

Using **COMPETES** to Analyze Geographic Markets and Mergers

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Outline

1. Objective and introduction
2. Description of the COMPETES (COMprehensive Market Power in Electricity Transmission and Energy Simulator) model
3. Comparison with Brattle Annual Model
4. Example application of COMPETES to geographic market delineation
5. Conclusion

1. Objective and Introduction



Objective

- Objective of geographic market analysis (SSNIP): Delineate relevant market for use in merger analysis
- Objective of merger analysis: Determine whether proposed merger would significantly affect competitive conditions
- Objective of talk: Demonstrate how COMPETES can delineate geographic markets and analyze mergers

Logic of merger analysis

Geographic market analysis (SSNIP Test):

- *Given demand elasticities, transmission constraints, supply data ...*
- *Then, for a candidate market area, determine if “hypothetical monopolist” could profitably raise prices by 5-10%*

↓ Geographic market

Proposed Merger →

For assumed market & merger, calculate and interpret:

- *Pivotal supplier / Residual Supply Index*
- *Concentration index (HHI)*
- *Oligopolistic equilibrium*

↓ Recommendation

Logic of merger analysis

Focus of this presentation



Geographic market analysis (SSNIP Test):

- *Given demand elasticities, transmission constraints, supply data ...*
- *Then, for a candidate market area, determine if “hypothetical monopolist” could profitably raise prices by 5-10%*



Geographic market

2. Description of the COMPETES model



Scope of COMPETES

- The COMPETES model version 2.0 is a simplified version of Hobbs et al (2004a,b), which had multiple nodes per country
 - Assumes no congestion within countries
 - But that can be modeled
- COMPETES 2.0 covers 20 countries, namely: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK/England & Wales.
- Calculates the simultaneous equilibrium outcomes under perfect and strategic competition and various conjectures considering:
 - Demand price elasticity
 - Transmission constraints
 - Short run variable costs.

Generation assumptions

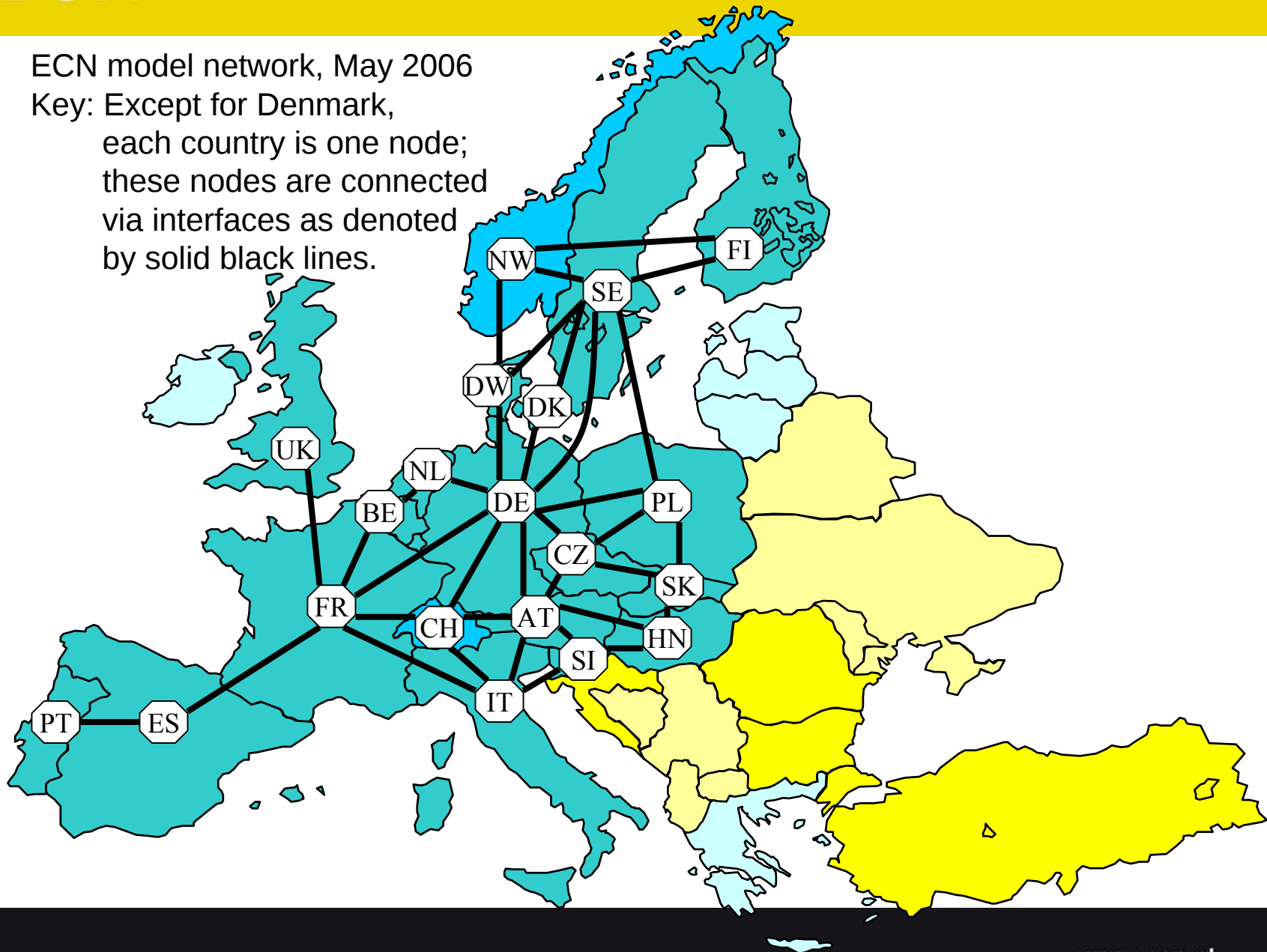
- COMPETES model represents ~25,000 power plants, with data on capacity, production technology, owner.
- Availability, efficiency, CO₂ emissions, fuel costs are collected from other sources (EU20 uniform)
- Firms can own power plants in various countries and thus have *active* cross-border ownership relations
- The year has 12 demand periods: super peak, peak, shoulder, off peak; winter, summer, midseason

Transmission assumptions

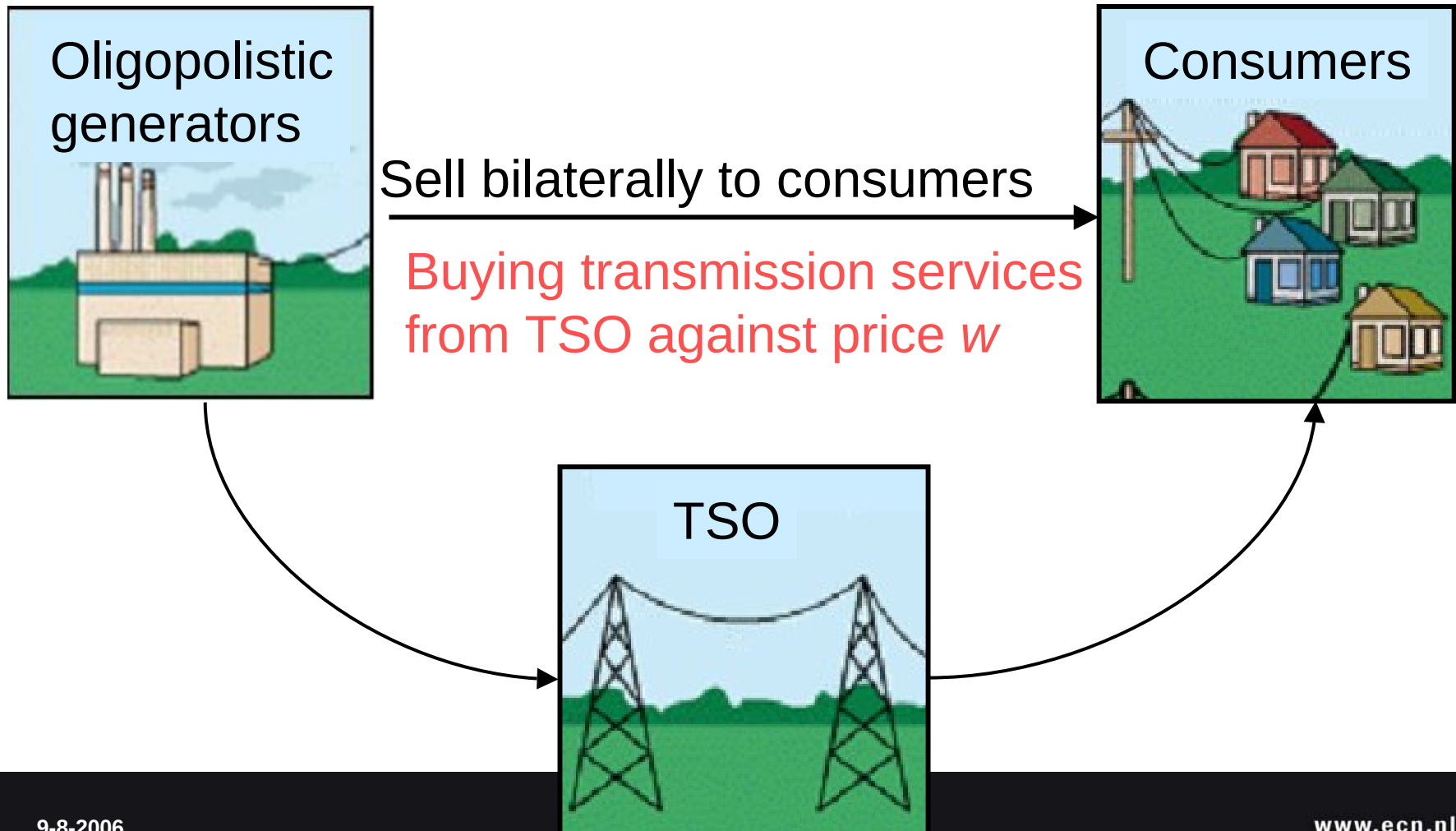
- Affine demand curves based on assumed elasticities
- Trade among the twenty countries is delimited by inter-connector transmission capacity
 - Either a path-based or network load flow formulation
- Transmission losses ignored
 - but could be included

ECN model network, May 2006

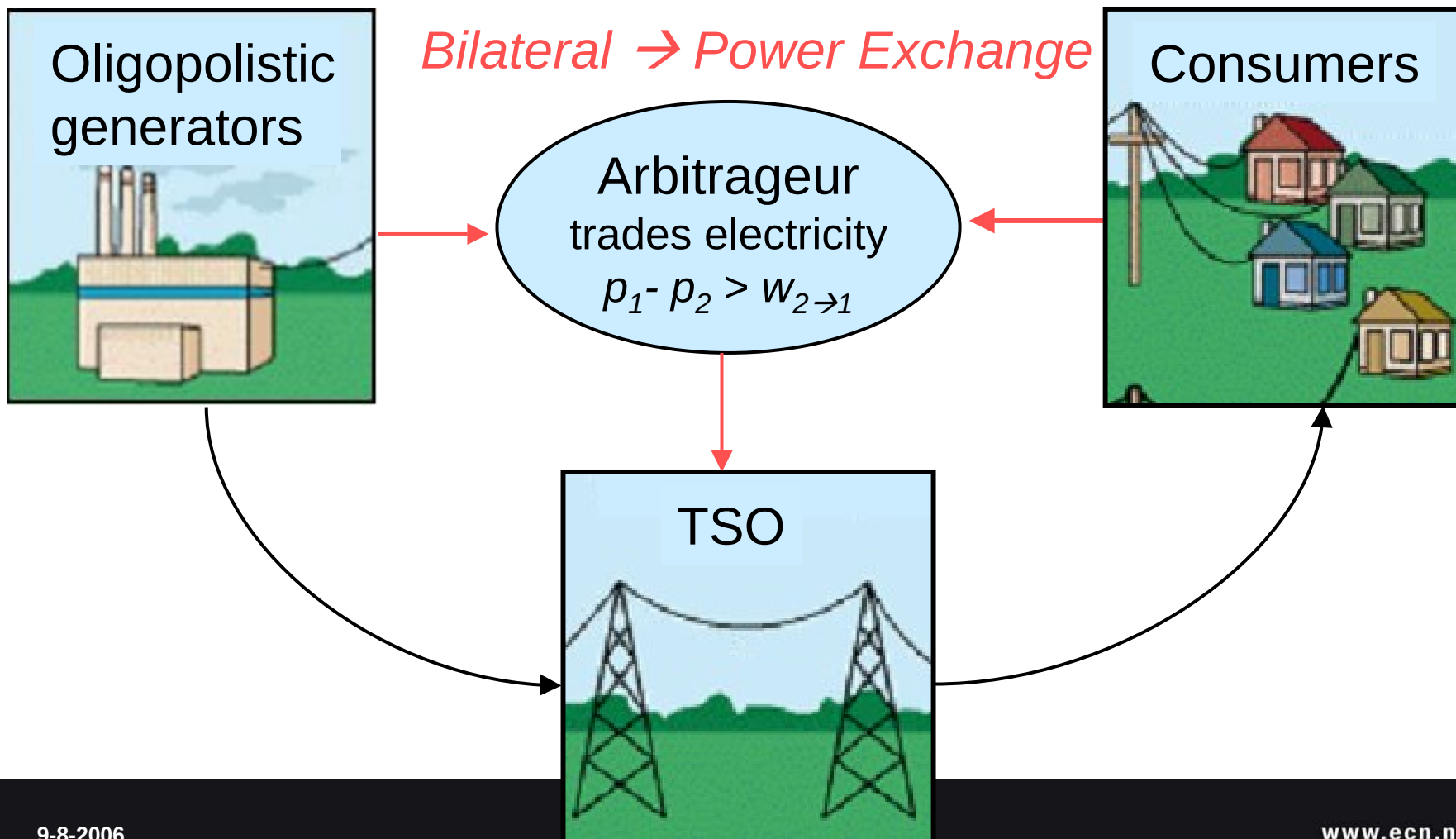
Key: Except for Denmark,
each country is one node;
these nodes are connected
via interfaces as denoted
by solid black lines.



Market structure - Transmission operator



Market structure - Arbitrageur



Mathematical formulation and properties

Methodology

- Derive the first-order conditions for each player
- Formulate market clearing conditions
 - Including markets for transmission, energy, emissions allowances
- Solve resulting system of conditions (“Complementarity Problem”)

Properties of model

- Complementarity solver efficiently solves large problems (thousands of variables)
- Price equilibrium provably exists and is unique

3. Comparison of COMPETES and Brattle Annual Model (BAM)



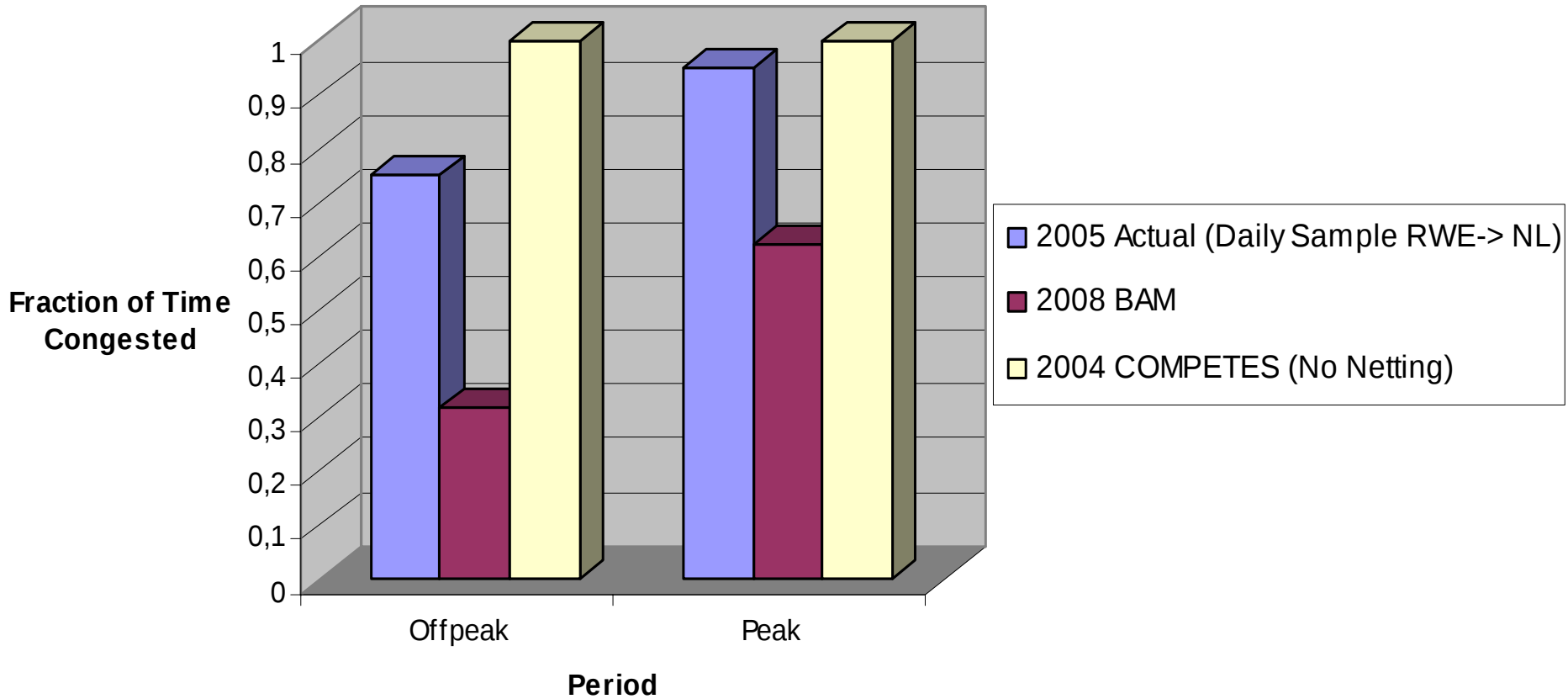
Comparison of features

<u>Feature</u>	<u>BAM</u>	<u>COMPETES</u>
Markets	4 or 5 countries	20 countries; can have within-country congestion
Transmission constraints	NL-D and NL-BE constraints only (iterative solution)	All constraints, including NO-NL, UK-NL, & nomograms (simultaneous solution)
Effect of Netting in Market Coupling	Does not consider "no netting" in Cournot solution	Can have either "netting" or "no netting"
Demand elasticity	Iterate between supply and demand models	Simultaneous demand-supply solution
Mark-up calibration	All players have same mark-up	Mark-up can be either same for all players, or proportional to sales
Cournot solution	Single market; iterative solution	Transmission constrained, simultaneous for all markets
Carbon trading	Exogenous price	Could be endogenous

Significance of differences for SSNIP

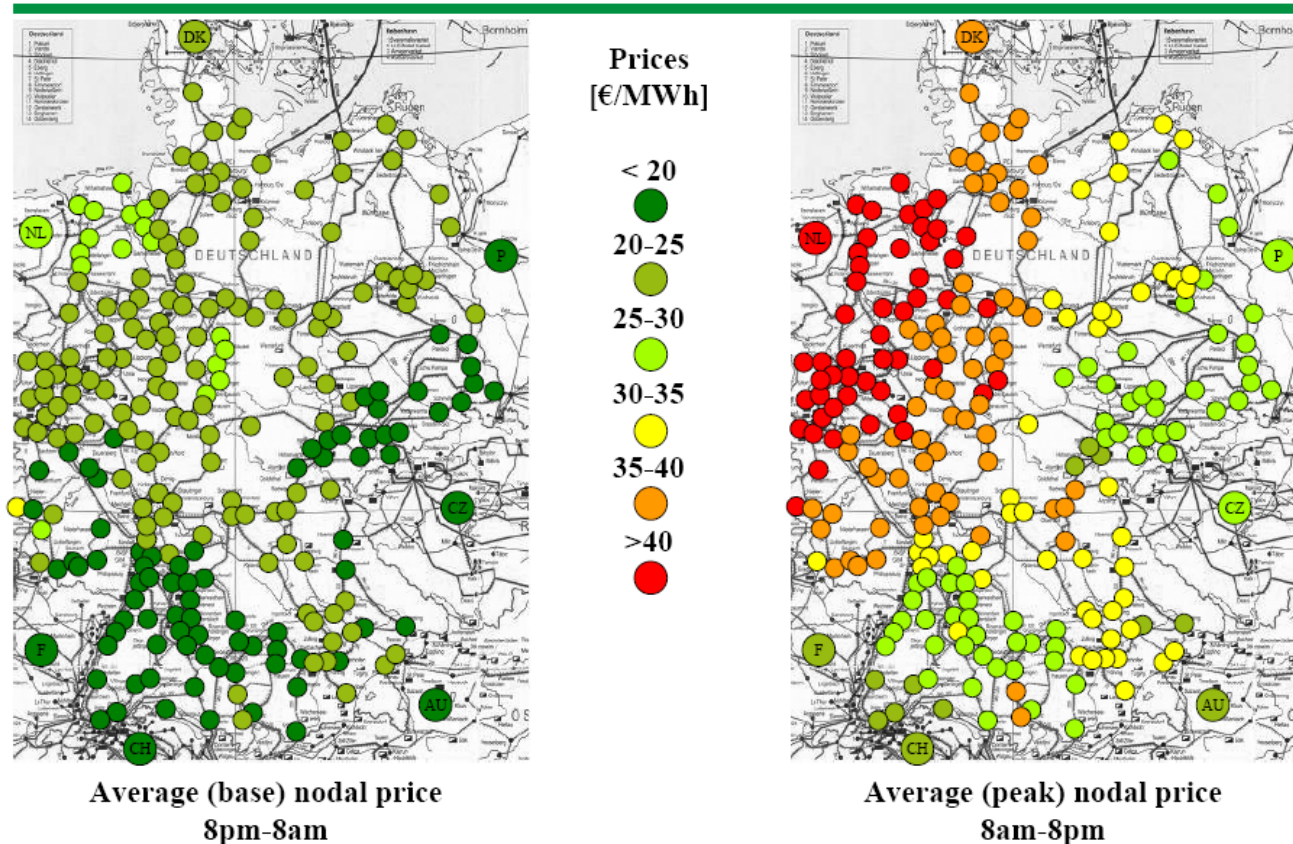
- Disregarding other countries could understate elasticity of import supply
⇒ *Estimated geographic market may be too small*
- Disregarding internal congestion and “no netting” could inflate elasticity of import supply (see next slides)
⇒ *Estimated geographic market may be too large*
- Assuming the same mark-up for all generators
⇒ *Possibility of distorted market shares in base case*
- Iterative solution procedure makes simultaneous consideration of transmission, energy, demand elasticity, and carbon markets less convenient
⇒ *Or even impossible for continental-wide market*

Frequency of congestion D→NL



Evidence of internal German congestion

Nodal prices in Germany (winter)



Source: Hannes Weigt, Technische Universität Dresden, personal communication. See: H. Weigt, K. Freund, Till Jeske, "Nodal Pricing of the European Electricity Grid - A Welfare Economic Analysis for Feeding-in Offshore Wind Electricity," WP-GE-10, www.tu-dresden.de/wwwbleeg/publications/wp_ge_10_freund_weigt_jeske_nodal_%20pricing_nw_europe.pdf

Significance of differences for merger evaluation

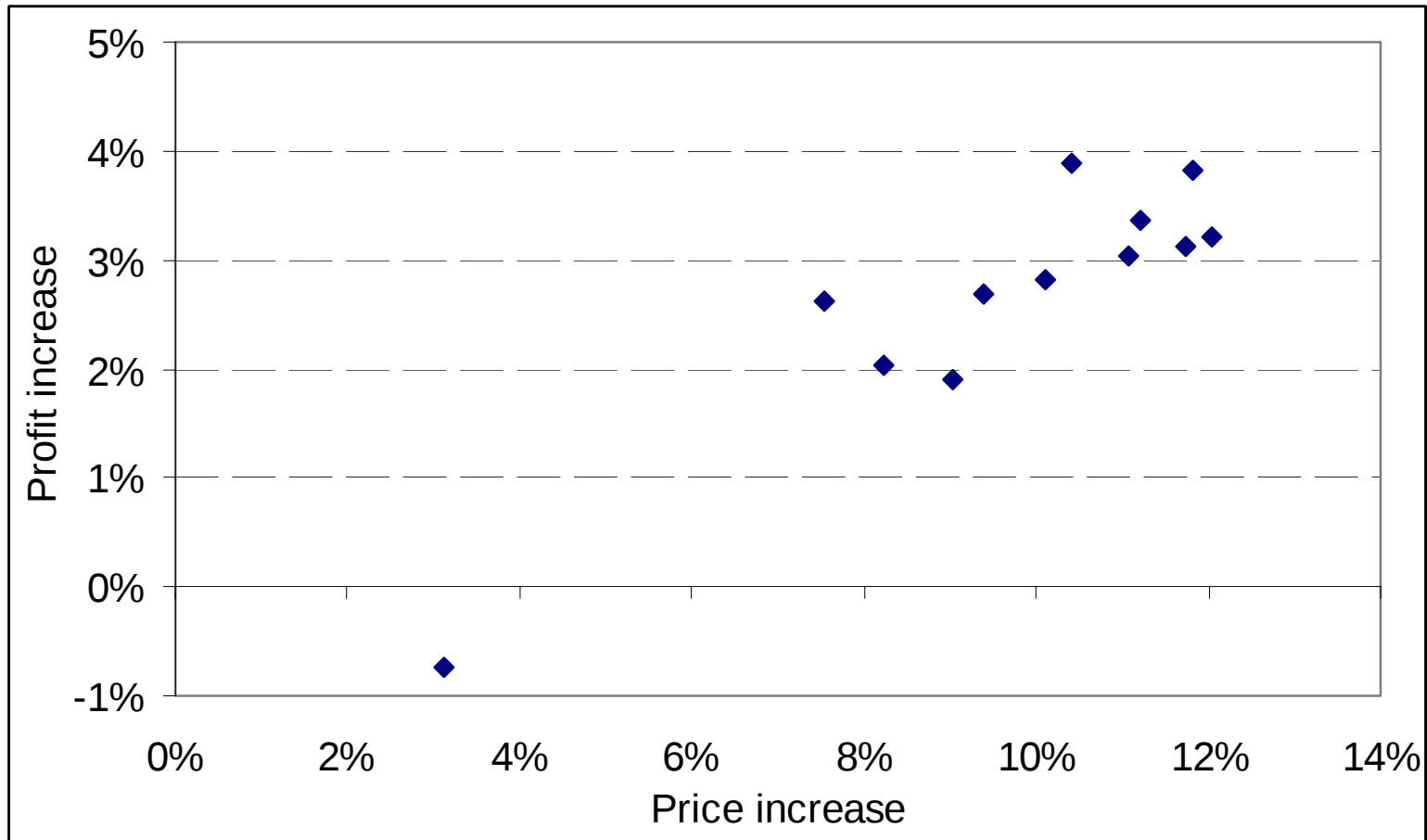
- Different geographic markets (especially off-peak) could affect conclusions
⇒ Possible over- or understatement of competitive effects
- Different treatment of transmission (“no-netting”, market access) could affect degree of competition within geographic market
⇒ Possibility of different conclusions from Cournot model

4. COMPETES SSNIP Results



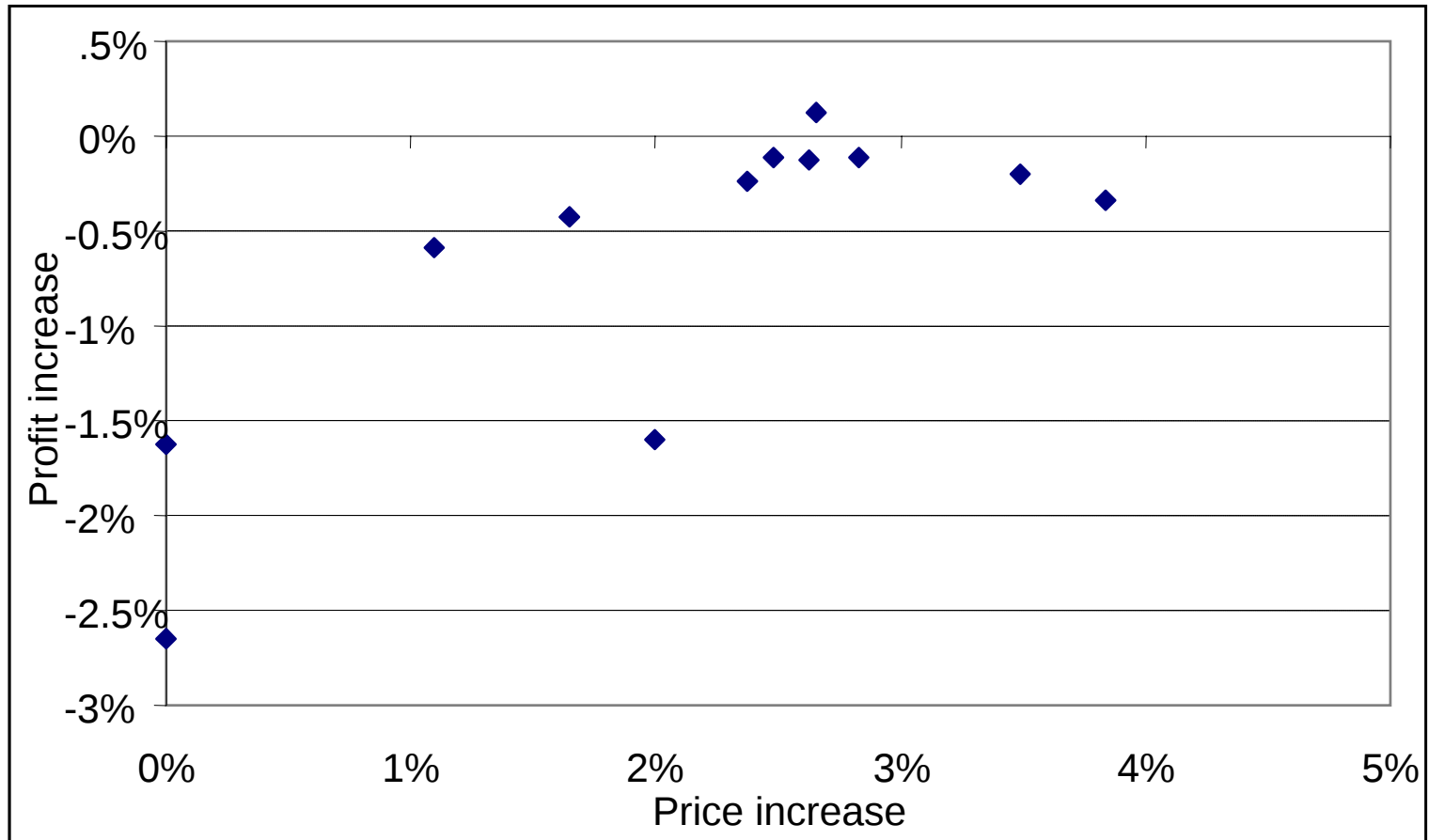
Change in profit and price of hypothetical Dutch monopolist

The case of explicit auction, mark-up increased in NED to 0.5



Change in profit and price of hypothetical Dutch monopolist

The case of market coupling, mark-up increased in NED to 1.0



5. Conclusions

- Market size depends on congestion management
 - *Market coupling vs Explicit auction*
 - *Market size is larger under Market coupling*
- Market size may be smaller due to:
 - *Internal German congestion*
- COMPETES can be used for market definition and merger evaluation
 - *Simultaneously account for multiple markets, demand elasticity, transmission allocation method and constraints*
 - *Transmission-constrained Cournot solution*



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The end

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