

# Differentiated Infrastructure Charging: A Comparison of Theory and Practice

Jasper Knockaert, Piet Rietveld  
Vrije Universiteit Amsterdam

Christos Evangelinos, Bernhard Wieland  
Technische Universität Dresden

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## Basic Research Question:

**A look at the differentiation of existing infrastructure charges in Europe – In how far does actual practice correspond to economic theory?**

- Cases from EU-Project DIFFERENT, 2006-2008, 6th Framework Programme
- Practice differs from theory
- In which respect and how much?
- How can the existing degree of differentiation be explained?
- Are there systematic patterns?
- Formulation and „testing“ of hypotheses possible
  - Normative economic theory
  - Positive economic theory

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## 27 Case studies:

- Airlines (5)
- Shipping (8)
- Railways (4)
- Road Haulage (4)
- Private Cars (6)

## Area covered:

- Whole of the EU
- Switzerland
- Norway

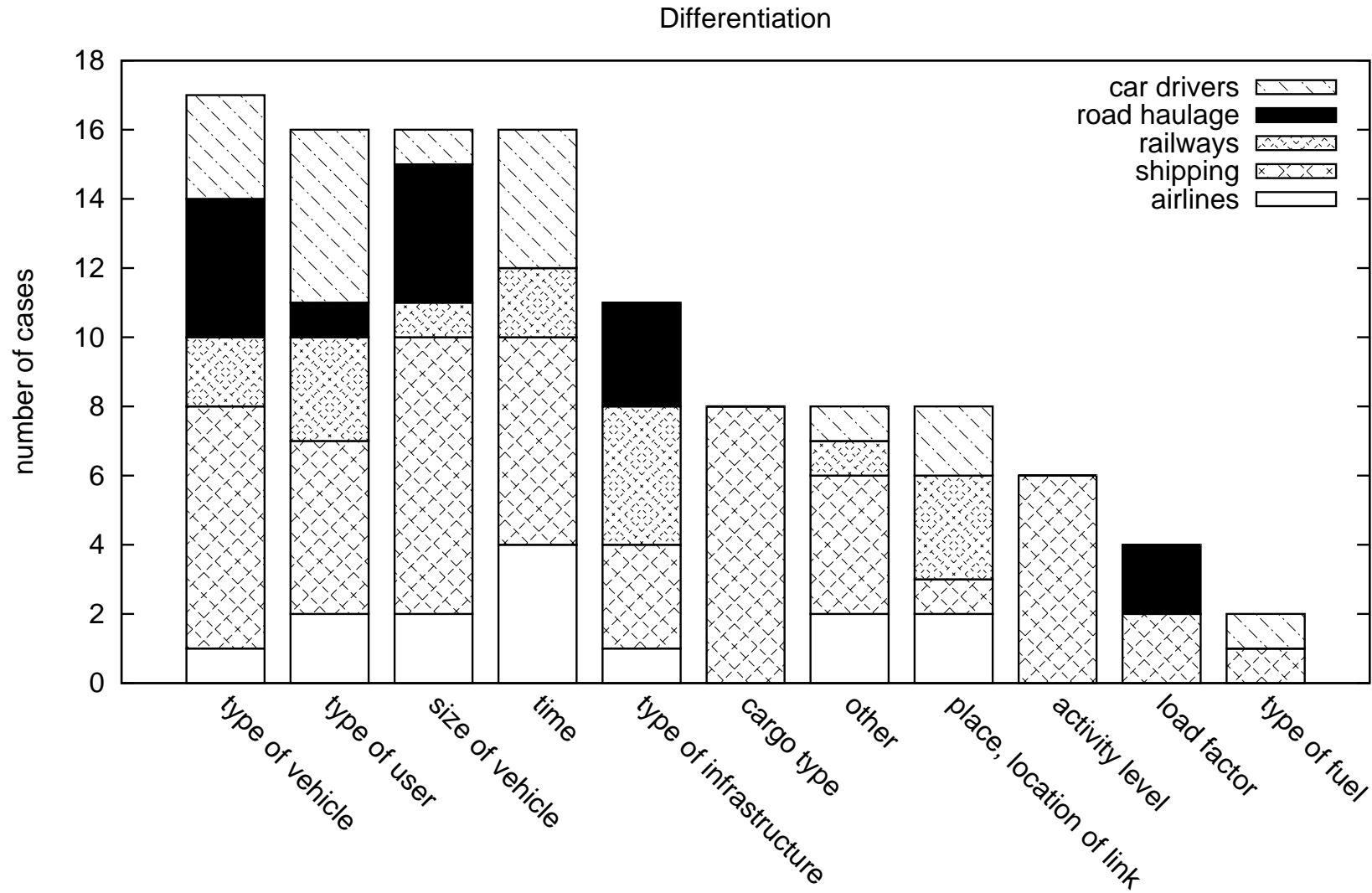
## Methodology:

- Factsheets
- „Delphi“ Study (for the „positive theory aspect“)

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## Dimensions of Price Differentiation Observed in the Case Studies:

- Type of Vehicle
- Type of User
- Size of Vehicle
- Time of Travel
- Type of Infrastructure
- Cargo Type
- Place, Location of Link
- Activity Level (mainly relevant for Ports)
- Load Factor
- Type of Fuel
- Other



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## A Measure for the Degree of Differentiation of a given price structure:

An **intuitive first attempt**: Count the number of dimensions

Counterargument: Two given price structures A and B may have the same amount of dimensions but A may be much more differentiated within one or more of these dimensions

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## Our own attempt:

### 1st step:

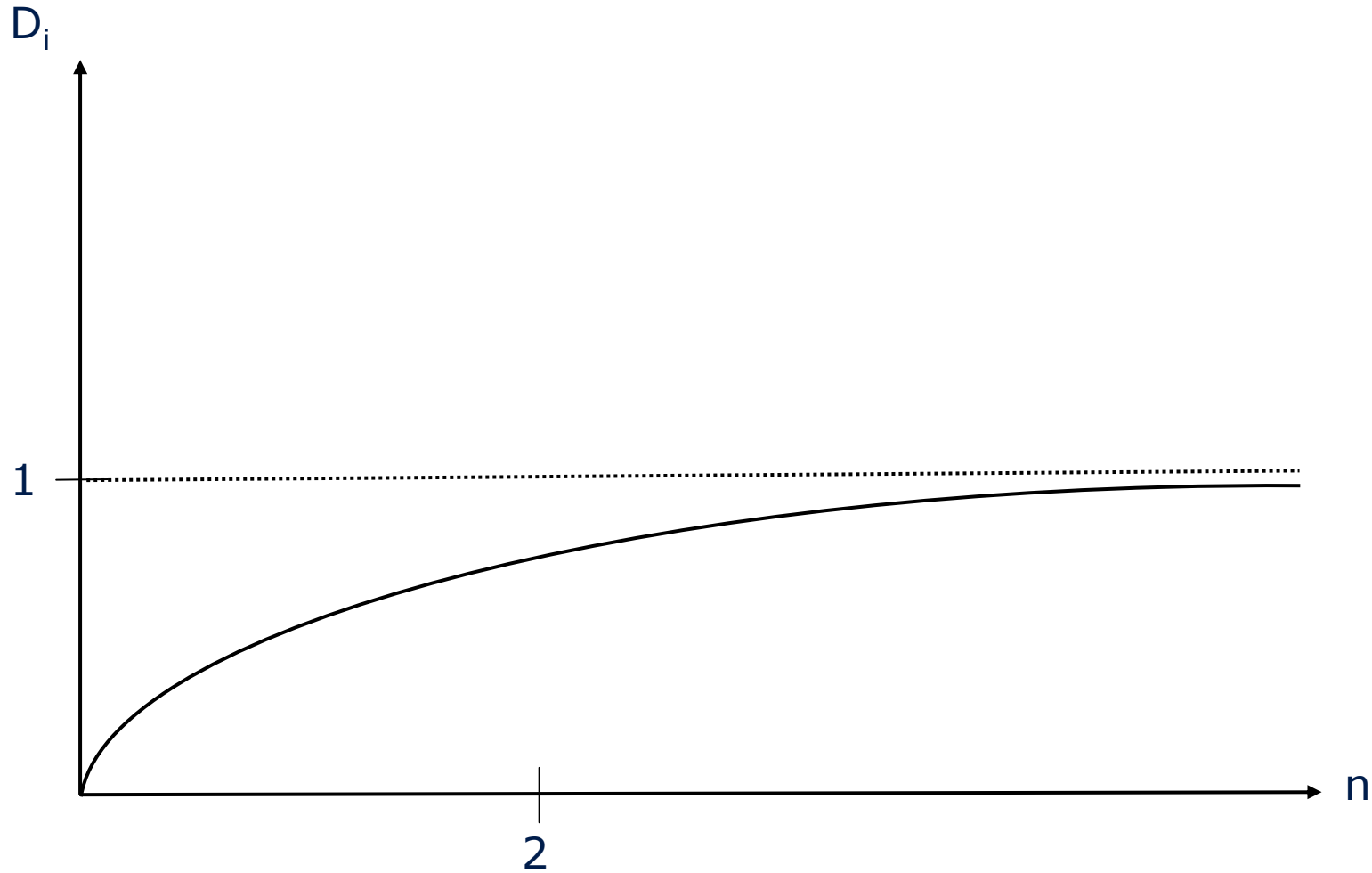
Price Differentiation **along dimension number**  $i$  :  $D_i = 1 - 1/n$   
with  $n$  = number of price levels,  $n > 0$

### 2nd step:

Degree of Differentiation of price-structure A:  $DP_A = \sum D_i$

### Properties (1st step):

- Two well defined extreme points (zero, unity)
- Concave („the first additional price level adds more to differentiation than the 999th“)
- Conforms to: Half of welfare maximum reached already with two price levels (Arnott, de Palma, Lindsey, 1993)





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## Obvious criticism:

### Implicit assumptions:

- Dimensions equally „important“
- No correlation between dimensions
- Why not one of the existing measures (Shannon-Entropy, Gini, etc.)?

## A further criticism

- Looking at Differentiation in the sense defined may be misleading:
- How to Control for Differences in the „Degree of Ambition“ of a Pricing Scheme (= the number of objectives being intended)?

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## Measure of „Degree of Ambition“ of a Pricing Scheme:

### Possible Objectives:

- Economic Efficiency
- Cost Coverage
- Environmental Goals
- Equity
- Profits
- Acceptability
- Competitiveness
- Safety
- Legislative Requirements
- Sustainability
- Other

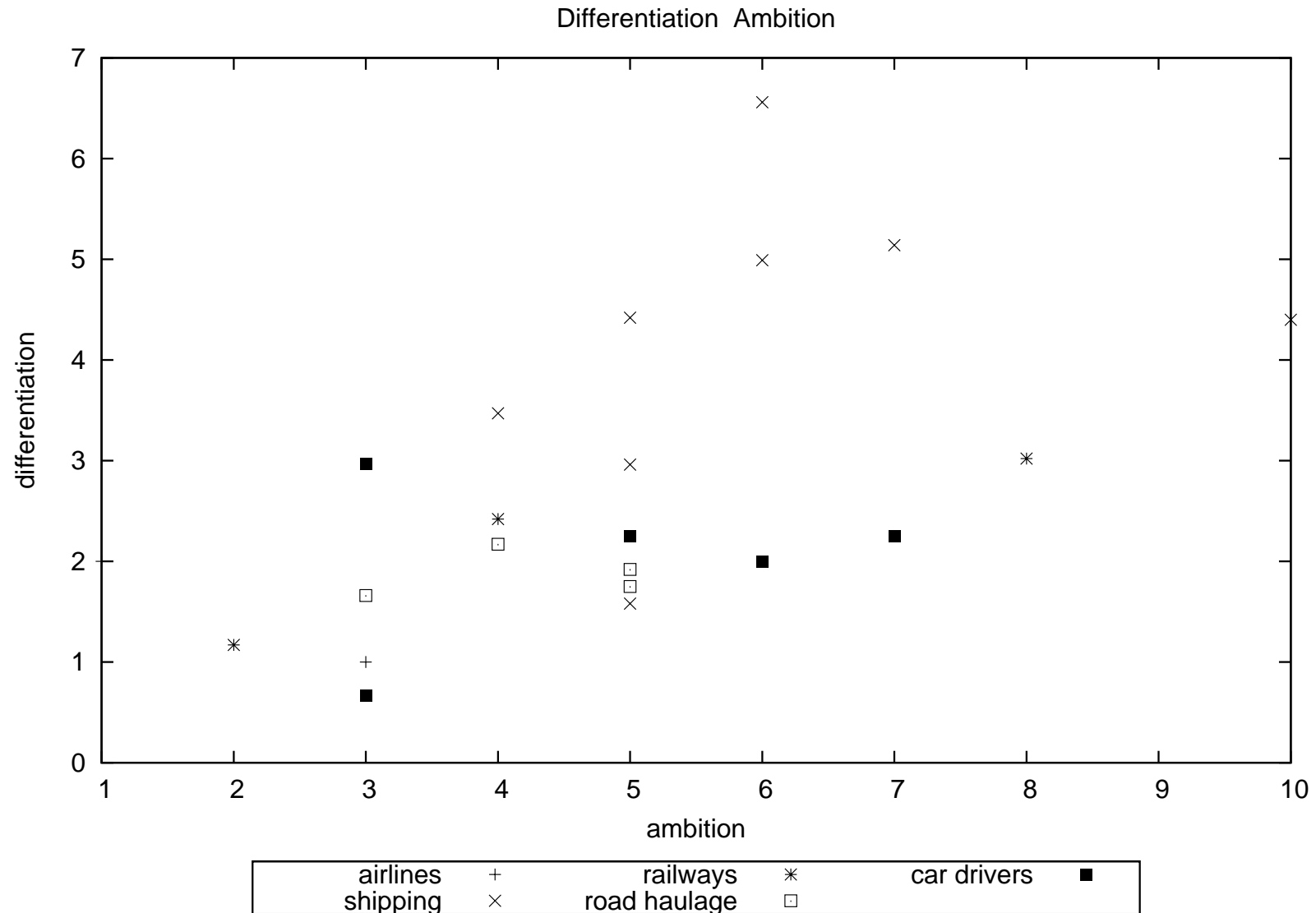
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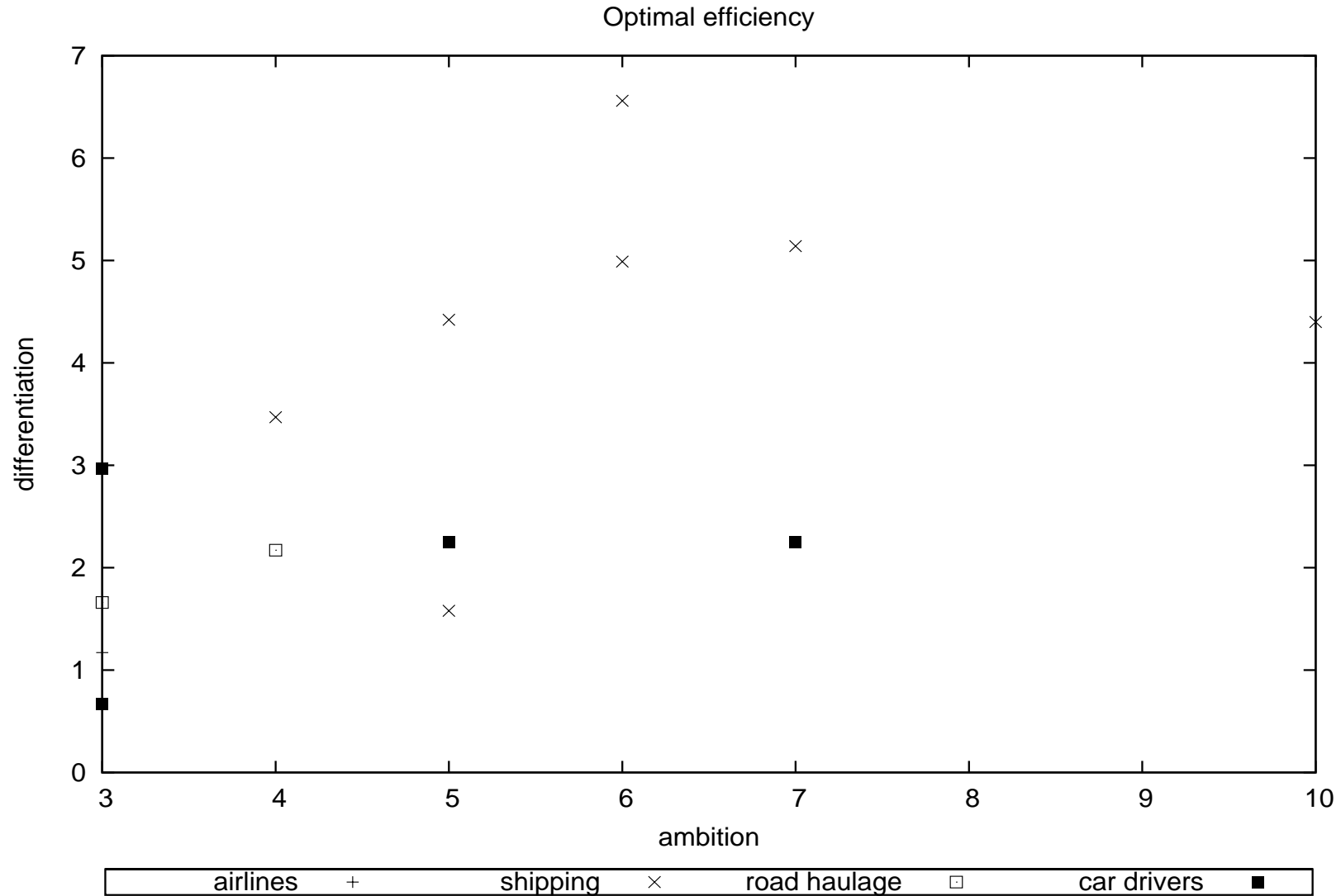
## Degree of Ambition of a Pricing Scheme: Number of Objectives Inherent in a Pricing Scheme

- Scale from 1-10

The following two Figures show a positive Trend between the two Measures of Differentiation and Ambition (as would be expected).

- The First Figure Shows *all* Case Studies
- The Second Figure omits all cases where the Influence of Interest Groups plays a role (as reported in the Fact Sheets)





Name of Case Study	Case Study Type	Degree of Ambition	Degree of Differentiation
Port of Amsterdam	shipping	6	6,6
Port of Hamburg	shipping	7	5,1
Port of Gothenburg	shipping	6	5,0
Lerwick - Shetland Islands	shipping	5	4,4
Port of Valencia	shipping	10	4,4
Port of Duisburg - (Duisport)	shipping	4	3,5
France rail infra charge	railways	8	3,0
Trondheim road charge	car drivers	3	3,0
Scalloway, Shetland Islands	shipping	5	3,0
Effects of differentiated charges at Airport Hamburg	airlines	1	2,7
German Railways	railways	4	2,4
Stockholm City	car drivers	7	2,2
London City Centre	car drivers	5	2,2

Name of Case Study	Case Study Type	Degree of Ambition	Degree of Differentiation
The German HGV Toll	road haulage	4	2,2
Edinburgh road pricing	car drivers	6	2,0
Brenner TEN-T (freight)	road haulage	5	1,9
Brenner TEN-T (passenger)	road haulage	5	1,8
Swiss Heavy Vehicle Fee (HVF)	road haulage	3	1,7
Sullom Voe, Shetland Islands	shipping	5	1,6
Ljubljana Airport Case Study	airlines	3	1,2
Rail infrastructure charges in Austria	railways	2	1,2
Spitsmijden	car drivers	3	0,7
London airports	airlines	3	
Madrid Barajas Airport	airlines	2	
Rail infrastructure charges in Britain	railways	2	
Gran Canaria Airport	airlines	2	
Rome road pricing	car drivers	1	

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## Results:

- Substantial differences among modes
- Highest degree of differentiation and ambition in the port cases (why?)
- Urban congestion schemes intermediate (Counterintuitive? Cognitive Burden!)
- No difference between freight and passenger



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## Hypotheses (Examples):

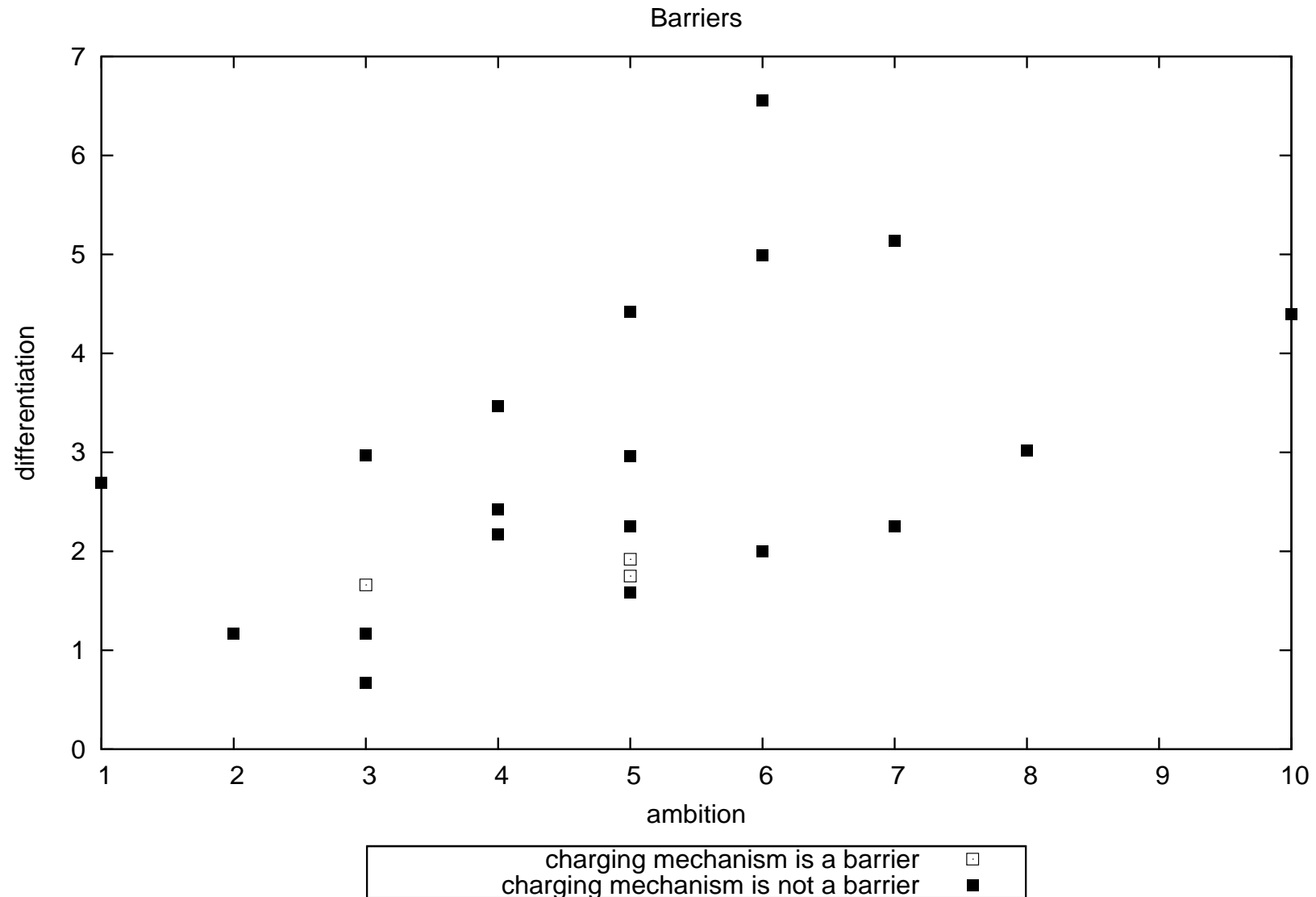
### A. Normative Economic Theory

#### A Confirmed Hypothesis:

„When the costs of price differentiated charging mechanisms are high for the price setting agents, they will choose simple (cheaper charging mechanisms as second best strategies“

Not as trivial as it sounds!

Correct for Degree of Ambition



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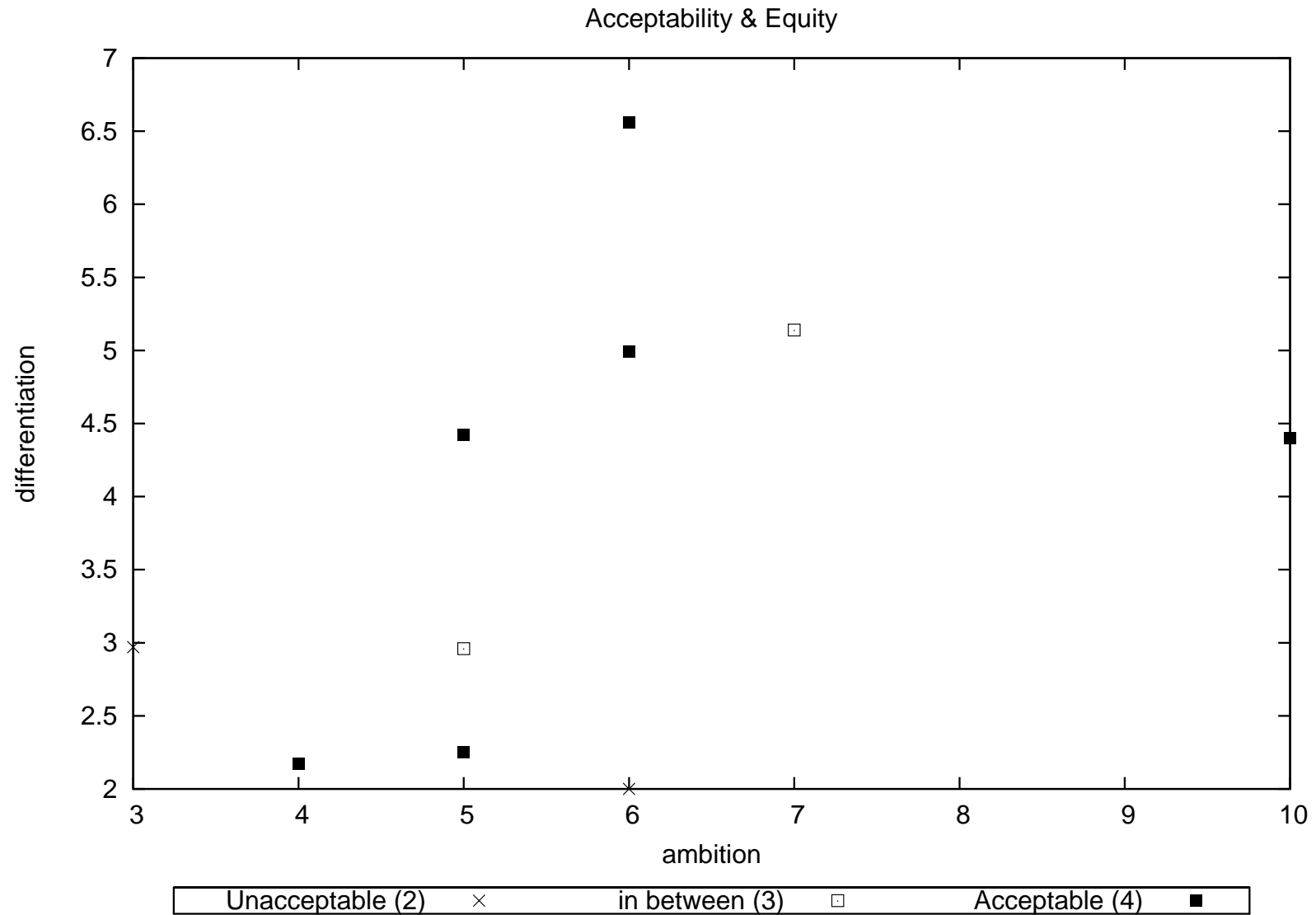
## Hypotheses (ctd.):

### A. Normative Economic Theory

#### A Refuted Hypothesis:

„In the case of equity oriented pricing policies, the level of acceptance of pricing increases with the degree of differentiation“

- The four cases with the highest acceptability occur at all levels of differentiation
- Lower levels of acceptability correspond to lower levels of differentiation



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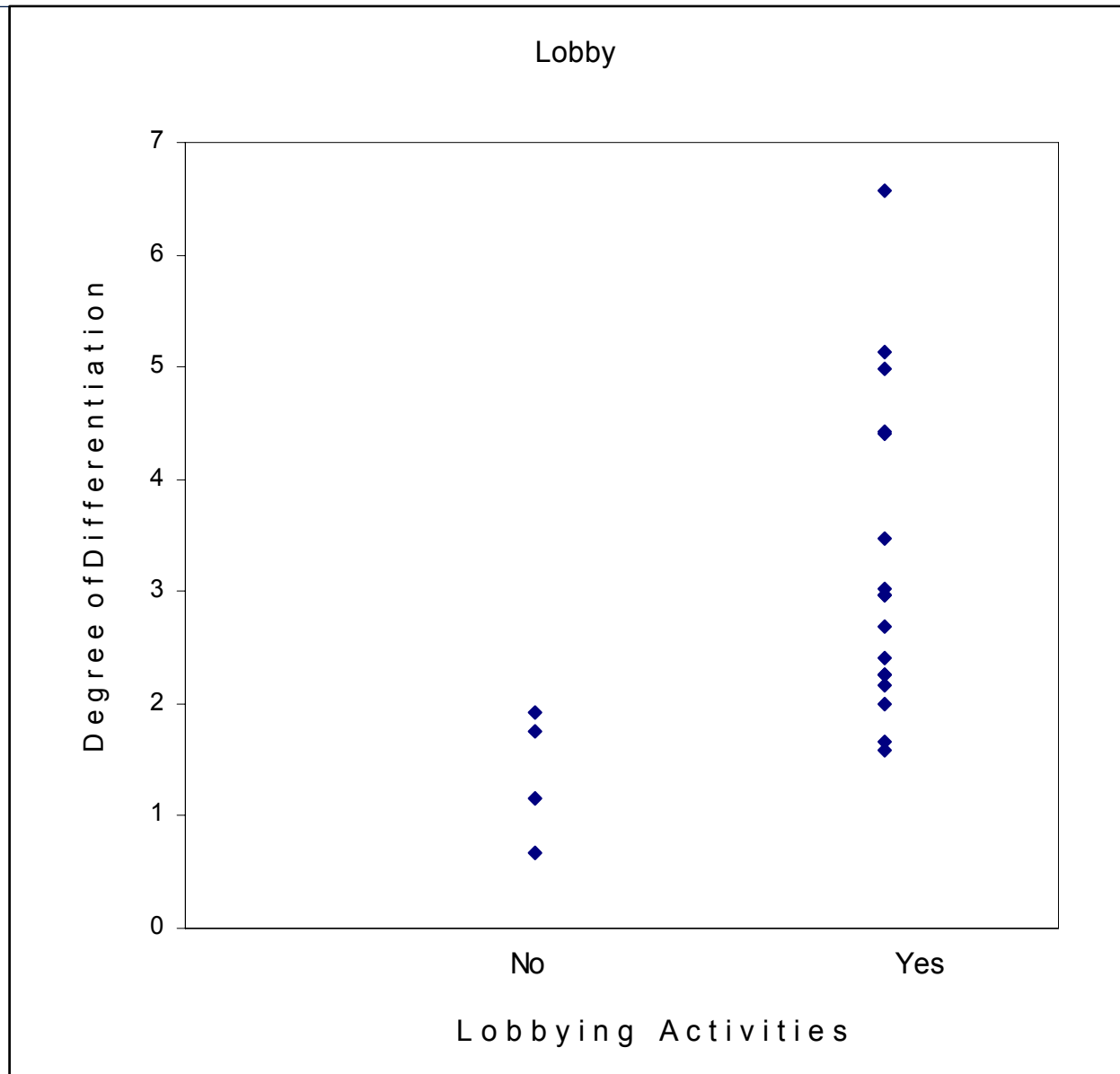
## Hypotheses (Examples):

### B. Positive Economic Theory

Conjecture:

„The degree of differentiation increases with increasing lobbying activity“

- Picture not quite clear
- Too large range of differentiation



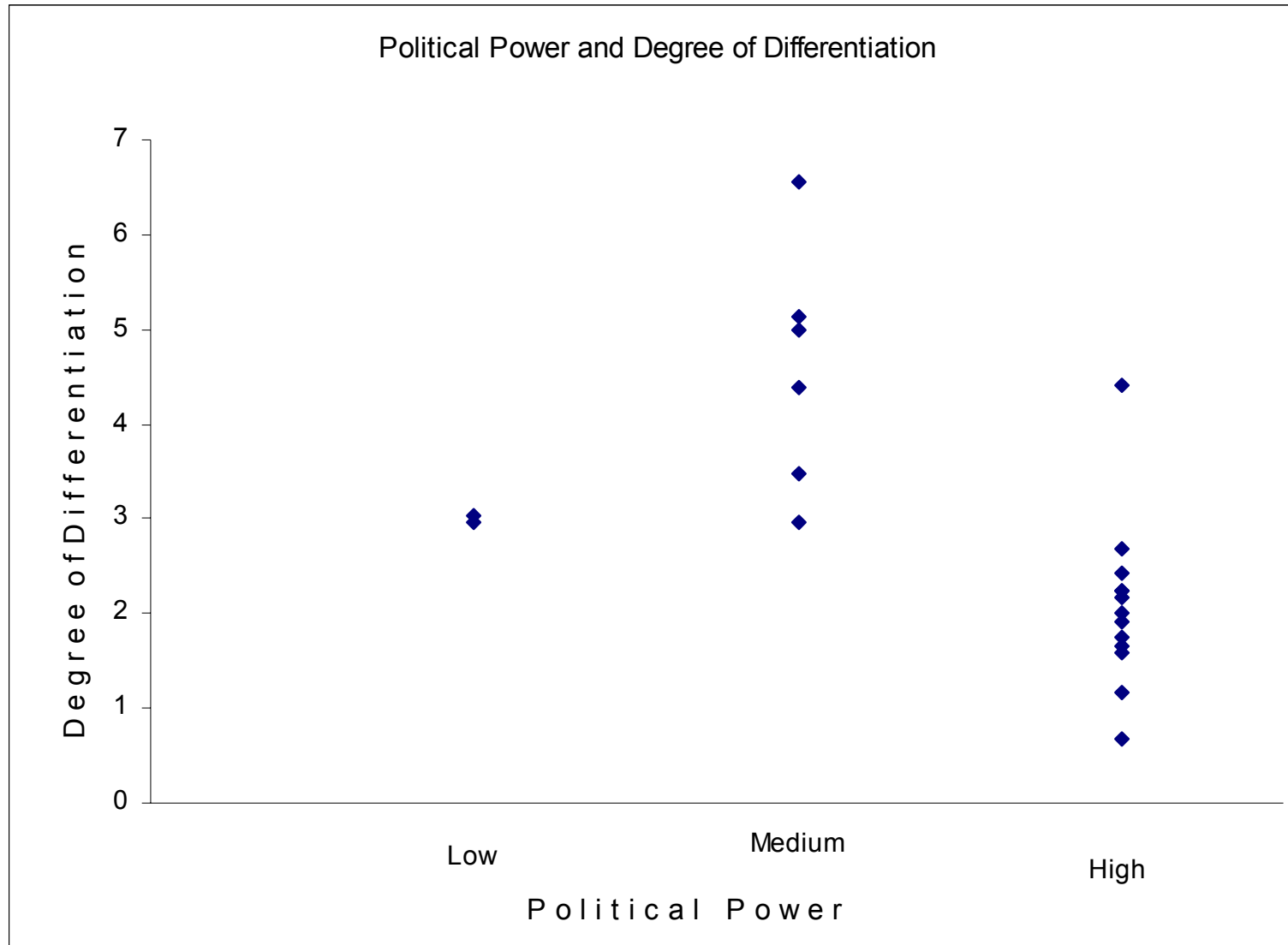
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## Hypotheses (Examples):

### B. Positive Economic Theory

„If voting power of the dominant interest groups is high, the degree of differentiation tends to decrease; if voting power of the dominant interest groups is medium, the degree of differentiation tends to be high.“

No clear cut evidence for the case of low voting power





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## Possible Explanation:

- High voting power: one interest group probably dominates → tariff structure reflects only welfare of this particular group → low differentiation
- Intermediate level of voting power: small number of interest groups → policy makers try to achieve SIG equilibrium → higher degree of differentiation
- Seems to conform to Grossman-Helpman (2001, Chapter 7) model

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## Conclusions:

### Interesting research agenda:

- The empirical analysis of tariff-structures
- The political economy of tariff-structures
  - 1st Best-4th Best Pricing
  - Laffont (2000)-Programme



**Thank you for your attention!**