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ANT/OR

The effect of customer characteristics on coalition gains in collaborative vehicle routing

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Outline

Why horizontal collaboration?

What is horizontal collaboration?

Joint route planning

Econometric study

Results

Further Research

Why horizontal collaboration?

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- The efficiency is very low today
- Road transport will remain an important modus in the future
- What about sustainability?

Why horizontal collaboration?

Solutions

- High–Tech, more efficient and aerodynamic trucks
- Greener engines, new fuels
- Expand the road network
- Horizontal collaboration

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But what is horizontal collaboration about?

What is horizontal collaboration?

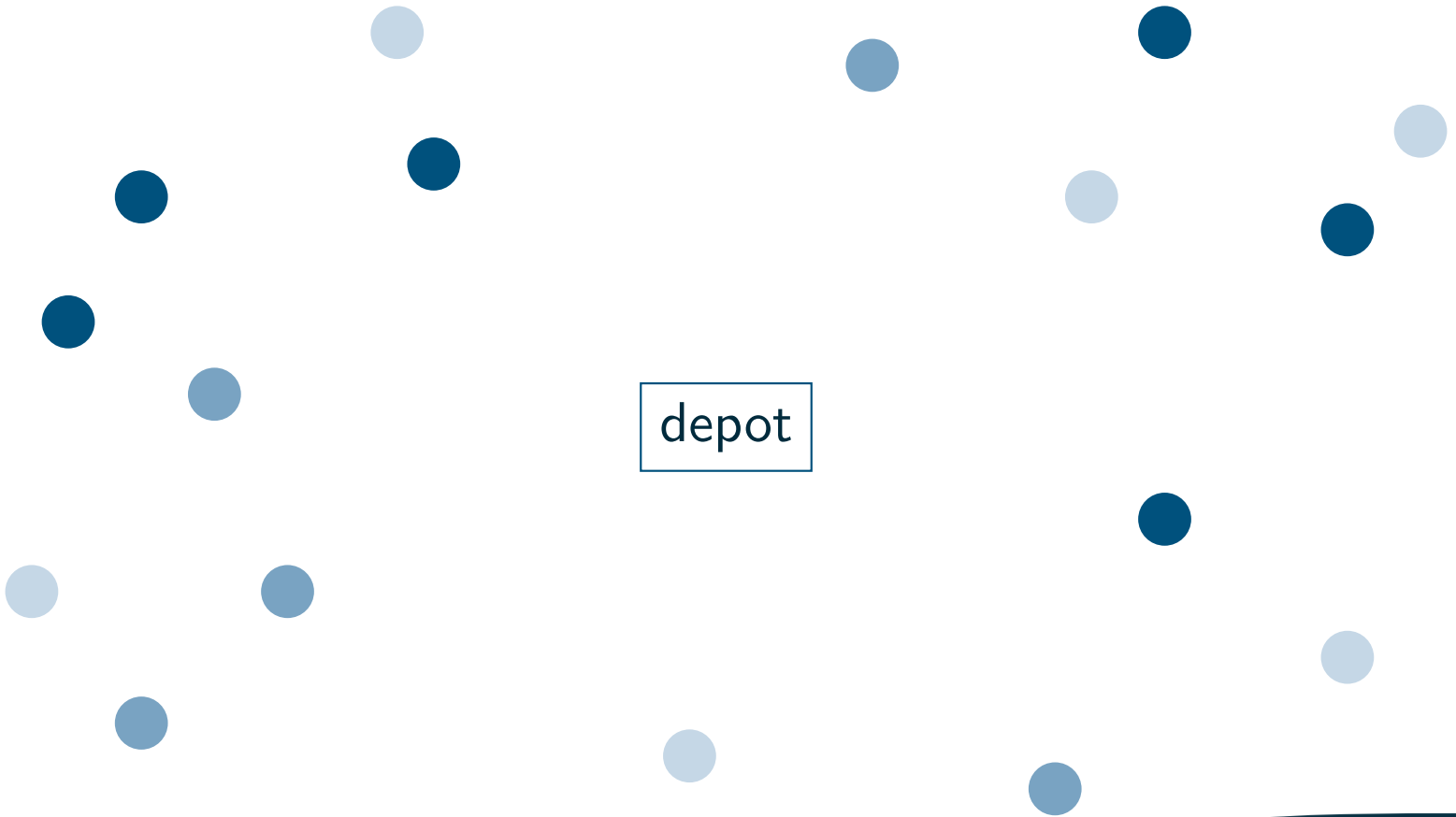
Definition

"Concerted practices between companies operating at the same level(s) in the market"

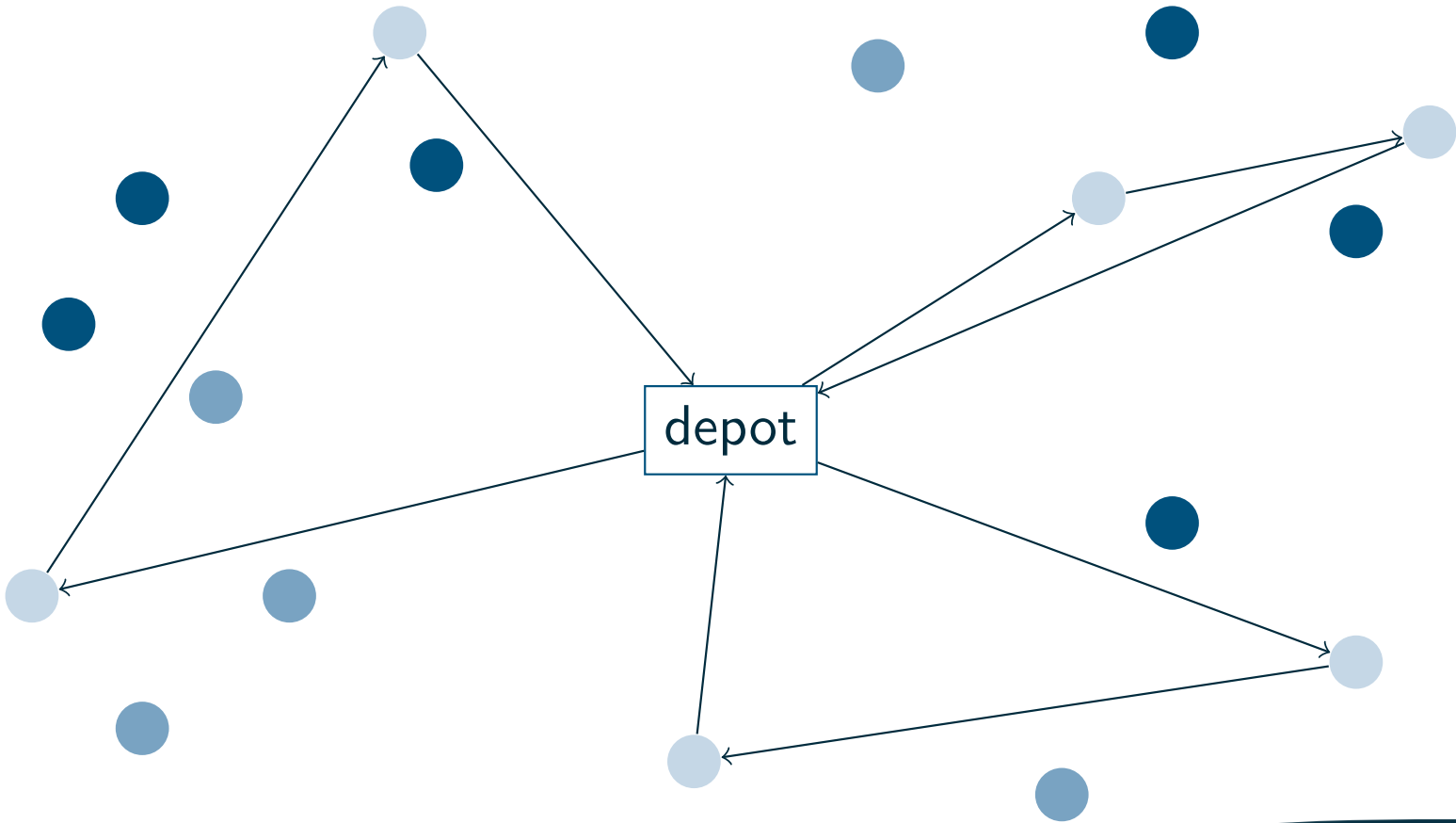
European Union, 2001

- Long-term time span
- Involves a certain level of operational integration
- Forming a strategic alliance

Joint route planning



Joint route planning



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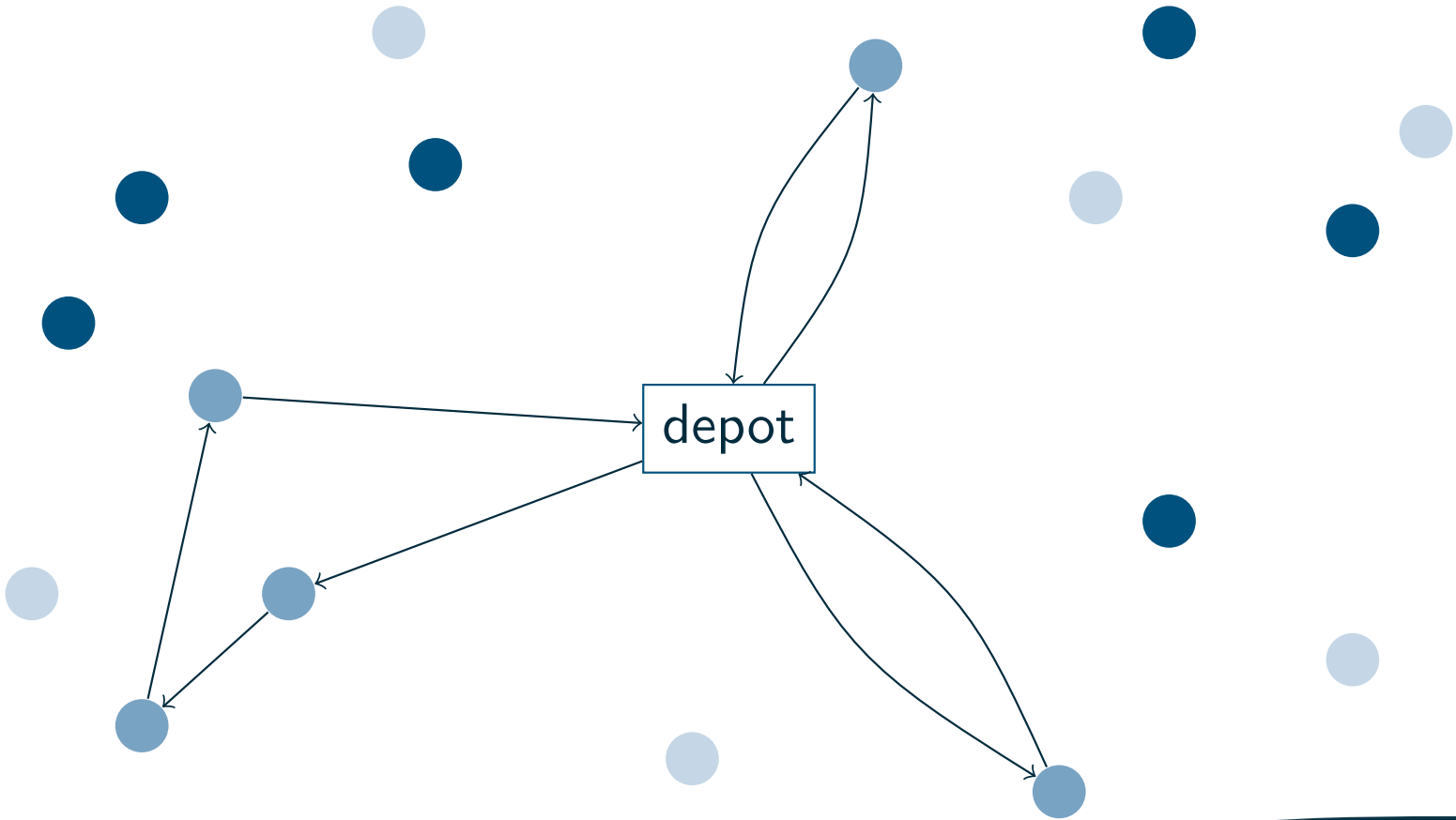

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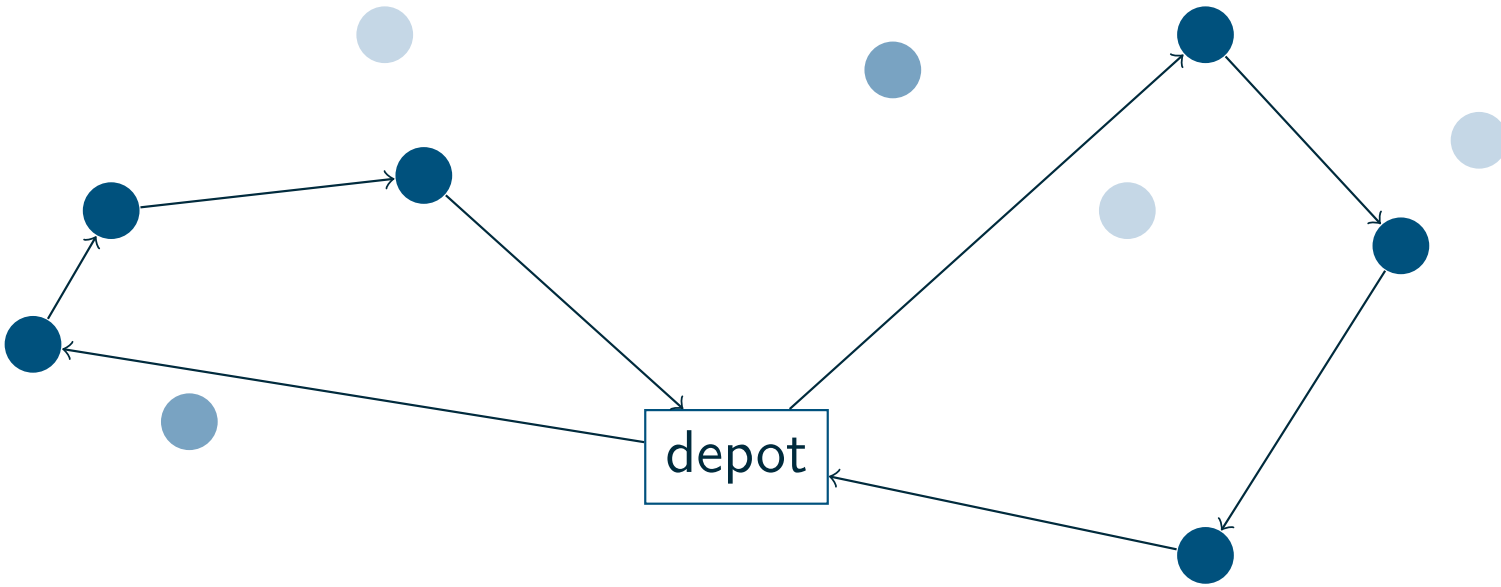

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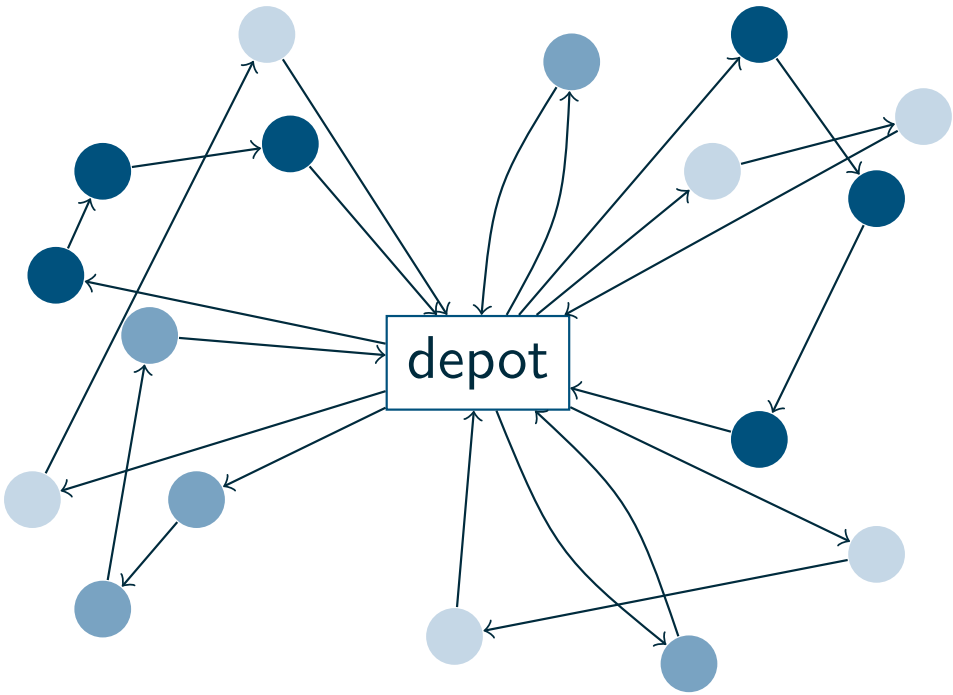

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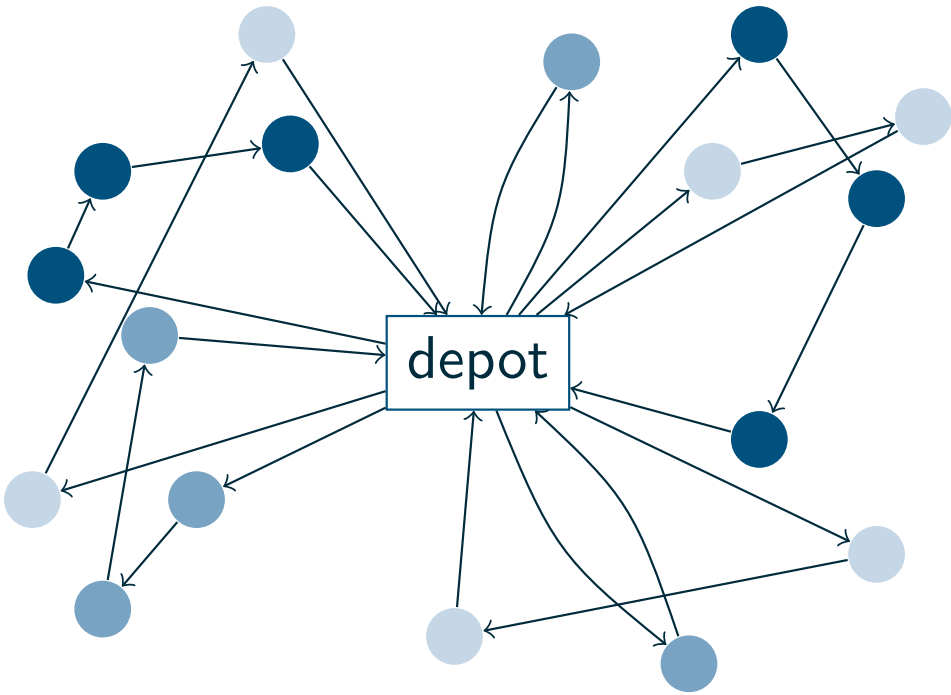

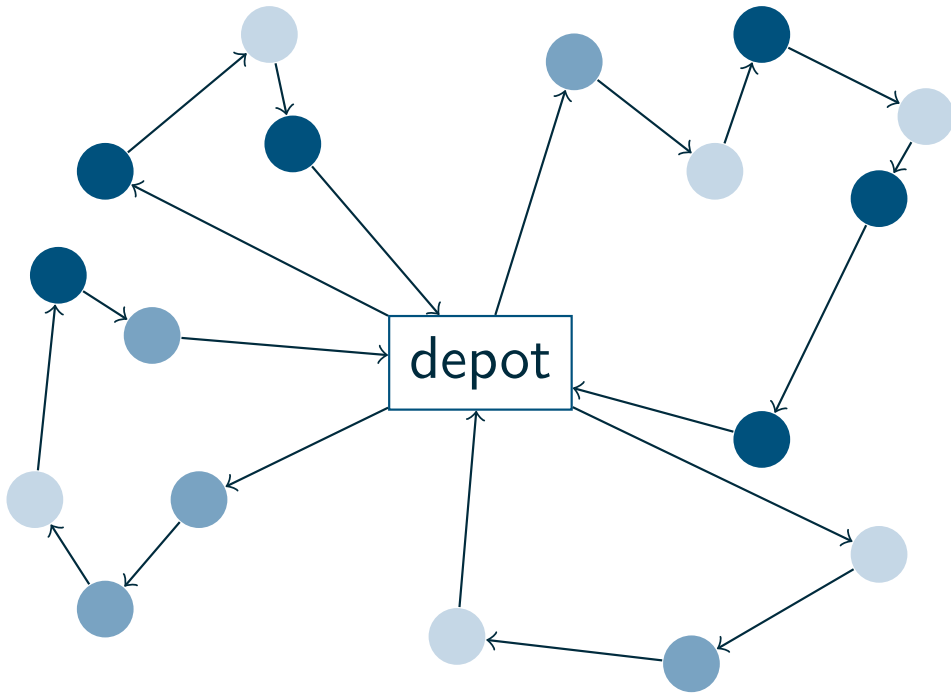

Joint route planning

- Cost reduction
  Total cost of the coalition is lower than the summed stand-alone costs of the players
- Sustainability
  Through better optimization of the routing, total CO_2 emission can be reduced

The study

Problem

- High variability in the profit of a joint route planning
- Can we know profits beforehand?
- Who is a good partner for me?
- We do not want to share too much information

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Research question

- Predict the profit of a joint routing problem
- Based on basic business characteristics
- Partner choice

Data

- Own-generated test instances (two-party collaborations)
- Client coordinates are randomly chosen

Variable	Low	High
Average order size (AO)	50	120
Standard deviation of order sizes (SD)	5	30
Number of clients (CL)	5	20

- VRPH - algorithm

Data

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Variable	Company 1	Company 2
Average order size	Low	High
Standard deviation of order sizes	Low	Low
Number of clients	Low	High

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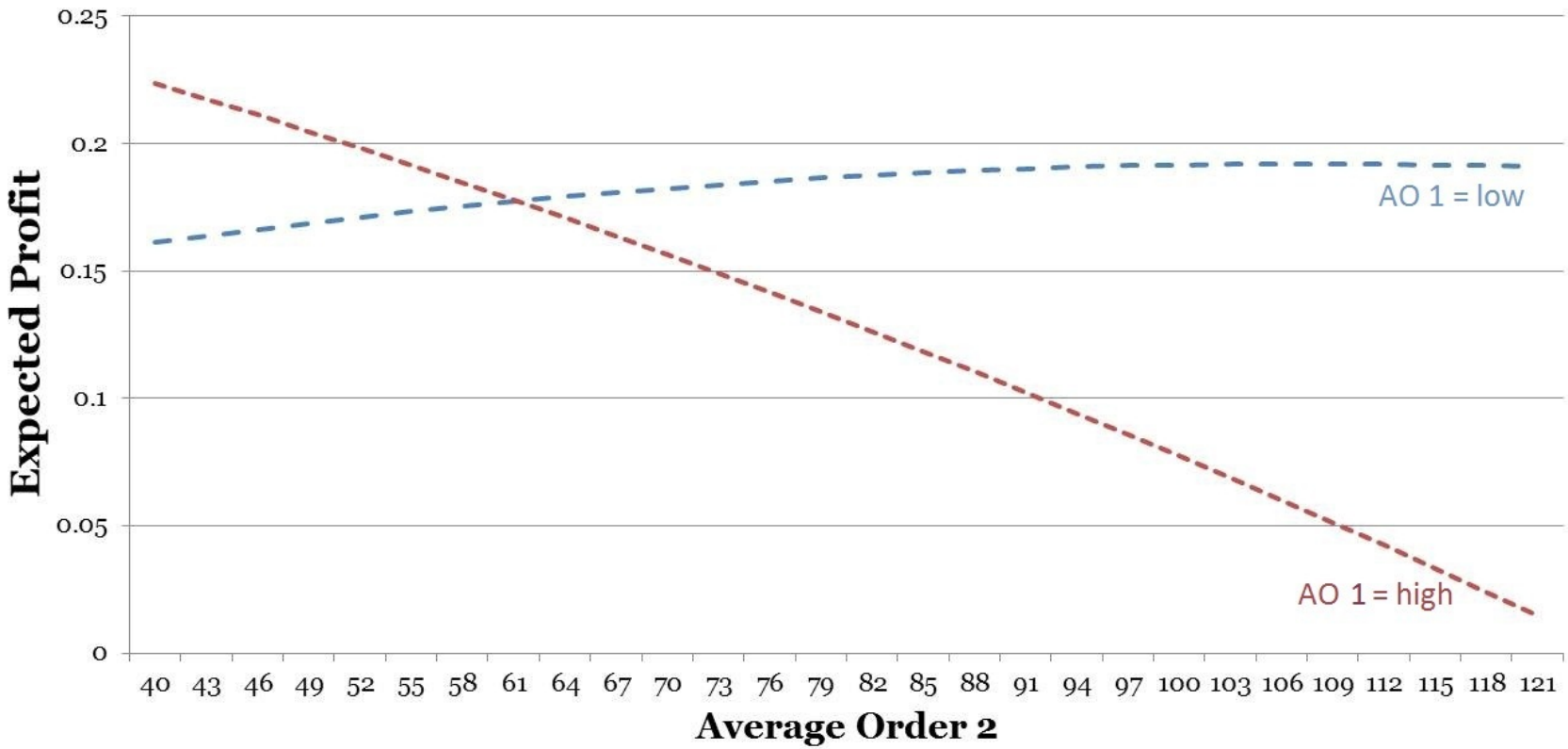
- Profit = Reduction of the kilometres driven
- Variables and Profit = input regression analysis

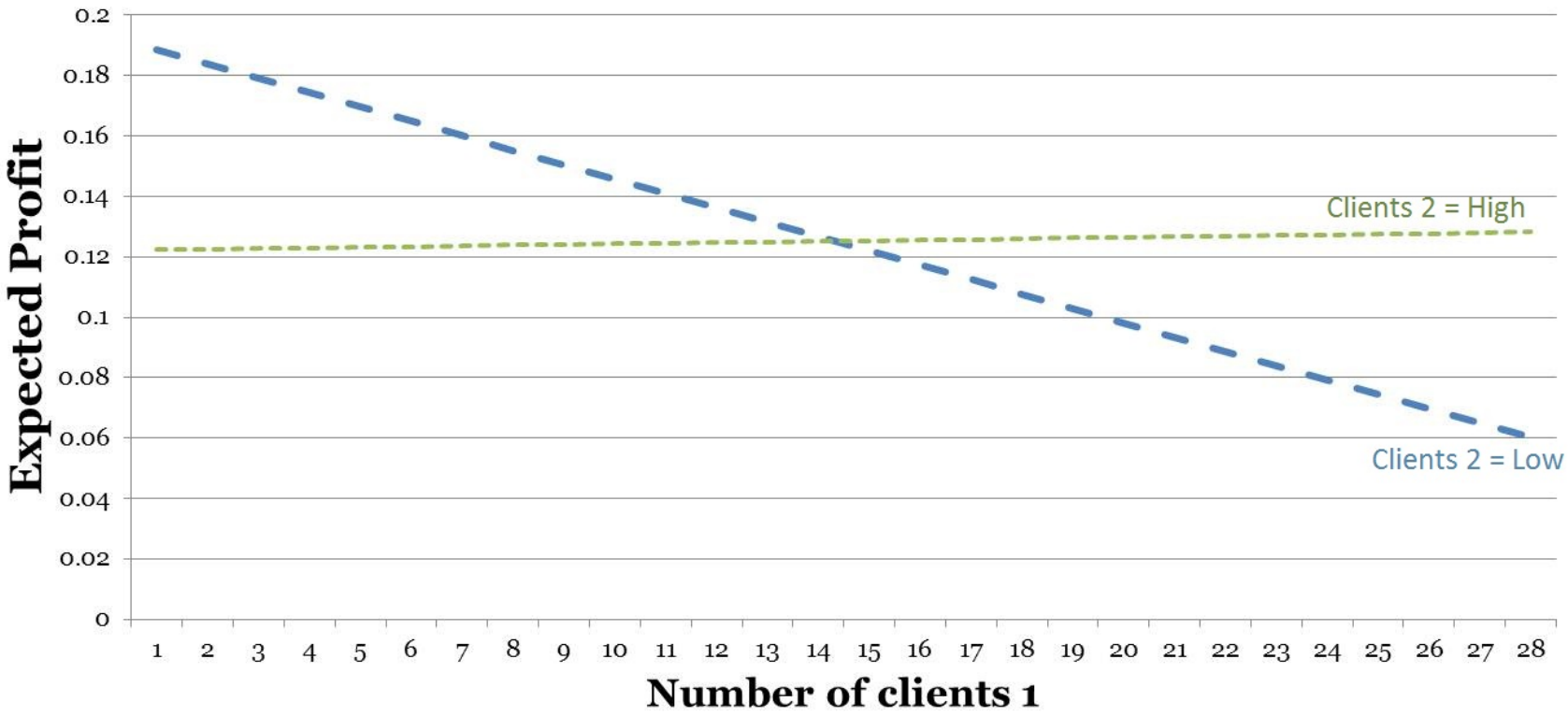
Results

- Standard error of the order sizes
  No significant impact
- Average order sizes
  Complementarity with respect to FTL
  - Companies with **low** order sizes need to look for a partner with **high** order sizes
  - Companies with **high** order sizes need to look for a partner with **low** order sizes
  - On average they reach together a high load factor
- Number of clients
  Find a similar partner

Results – Average order size



Results – Number of clients



Further research

Existing routing algorithms	Horizontal collaboration
a single company	multiple companies
a single market environment	multiple market environments
a single strategy	different strategies

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- The development of new metaheuristics is necessary to solve collaborative vehicle routing problems
- A fair gain sharing mechanism needs to be incorporated that rewards flexibility of the parties
- Tactical decision making
  - Which combination of market environments and strategies is profitable?

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