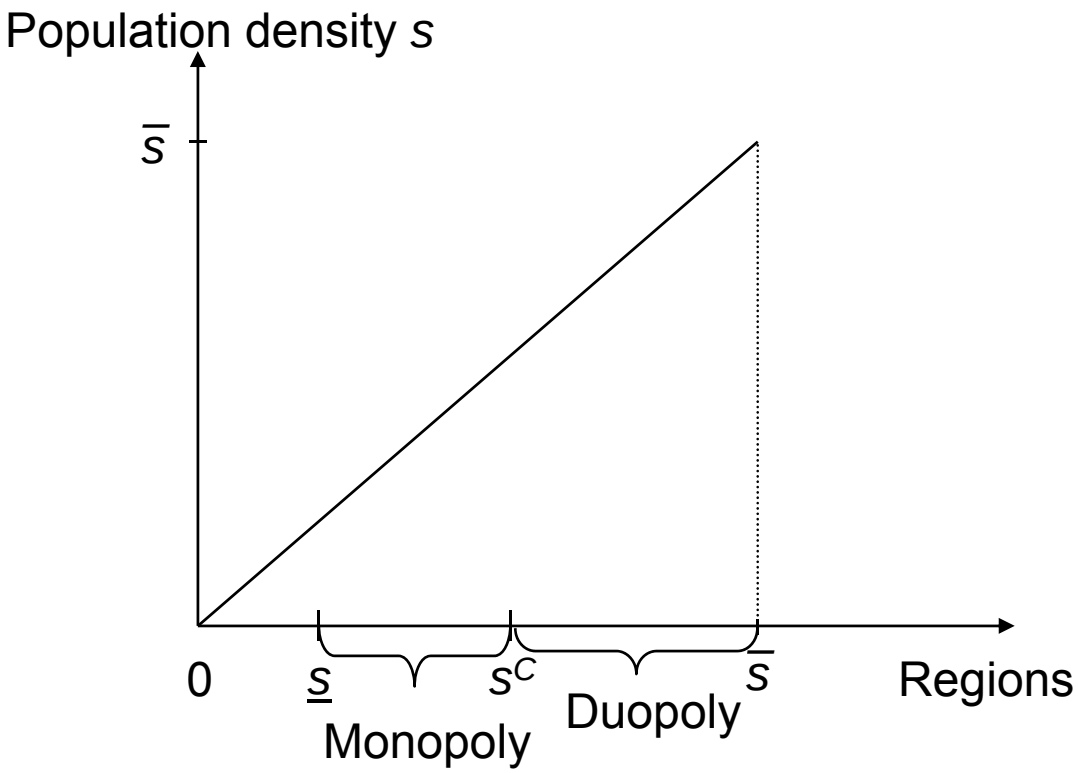


- Penetration initially increases with decreasing prices. However, as the price cap becomes very low, penetration eventually decreases.
  - $\Rightarrow$ Price decrease increases demand in covered regions
  - $\Rightarrow$ Monopolists invests less and coverage and number of potential consumers decreases

Unregulated vs. regulated monopoly: An example

- $a = 100$, $c = 0$, $\bar{s} = 1000$, $f = 500\,000$
  - $\Rightarrow$ Potential market: 50 000 000 HH and users, resp.
- Unregulated monopoly
  - $\Rightarrow$ $p^M = 50$, $\underline{s}^M = 200$, $Y^M = 24\,000\,000$,
  - $\Rightarrow$ Penetration: 48%, Coverage: 96% of HH
- Regulated monopoly (maximum penetration)
  - $\Rightarrow$ $p^{RP} = 17{,}6$, $\underline{s}^{RP} = 345{,}3$, $Y^{RP} = 36{,}3$ Mio.,
  - $\Rightarrow$ Penetration: 72,6%, Coverage: 88,1% of HH
- Regulated monopoly (maximum welfare)
  - $\Rightarrow$ $p^{RW} = 21{,}2$, $\underline{s}^{RW} = 299{,}6$, $Y^{RW} = 35{,}9$ Mio.,
  - $\Rightarrow$ Penetration: 71,8%, Coverage: 91,0% of HH

Facilities-based competition (duopoly)



Inverse demand (Duopoly)

$\Rightarrow p_1 = a - x_1 - \sigma x_2$

$\Rightarrow p_2 = a - x_2 - \sigma x_1$

with $\sigma \in [0,1]$

Price competition (given coverage)

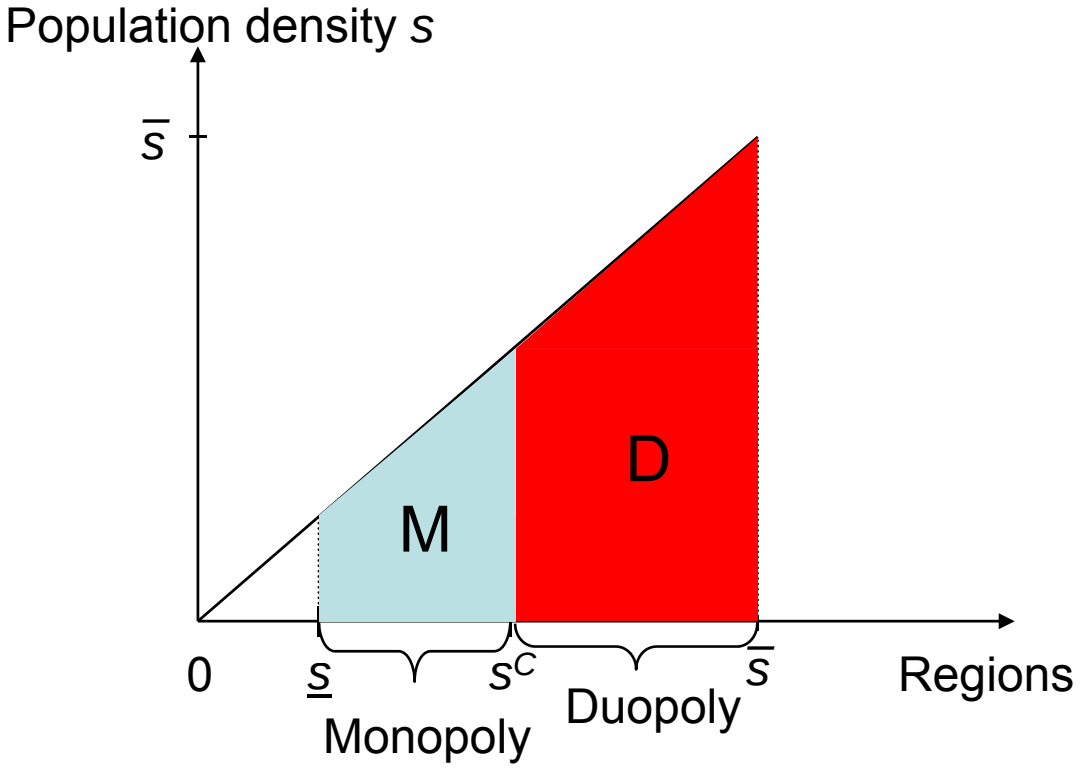
- no regulation

$\Rightarrow$Monopoly: p^M

$\Rightarrow$Duopoly: $p_1^D = p_2^D = p^D$

$$= \frac{a(1-\sigma) + c}{2 - \sigma}$$

Facilities-based competition (duopoly): geographically uniform prices (UP)



Share μ of the duopoly segment:

$\mu \equiv D/(D + M)$

Price competition (given coverage)

$\Rightarrow p^M \geq p_1^{UP} \geq p_2^{UP} \geq p^D$

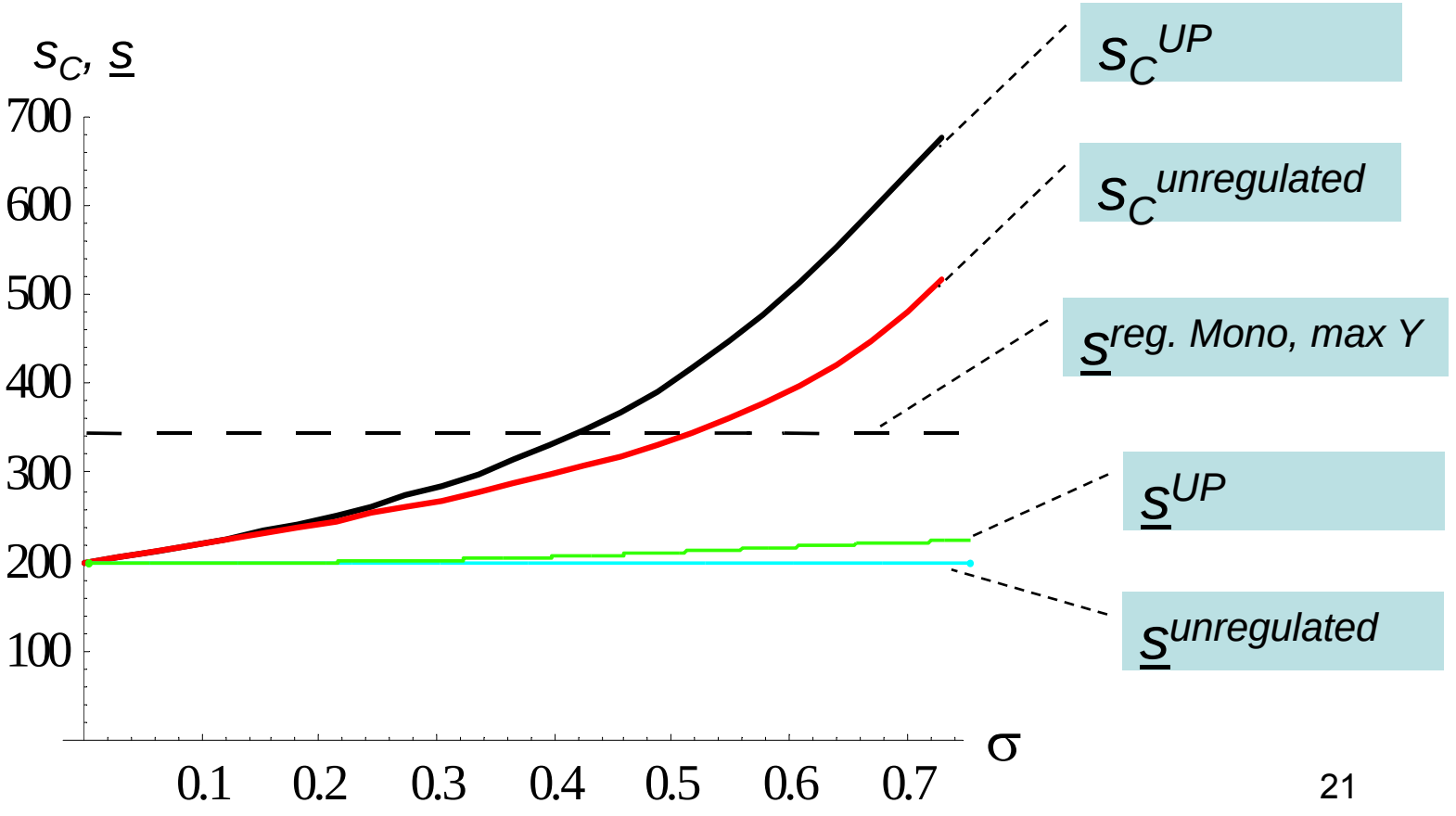
$\Rightarrow p_1^{UP}, p_2^{UP}$ decreasing in μ

$\Rightarrow$ For large σ (> 0.8) only equilibria in mixed strategies exist!

$\Rightarrow p_1^{UP}, p_2^{UP}$ may increase, if σ increases!

The firm‘s investment decisions: Coverage under facilities-based competition

Coverage 0% ⇔s = 1000; Coverage 100% ⇔s = 0



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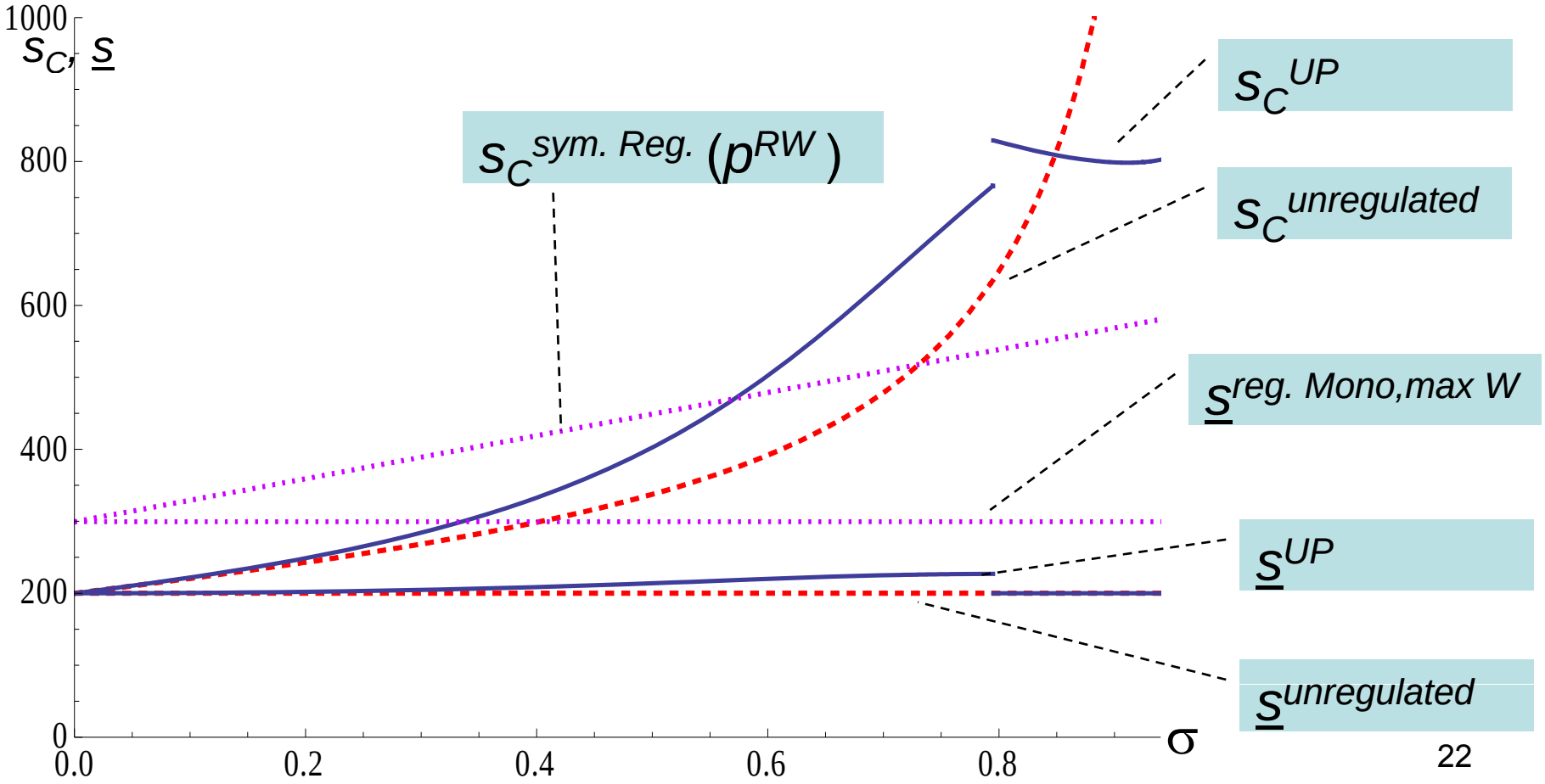
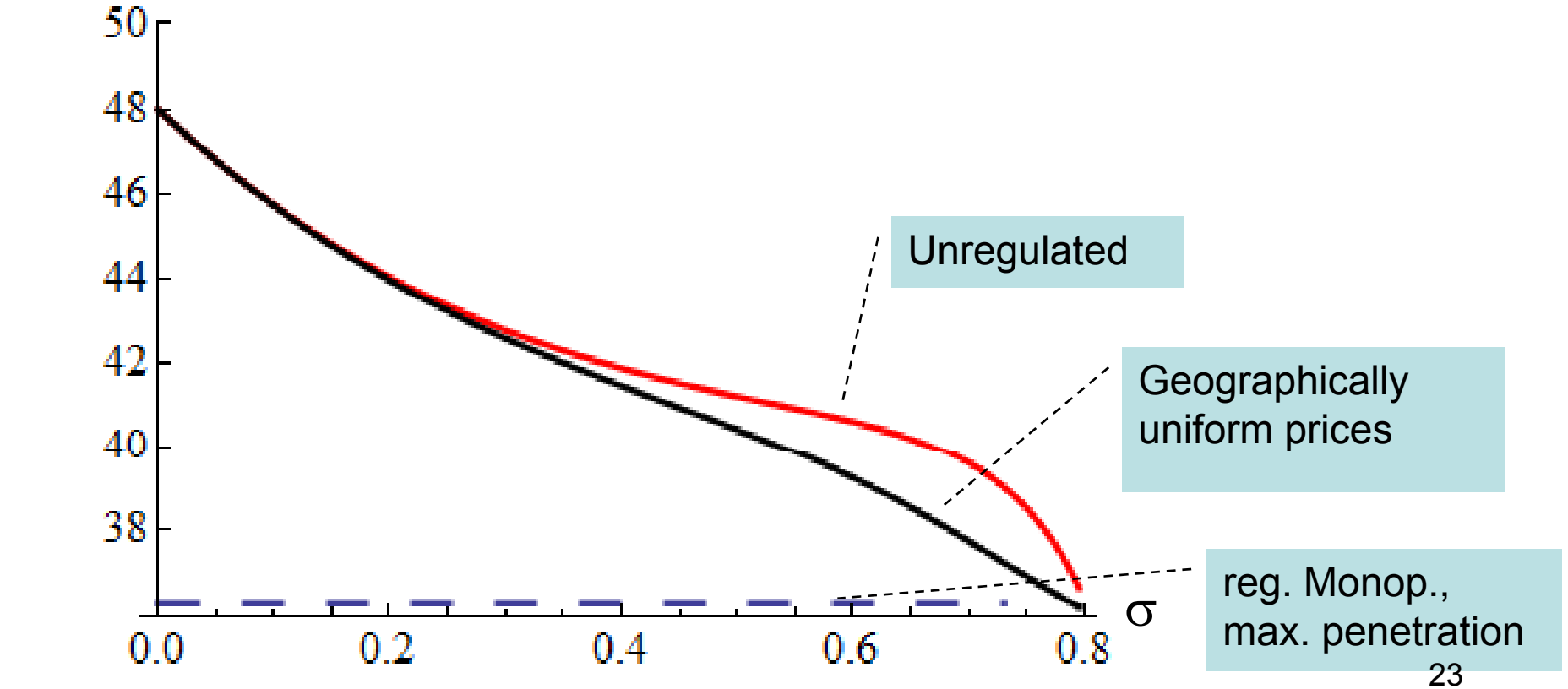


Broadband penetration under facilities based competition

Key parameter: Degree of product differentiation σ



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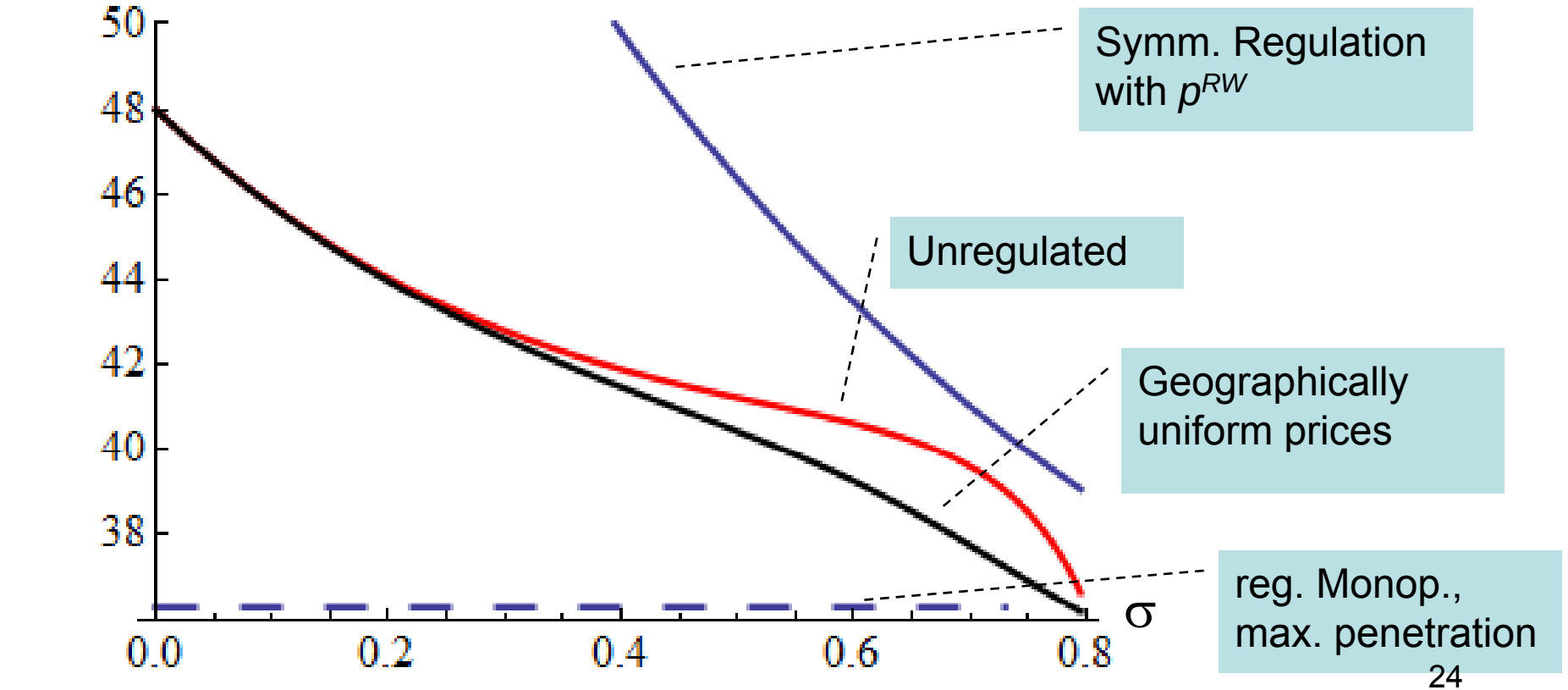
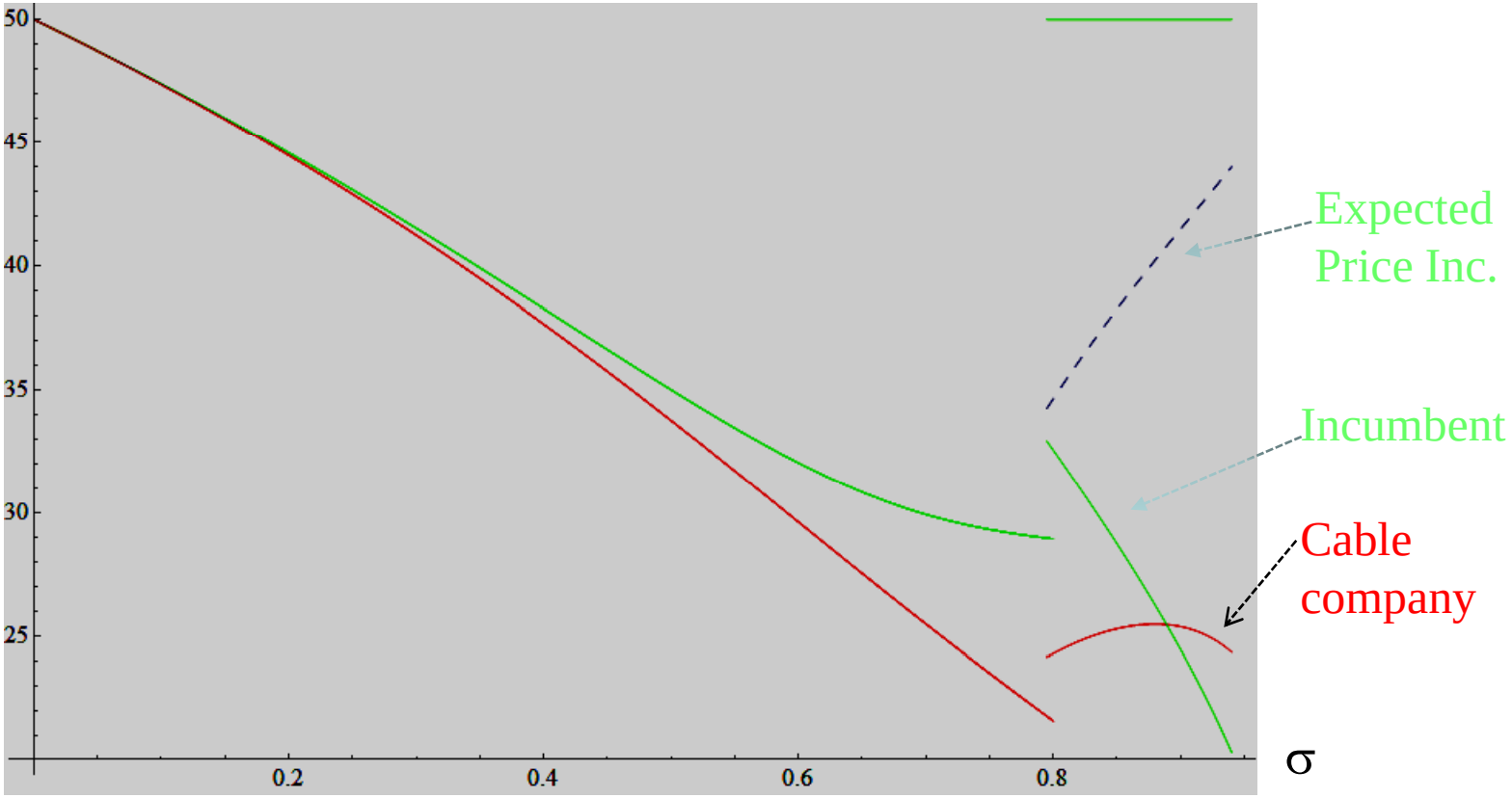
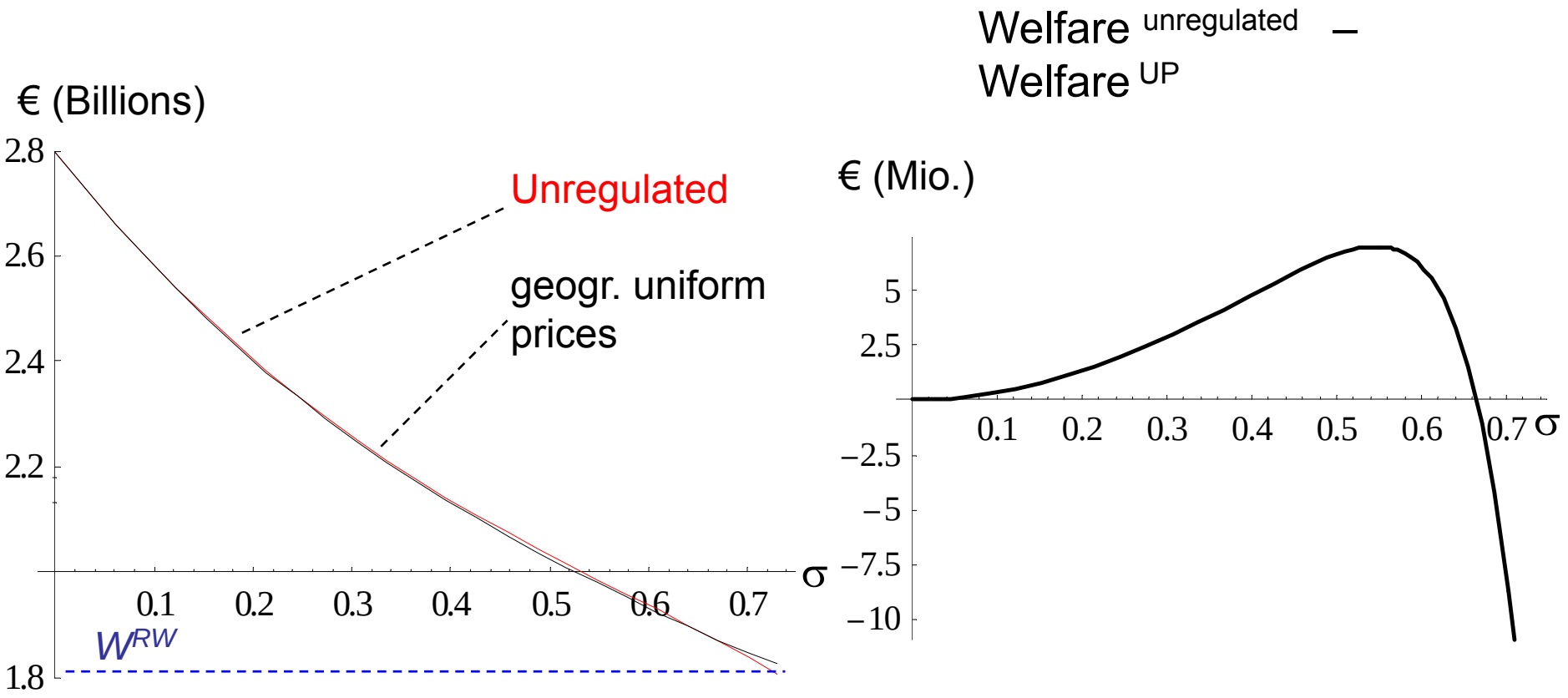


Prices and intensity of competition – geographically uniform prices

Price (€)



Welfare under facilities-based competition



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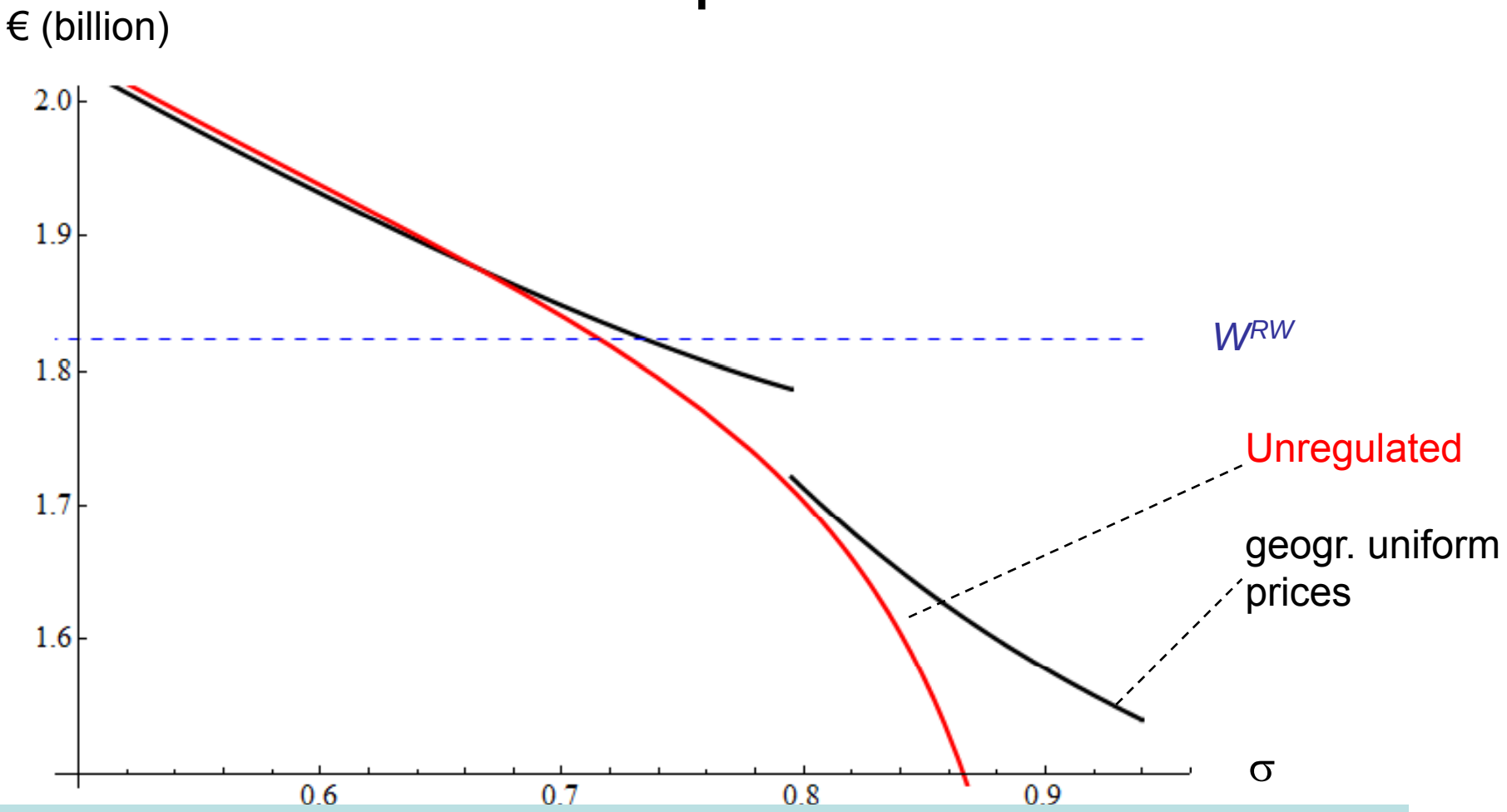
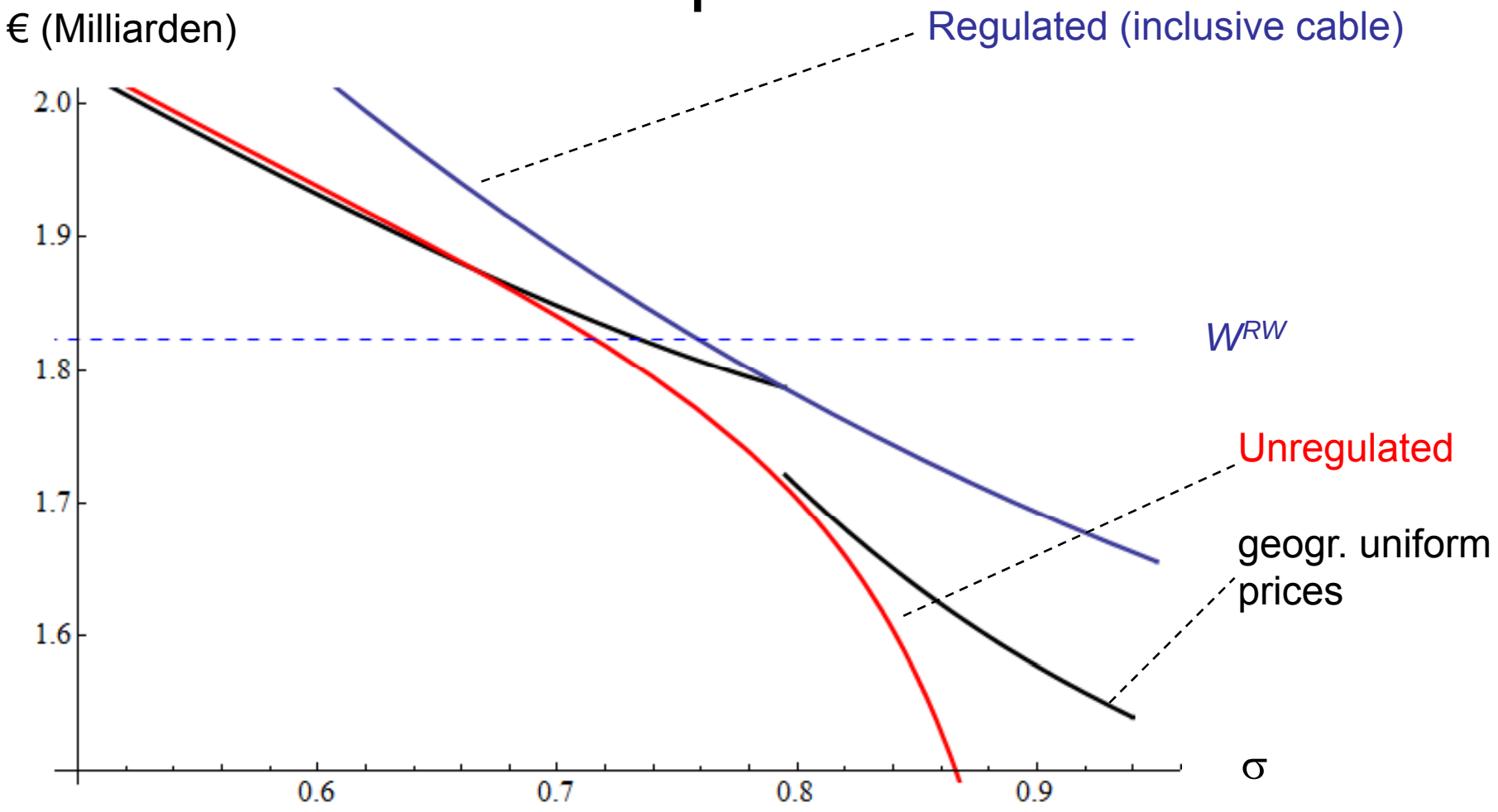


- If products are close substitutes

⇒ uniform pricing constraint as regulatory safeguard

Welfare under facilities-based competition



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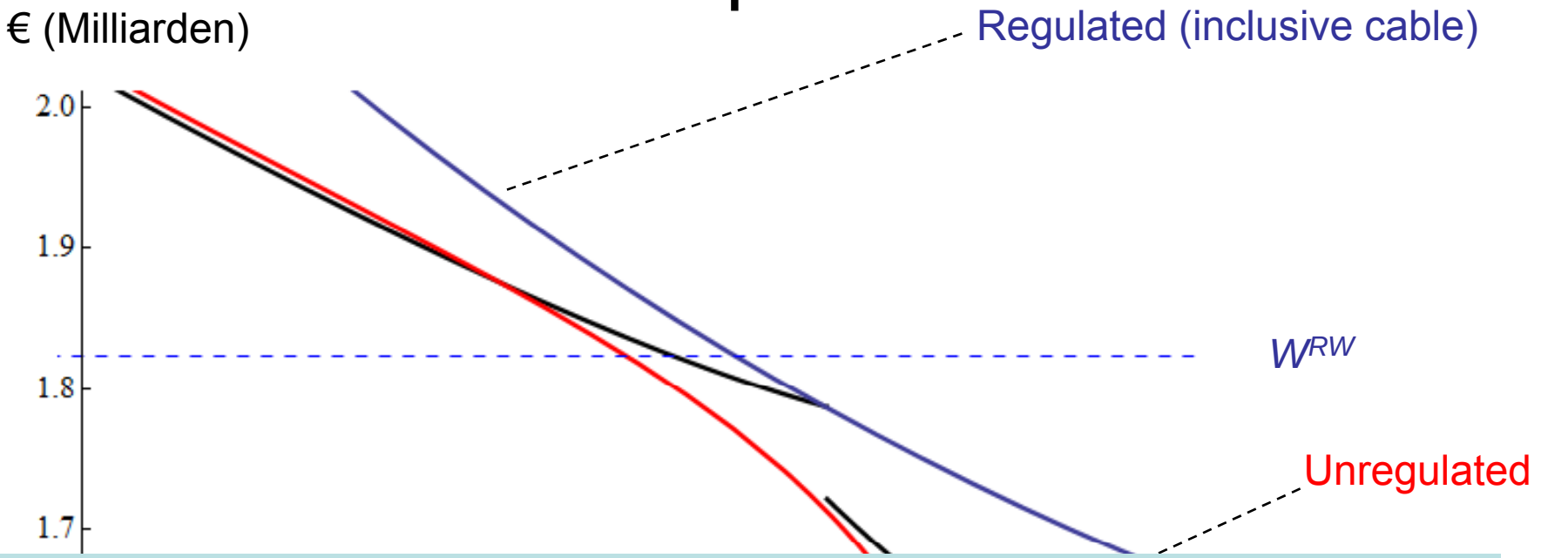
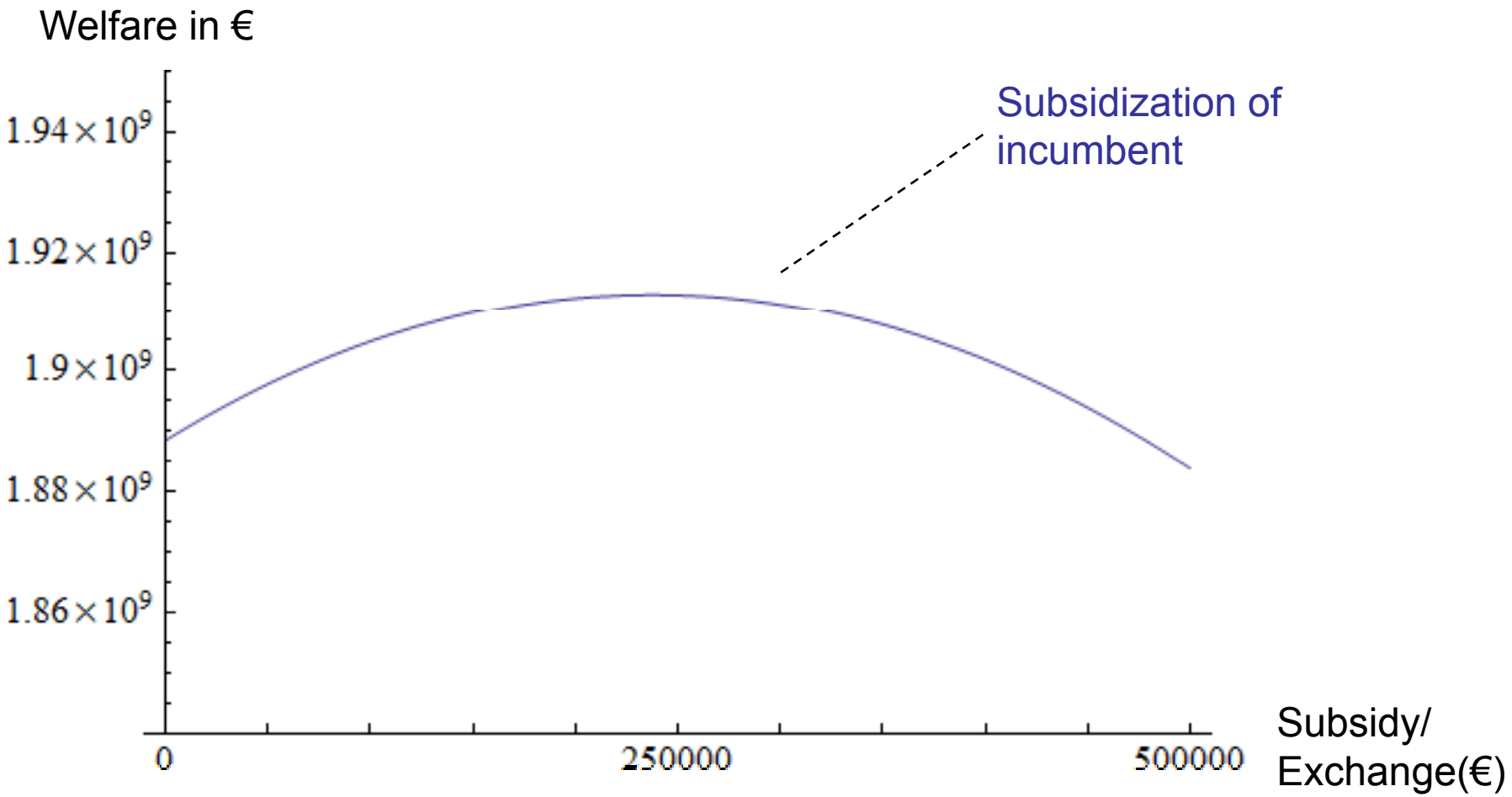


⇒ Differences in welfare are small.

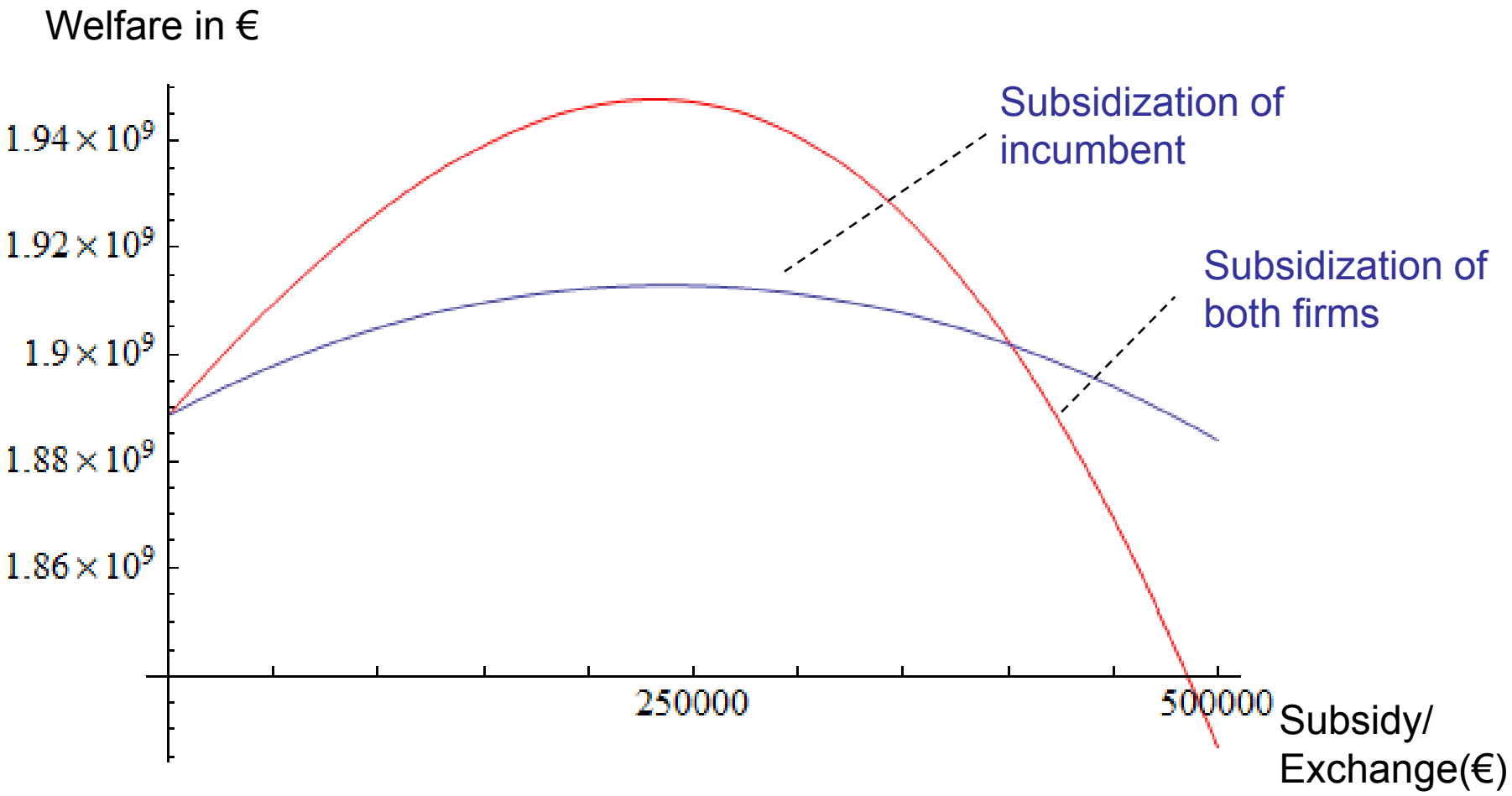
⇒ Even regulation by an omniscient and benevolent regulator cannot improve much on the unregulated situation

⇒ Important: Licensing of potentially competing network

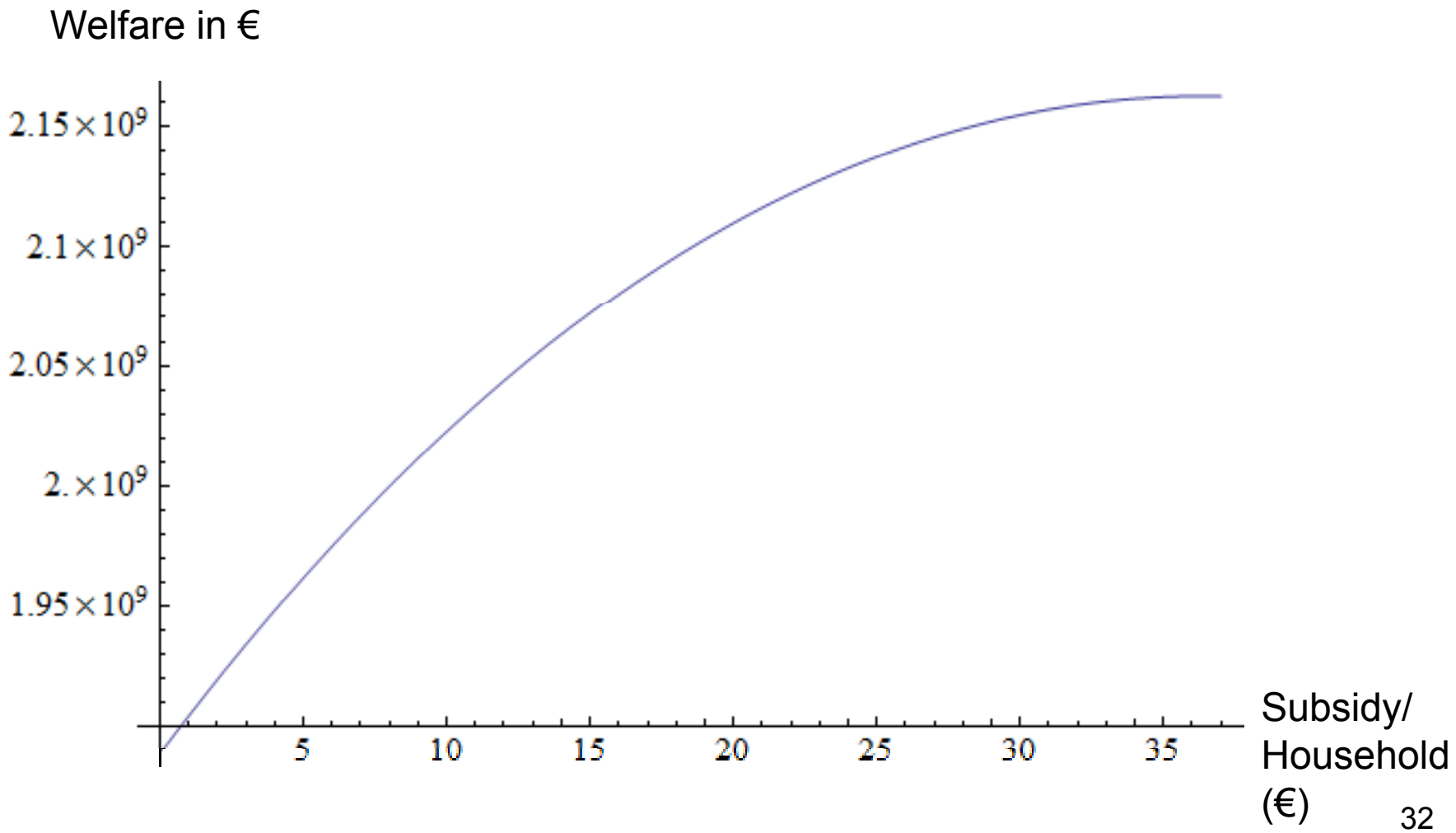
Subsidizing broadband access – supply side



Subsidizing broadband access – supply side



Subsidizing broadband access – demand side



Conclusions

- Low prices are “costly” :
  - Negative effect on investment
  - Regions with low population density are particularly bad off
  - Cost oriented, geographically uniform prices destroy incentives to invest
- Negative effects of policy focusing on service-based rather than facilities-based competition cannot be compensated by optimal regulation of “bottleneck”
  - Problem if (horizontal!) networks are not unbundled
  - Licensing of potentially competing network infrastructures to incumbents

Conclusions

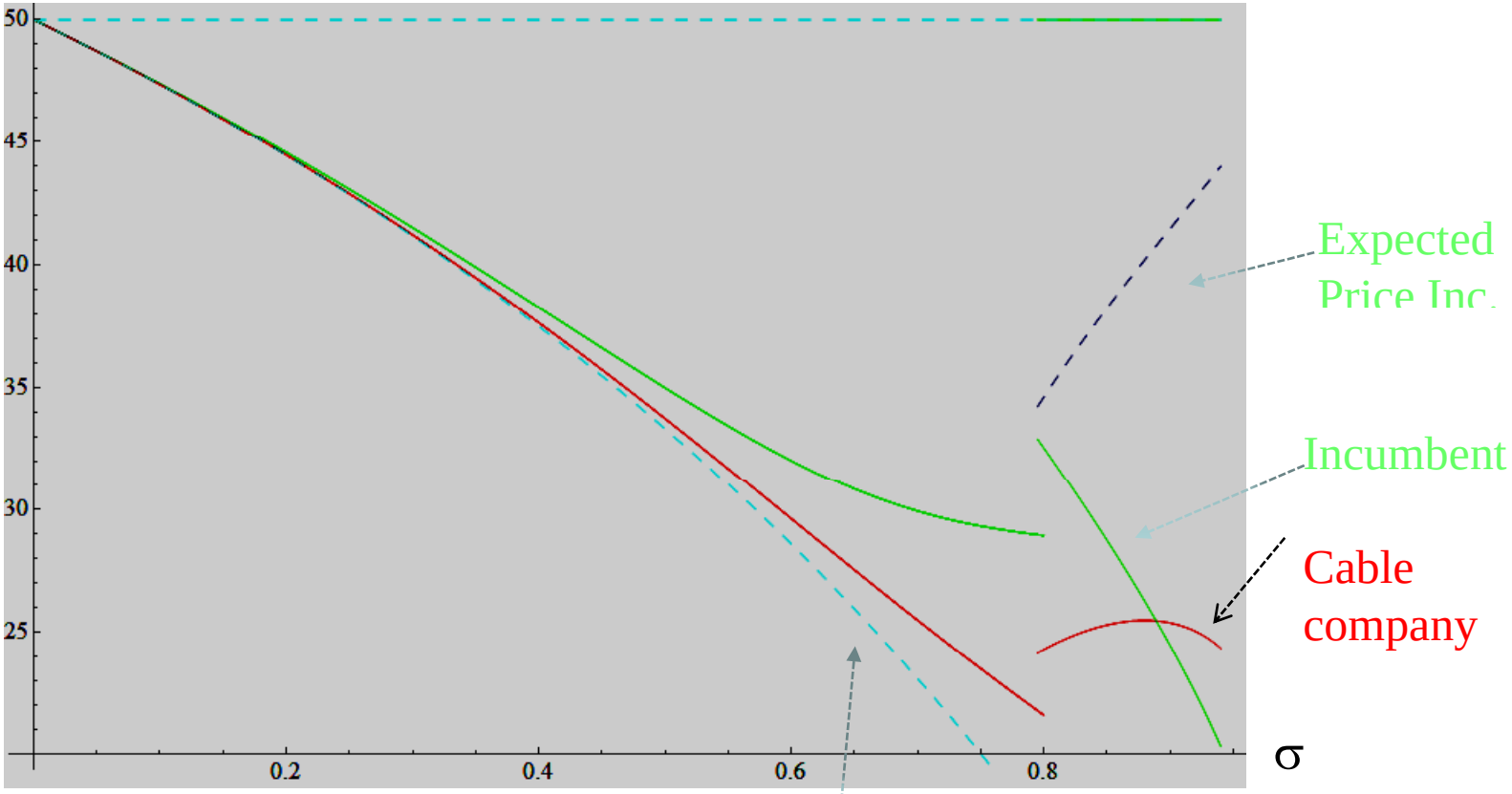
- Simple regulatory rules as “safeguards”
  - (e.g. geographically uniform prices as an instrument to provide “predation”/entry deterrence by incumbent

  $\Rightarrow$ Minimal invasive regulation to ensure effective competition!
- Welfare (in the model) is only slightly higher under “optimal” (benevolent, omniscient and costless) regulation than under facilities-based (platform) competition
  - Uncertainty and asymmetric information
  - Regulation is costly and produces regulatory risk

$\Rightarrow$ If facilities-based competition is “possible”, desirability of regulation (except safeguards) less than obvious!

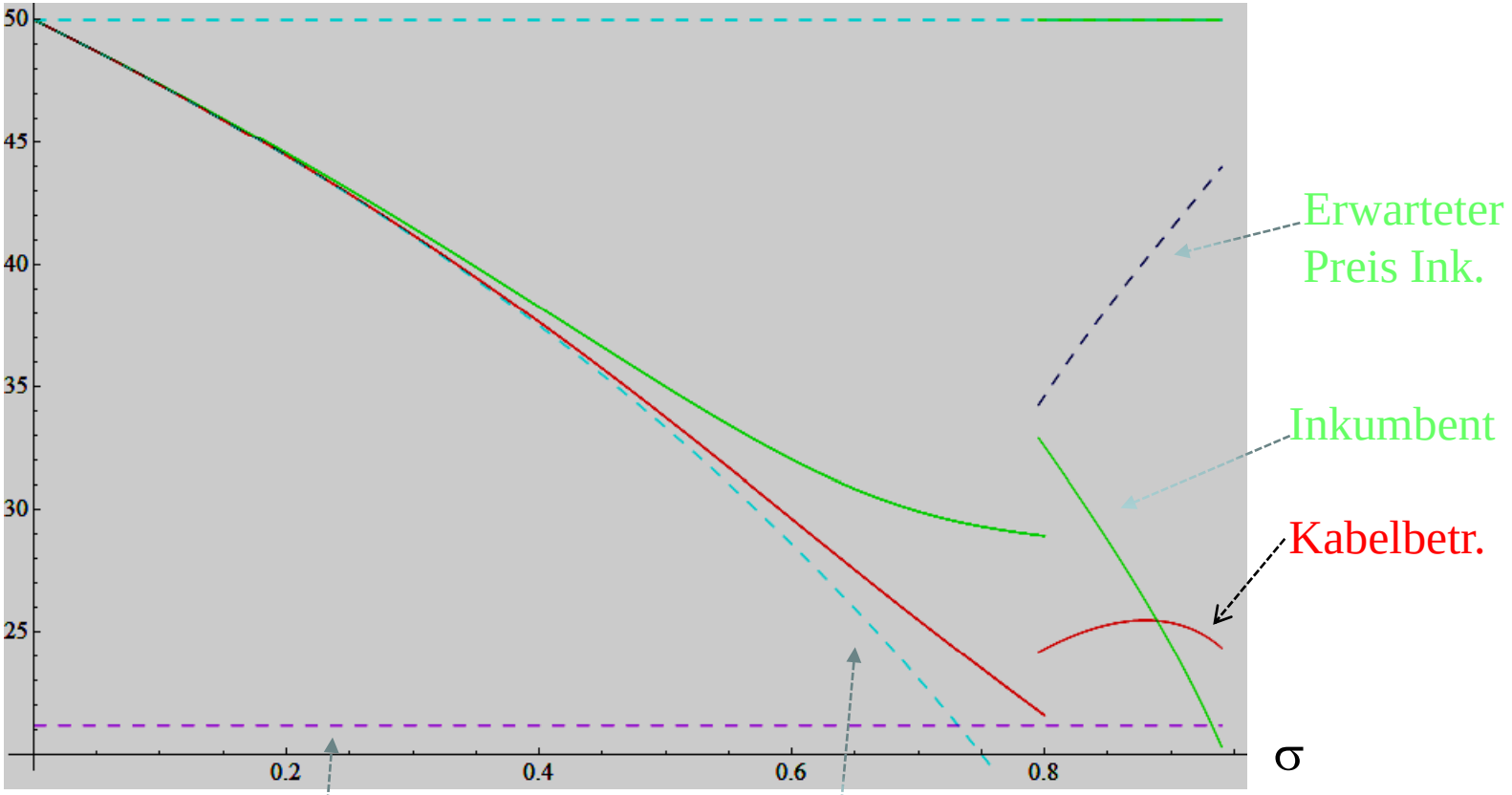
Prices and intensity of competition – UP and unregulated prices

Price (€)



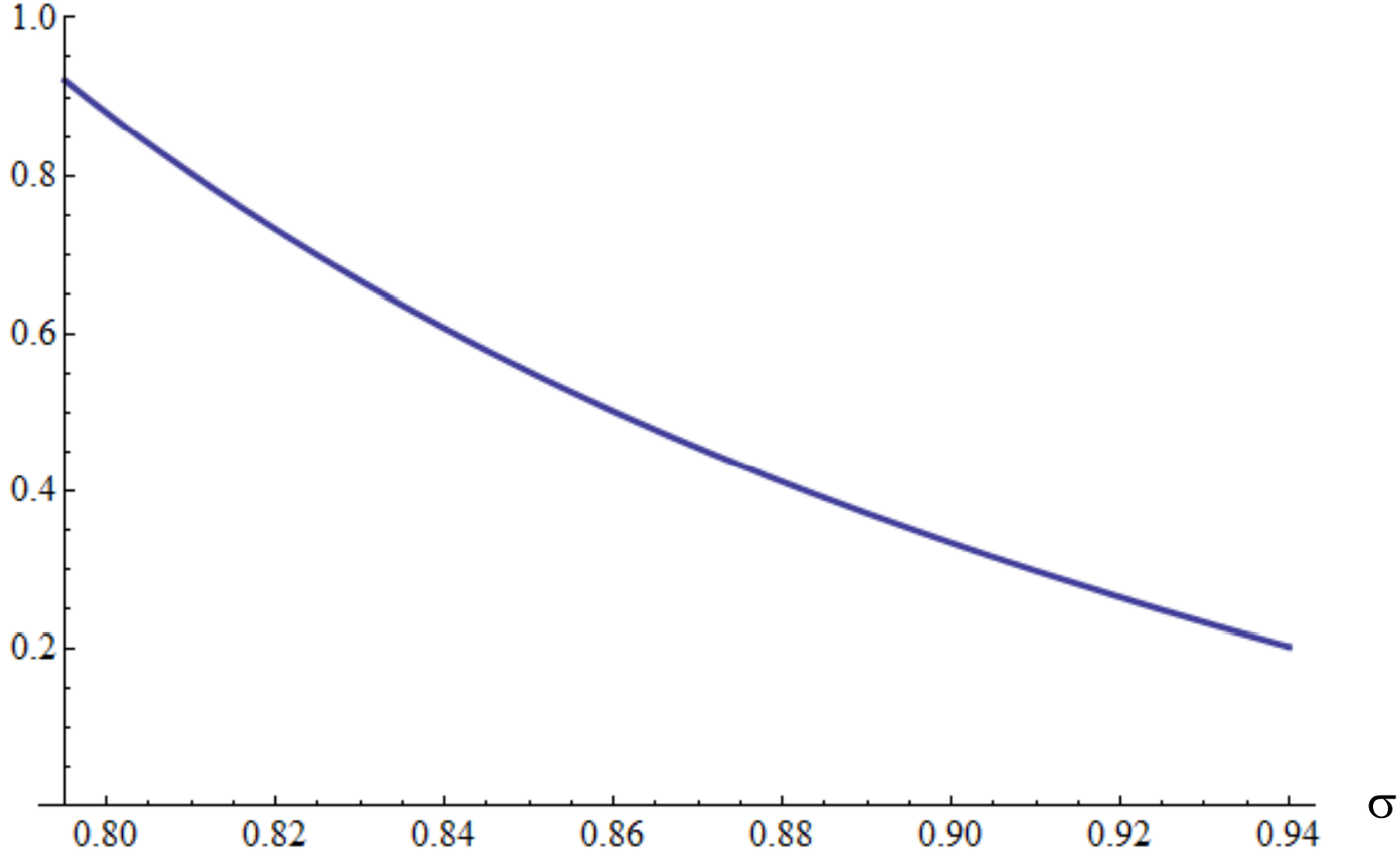
Prices and intensity of competition – UP and unregulated prices

Preis (€)

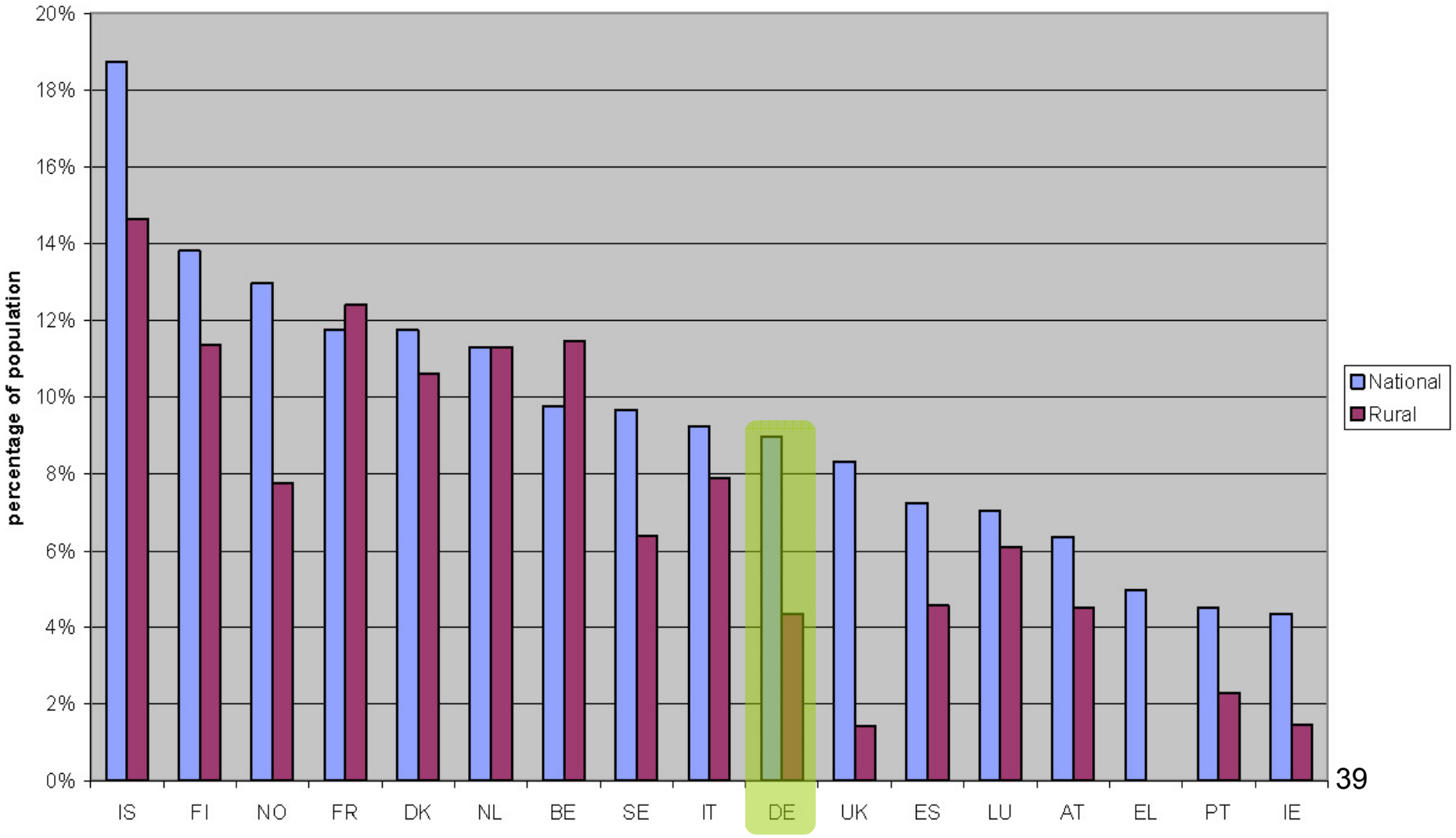


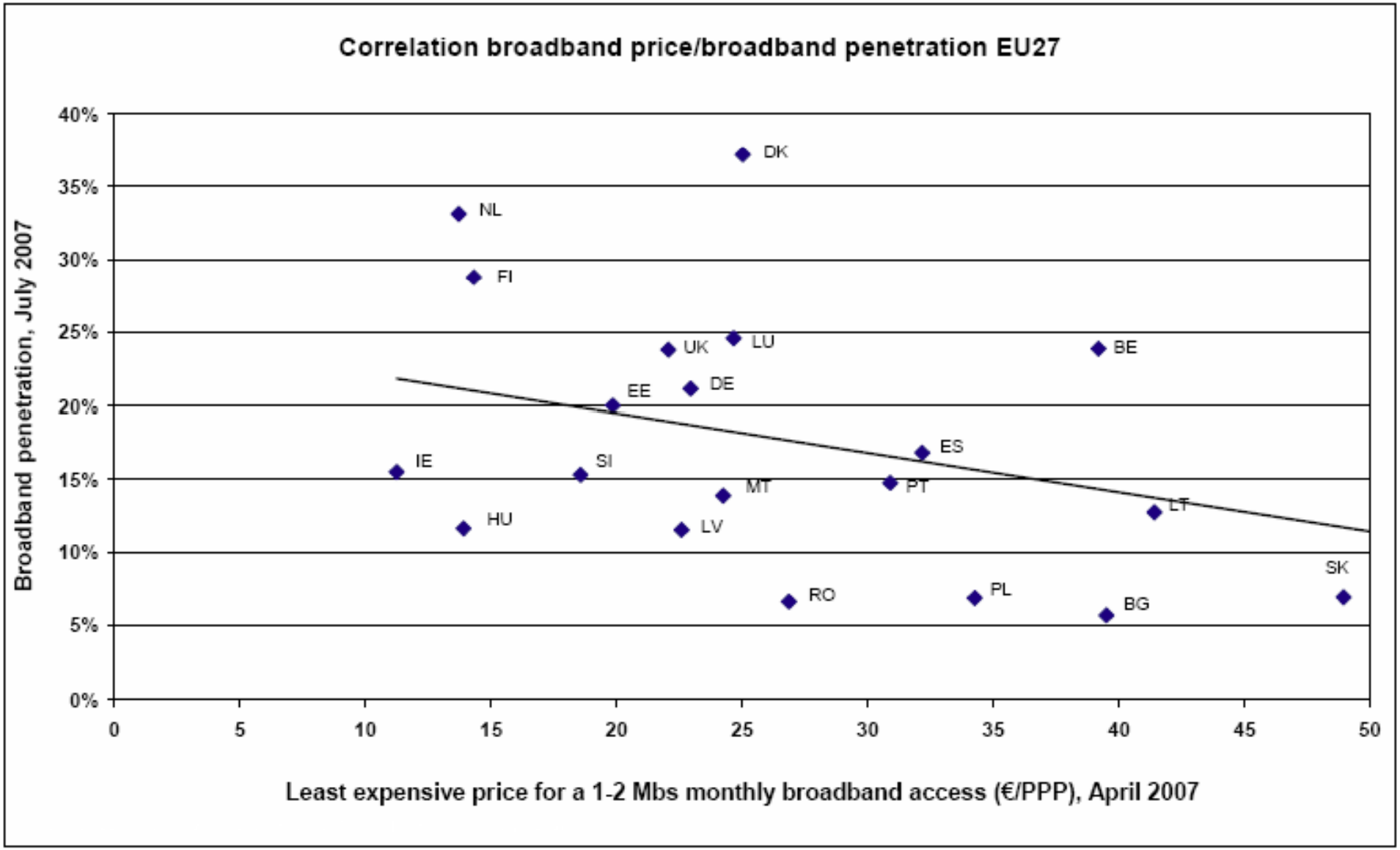
Mixed strategy equilibrium under geographically uniform prices

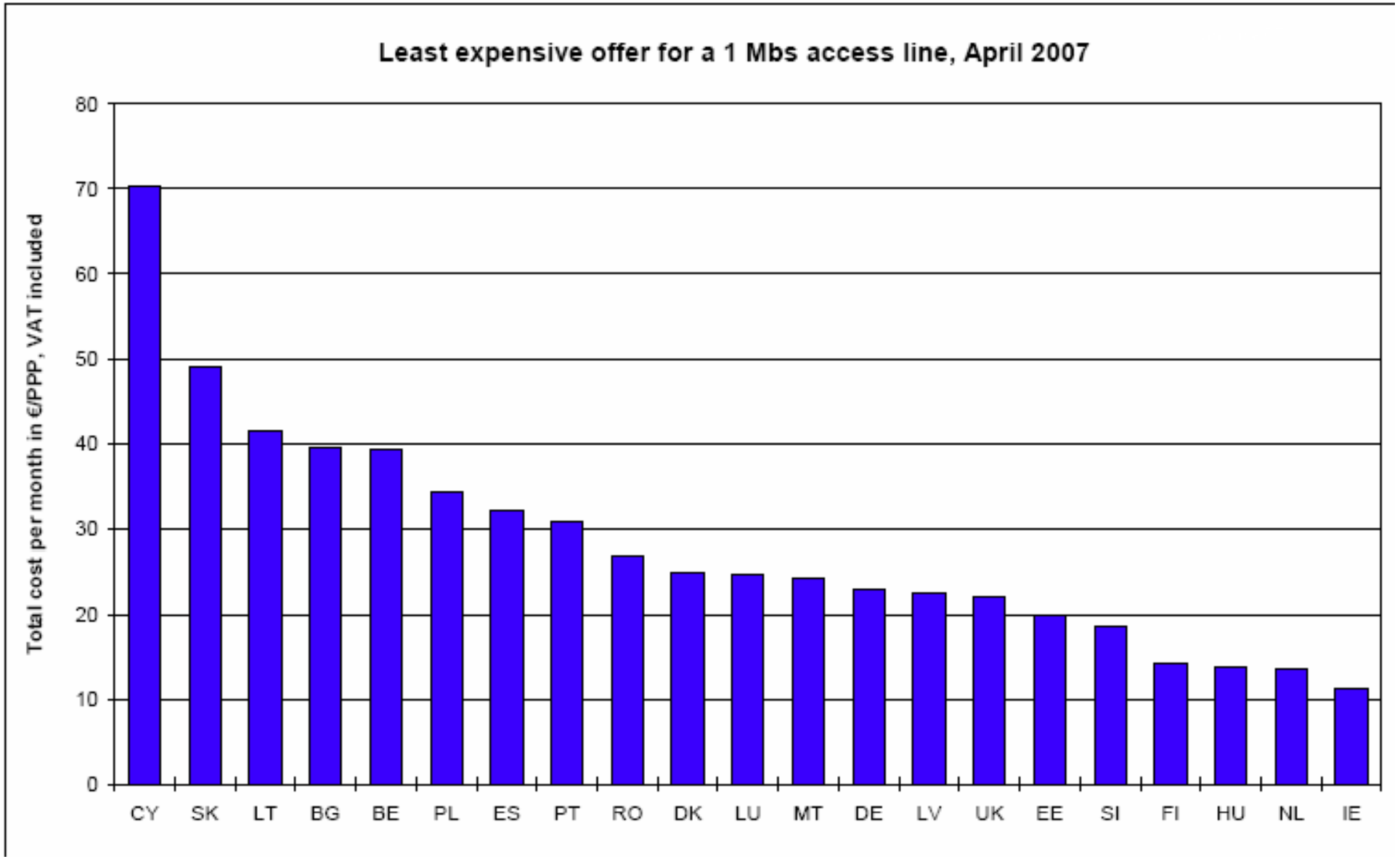
Probability of serving metropolitan areas



DSL Penetration/Coverage ratio per country (January 2005)




Correlation broadband price/broadband penetration EU27
Broadband penetration, July 2007
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
5
10
15
20
25
30
35
40
45
50
DK
NL
FI
UK
LU
BE
EE
DE
ES
IE
SI
MT
PT
LT
HU
LV
SK
RO
PL
BG
Least expensive price for a 1-2 Mbs monthly broadband access (€/PPP), April 2007


Least expensive offer for a 1 Mbs access line, April 2007
Total cost per month in €/PPP, VAT included
80
70
60
50
40
30
20
10
0
CY
SK
LT
BG
BE
PL
ES
PT
RO
DK
LU
MT
DE
LV
UK
EE
SI
FI
HU
NL
IE