

# Sources of growth – production functions of European automotive industry

## A micro approach



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15.11.2019.

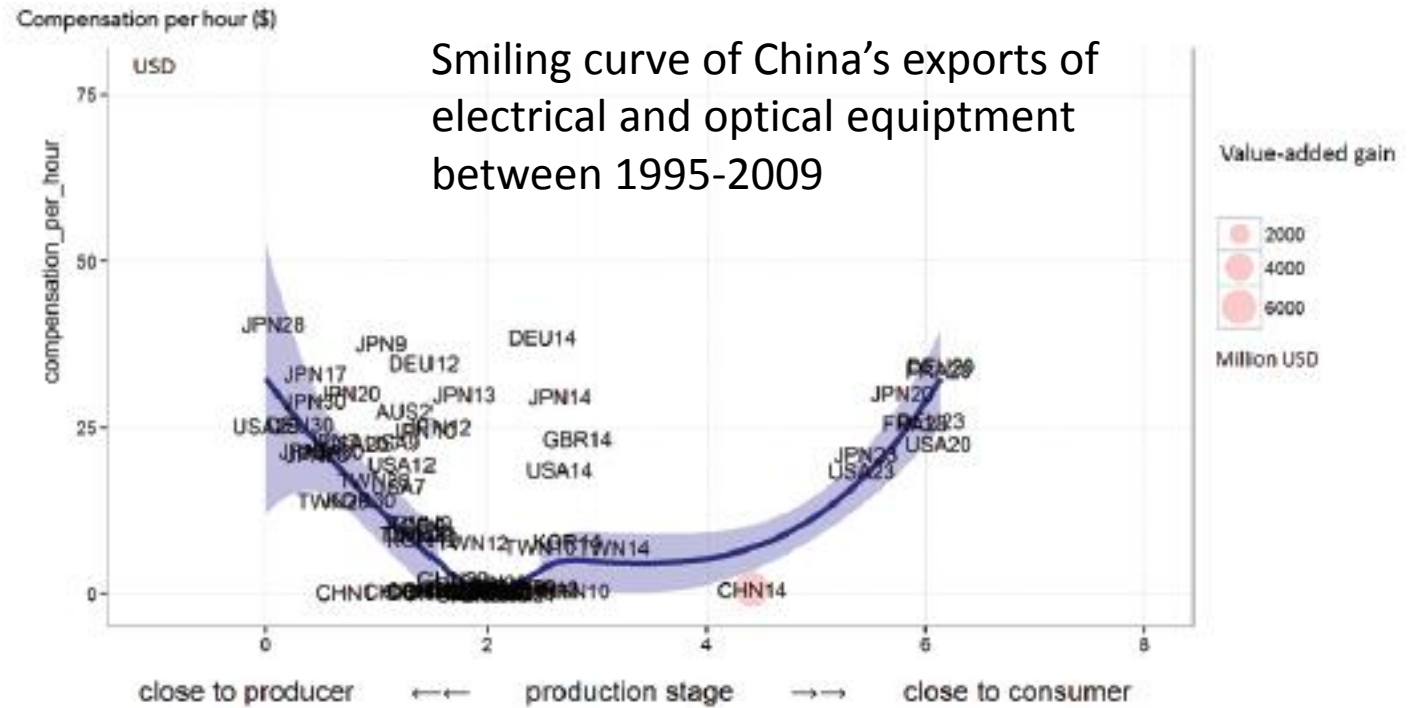
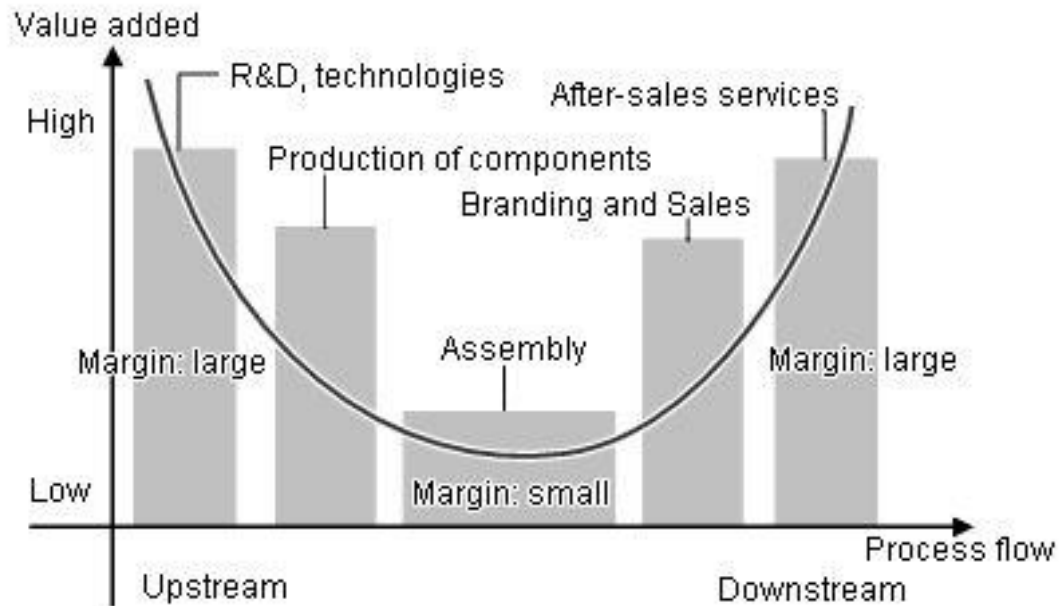
AIECE Autumn Meeting

Brussels, Belgium

# Motivation

- Companies in the same (Global) Value Chain (GVC) form quite heterogenous group.
- Due to differences in output (depending on the actual production process in the chain) input demand of the production functions is also unique.
- It is assumed that low value added production are more relying in labour than capital.
- Are these true? (spoiler: yes)
- What is the role of labour and capital in the production at different stages of the value chain?

# The smiling curve of value creation



Source: Meng, Ye and Wei, 2017

# What do we know from case studies?

- Low value added production is often based on the comparative advantage of labour force.
- The role of (intellectual) capital in production is much more important when higher value is created.
- The more complex the production process is the higher the value of the fixed assets.
- If value added is lower, the value of fixed assets fits to the lower labour productivity.

# How to measure?

- Expectation I: from international IO tables, that contain the labour and capital used for production.
  - Reality: There is no such statistics.
- Expectation II: net production or international trade statistics.
  - Reality: There is no such statistics (gross only).
- Expectation III: production function estimation from micro data.
  - Reality: This exists, this solution wins.

# Why automotive sector?

- True value chain.
  - There is demand for its product line in every countries of the world.
  - The supply network is wide and deep with myriad of suppliers, though there are just a few OEMs on the top of the hierarchy.
  - Most European countries are involved in the business.
- 
- NACE 29-30 only, revenue in 2016 over 10 million EUR
  - N=2621
  - Data source: ORBIS database (European version)

# Countries analysed (share of NACE 29-30 in total output)

- Austria (2.7%)
- Belgium (2.0%)
- Czech Republic (11.0%)
- Germany (7.8%)
- Spain (4.1%)
- France (3.3%)
- Hungary (11.6%)
- Italy (2.7%)
- Netherlands (1.4%)
- Portugal (2.6%)
- Romania (5.1%)
- Sweden (4.4%)
- Slovakia (13.3%)
- UK (2.6%)
- Poland left out due to data availability problems

# Production function

- Sources of value added should be reflected in the production function as well, though return to scale is not equivalent to productivity.
- Cobb-Douglas production function (other forms are limited due to data availability)

$$q = Av_1^\alpha v_a^\beta$$

q: output (revenue), v1: labour (average number of employees), v2: capital (total assets, current assets, fixed assets)

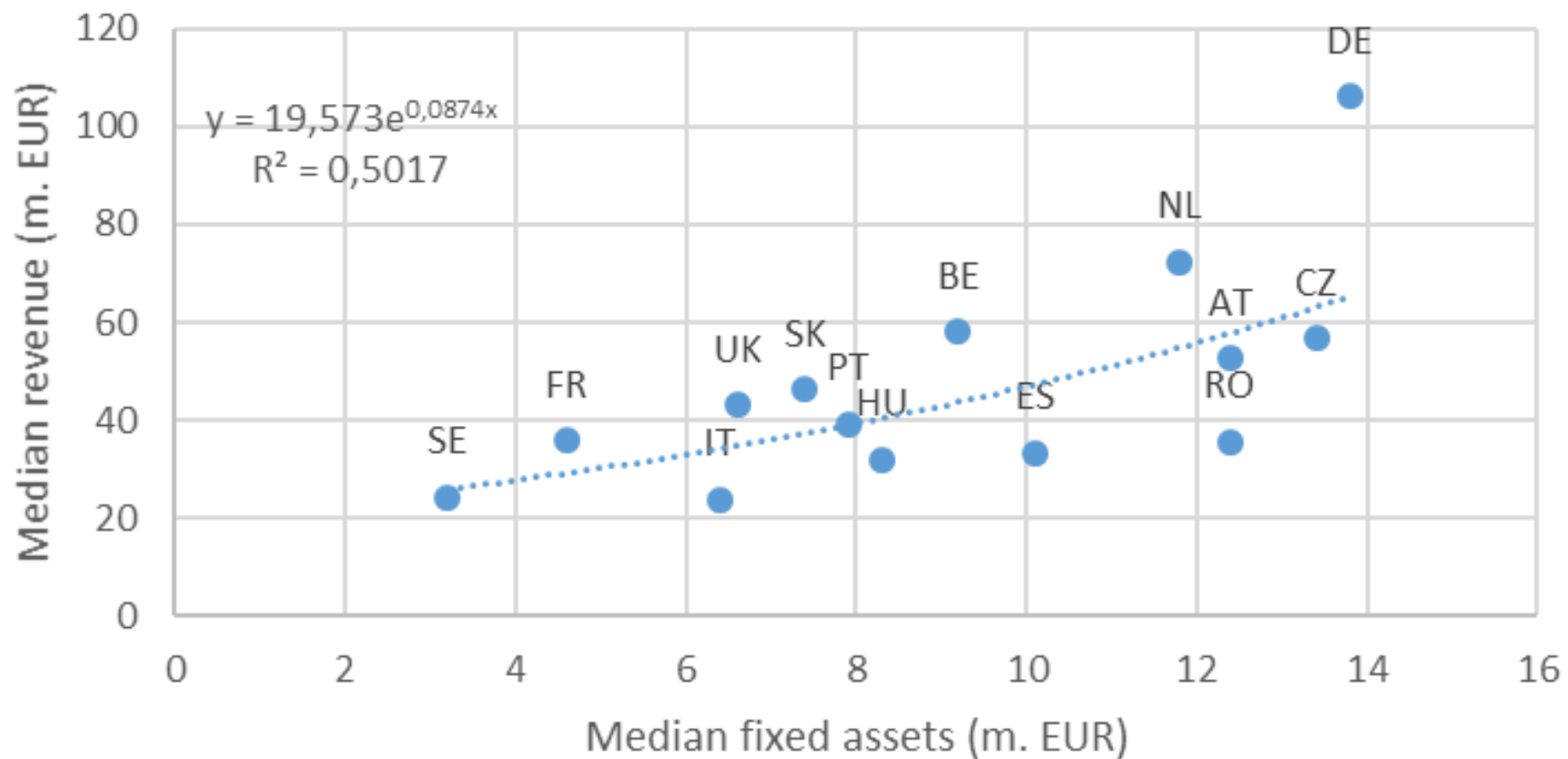
Two models: I. capital = total assets, II. capital = fixed assets



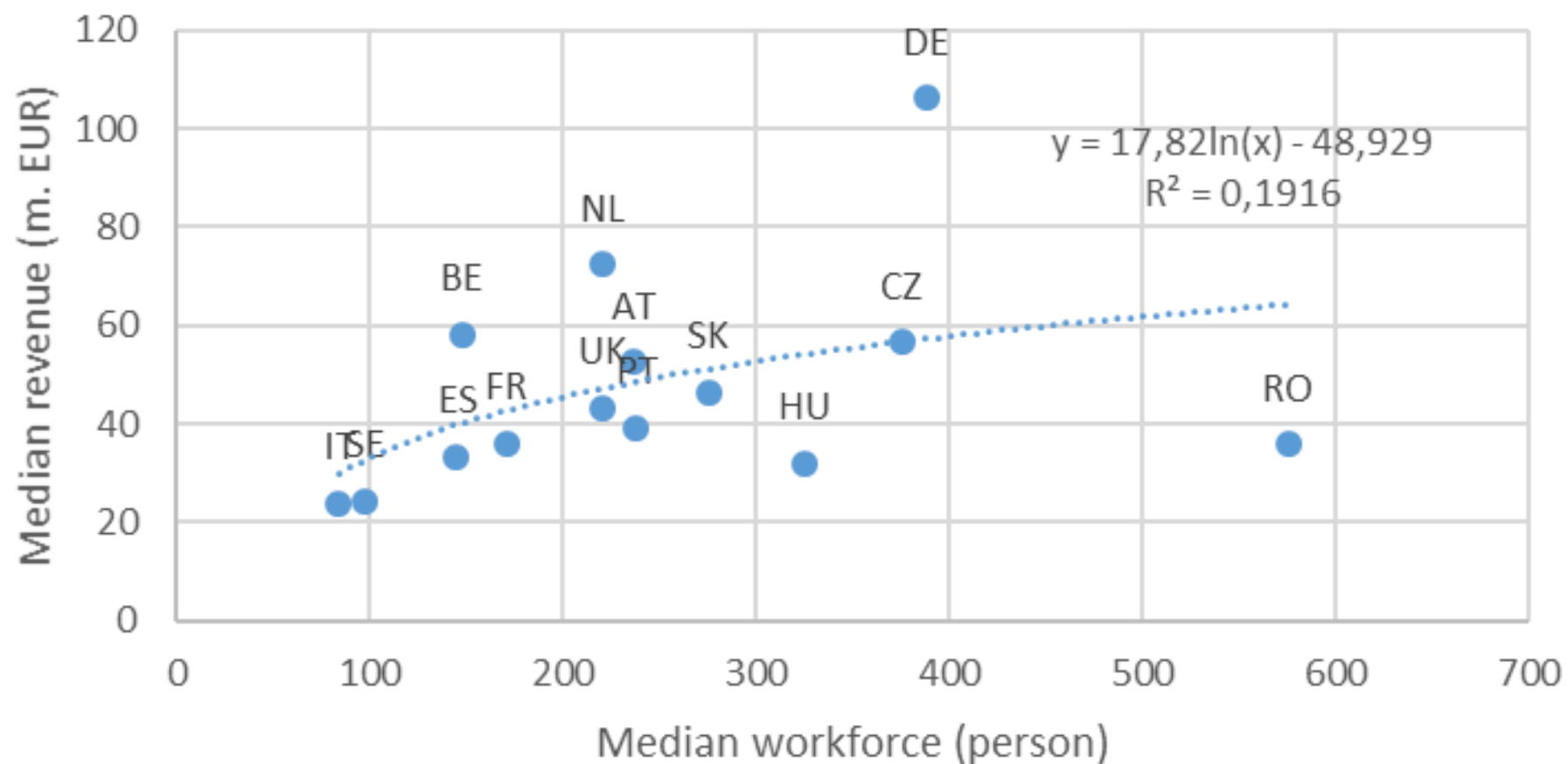
# Method

- Problem: endogeneity
- IV model – it may control endogeneity but in case of panel data it might become too complex
- Panel data with 5 years length
- Fixed effect panel regression was applied as we assumed constant differences in productivity.
- Log-log transformation was applied.
- Prices are deflated to 2010.

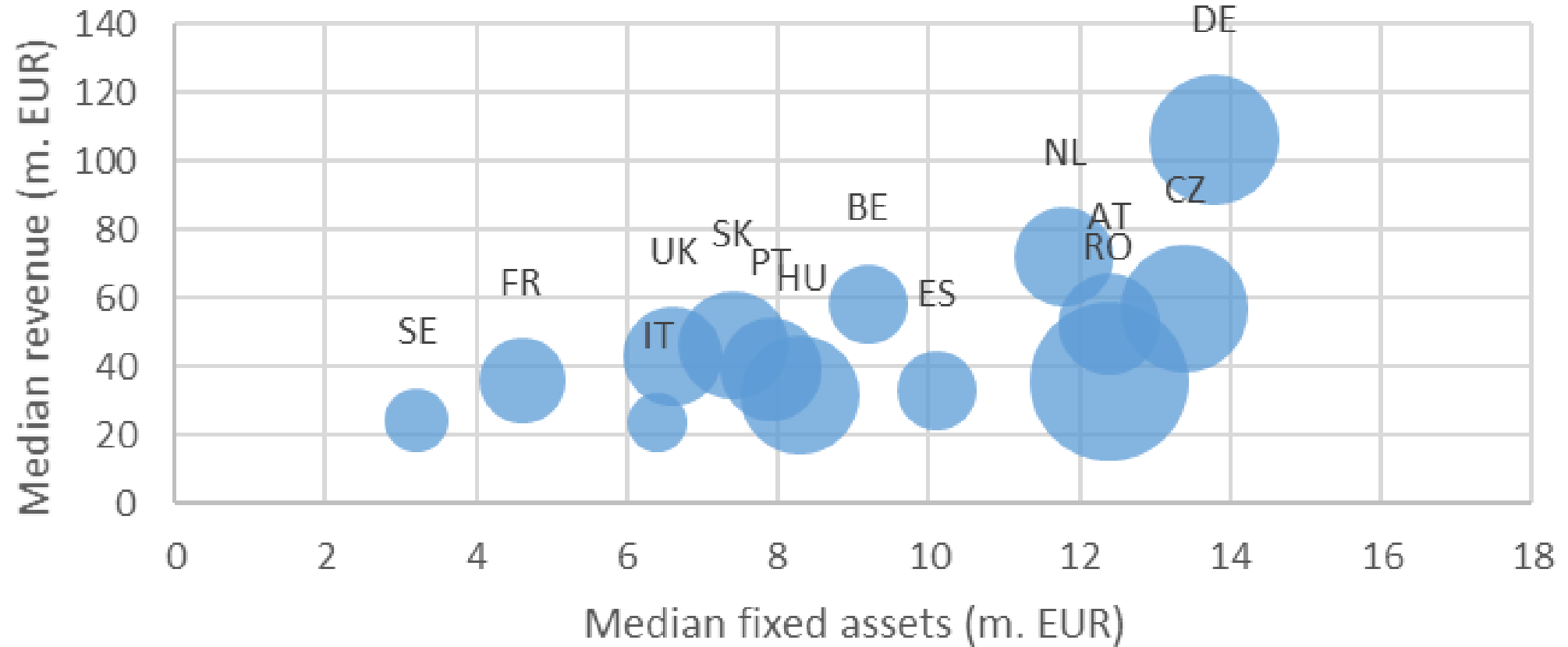
## Median revenue and median fixed assets



## Median workforce and median revenue

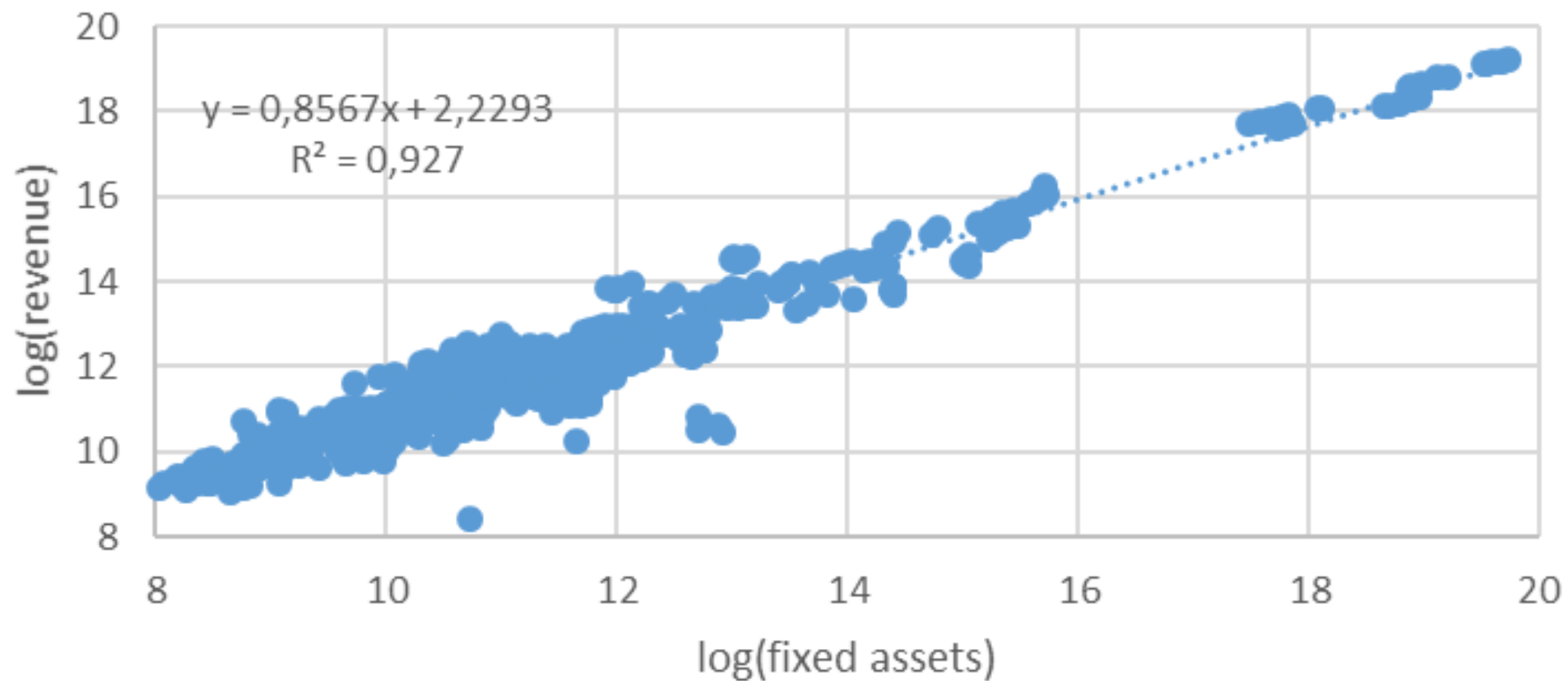


## Median production factors and median revenue

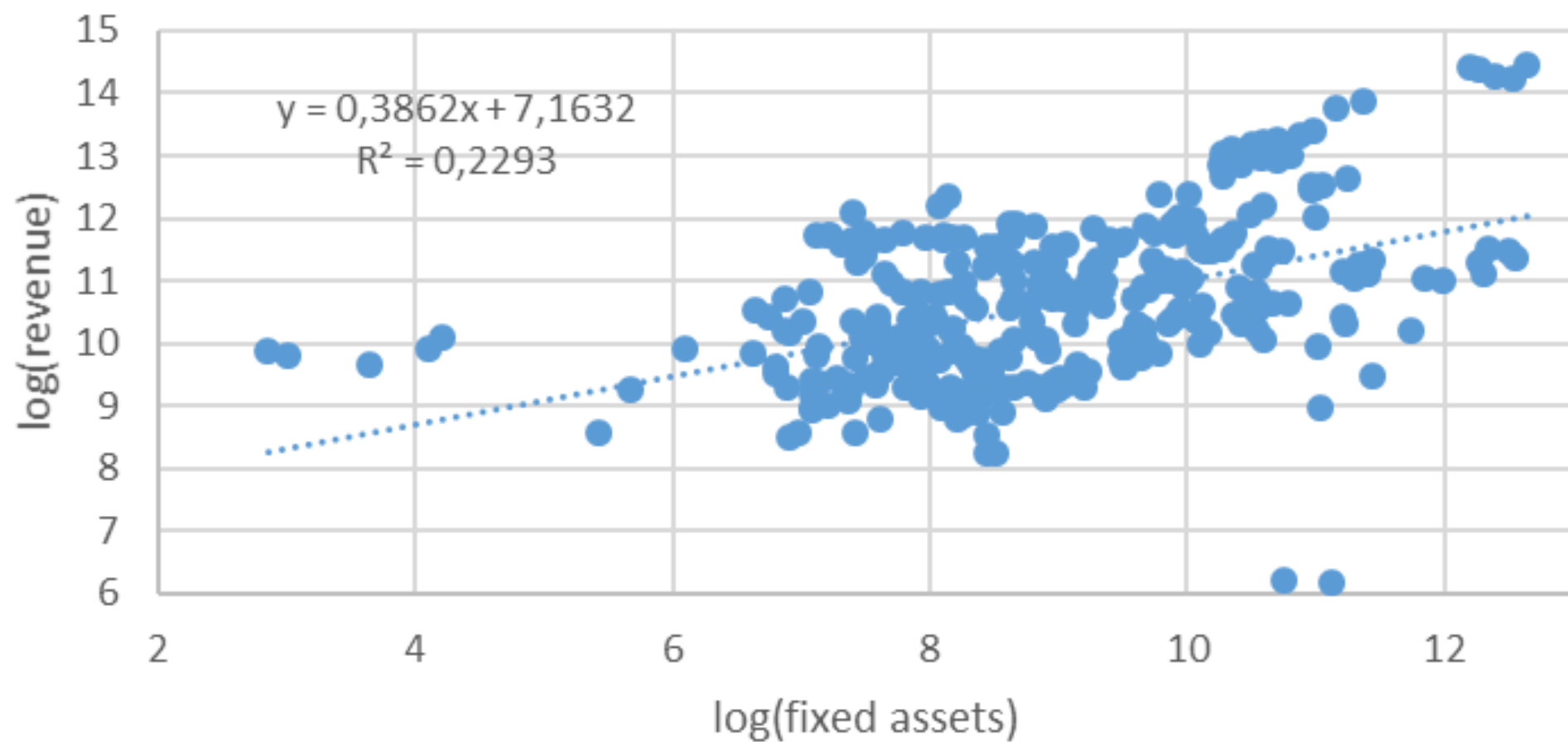


● Median workforce (person)

## Revenue and fixed assets in the German automotive industry 2012-2016)



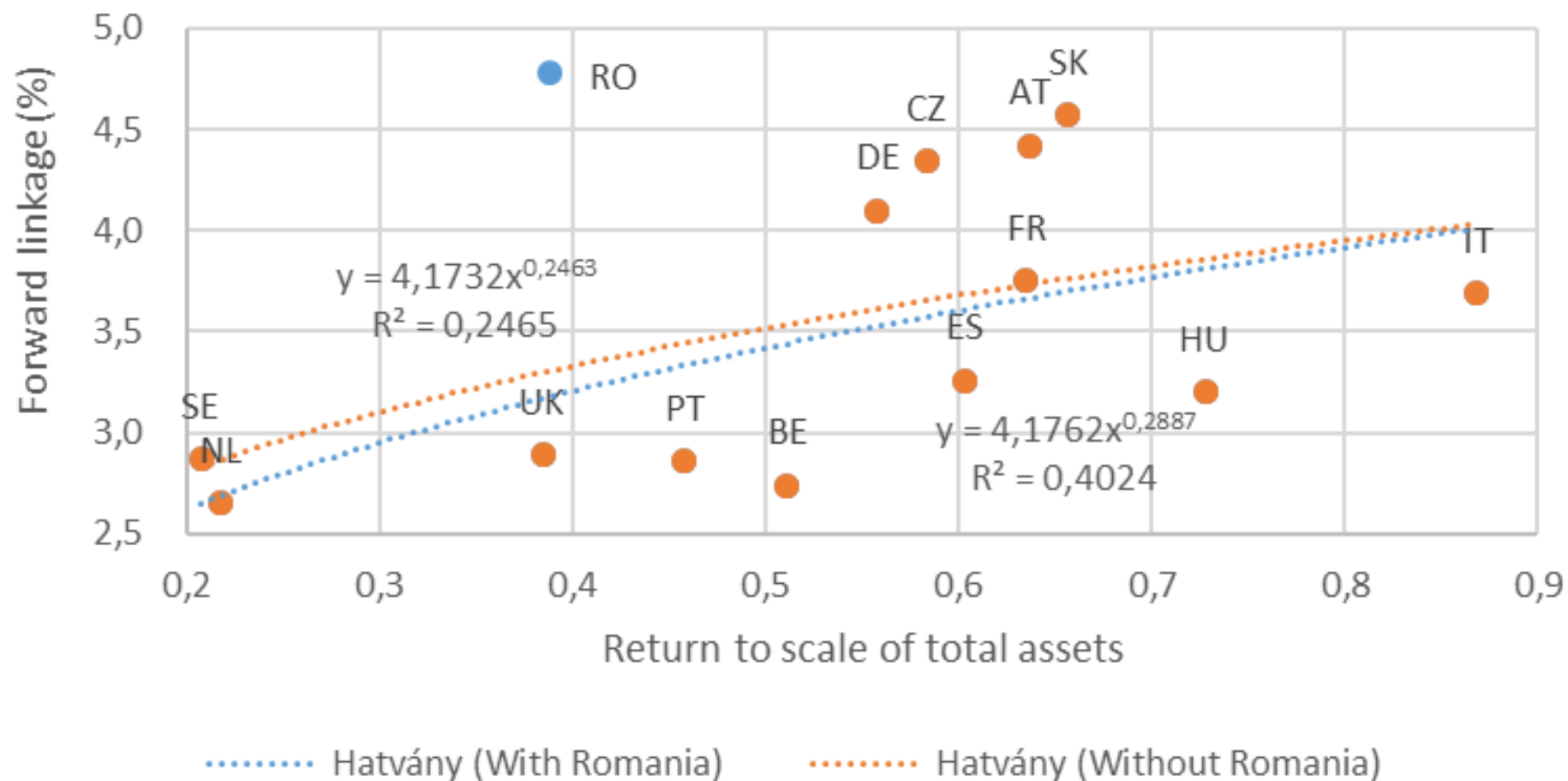
### Revenue and fixed assets in the Portugal automotive industry 2012-2016



# Model results

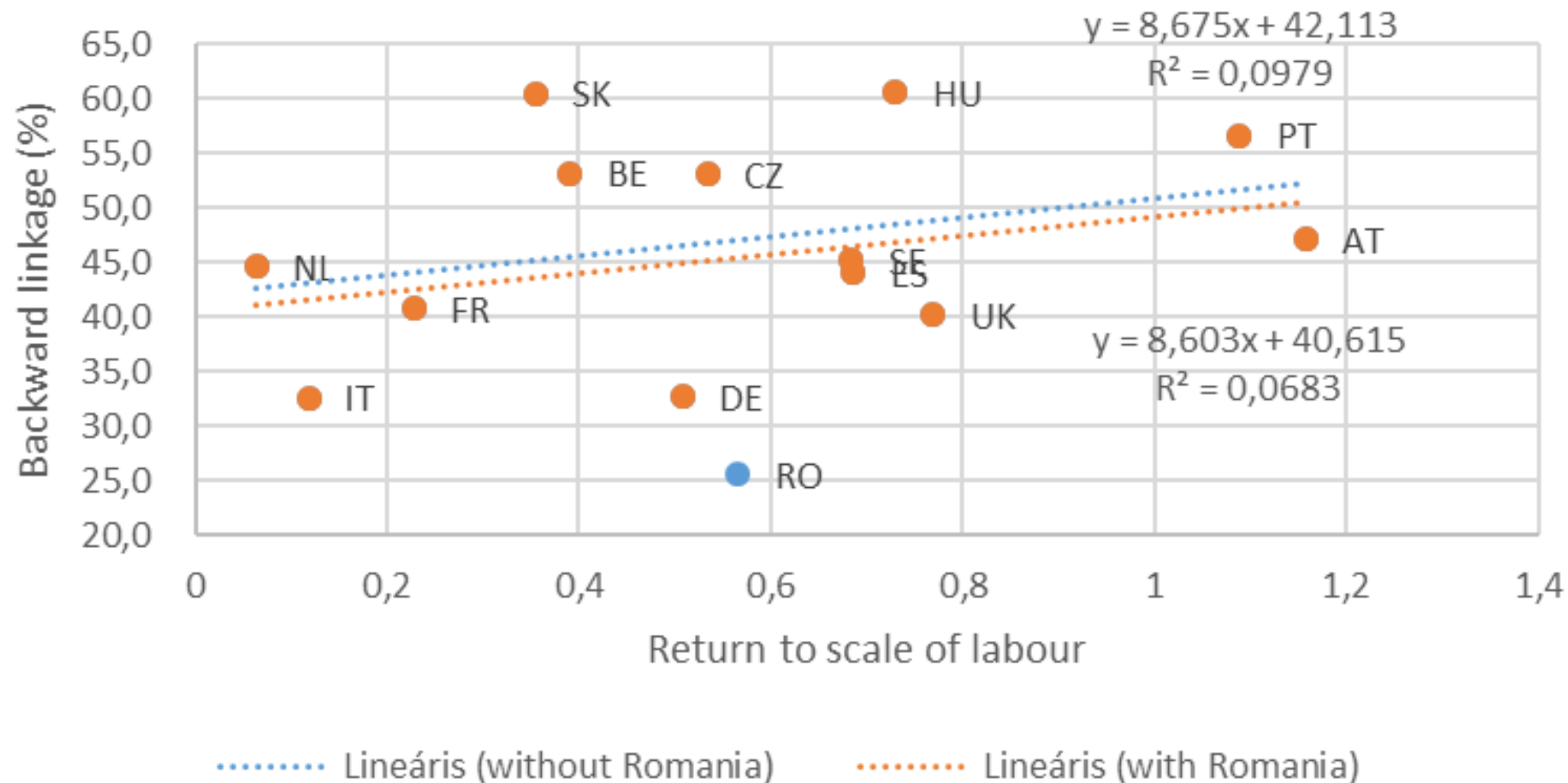
- All production factors are significant at 1% in all countries.
- Very high model fit.
- Sum of return to scales are less than one on most of the cases.
- Sum of return to scales equals to 1 only in Slovakia and Spain.
- Return to scale of labour  $>$  return to scale of fixed assets.
- Return to scale of total assets  $>$  return to scale of labour (7 countries)

Forward linkage and return to scale of total assets

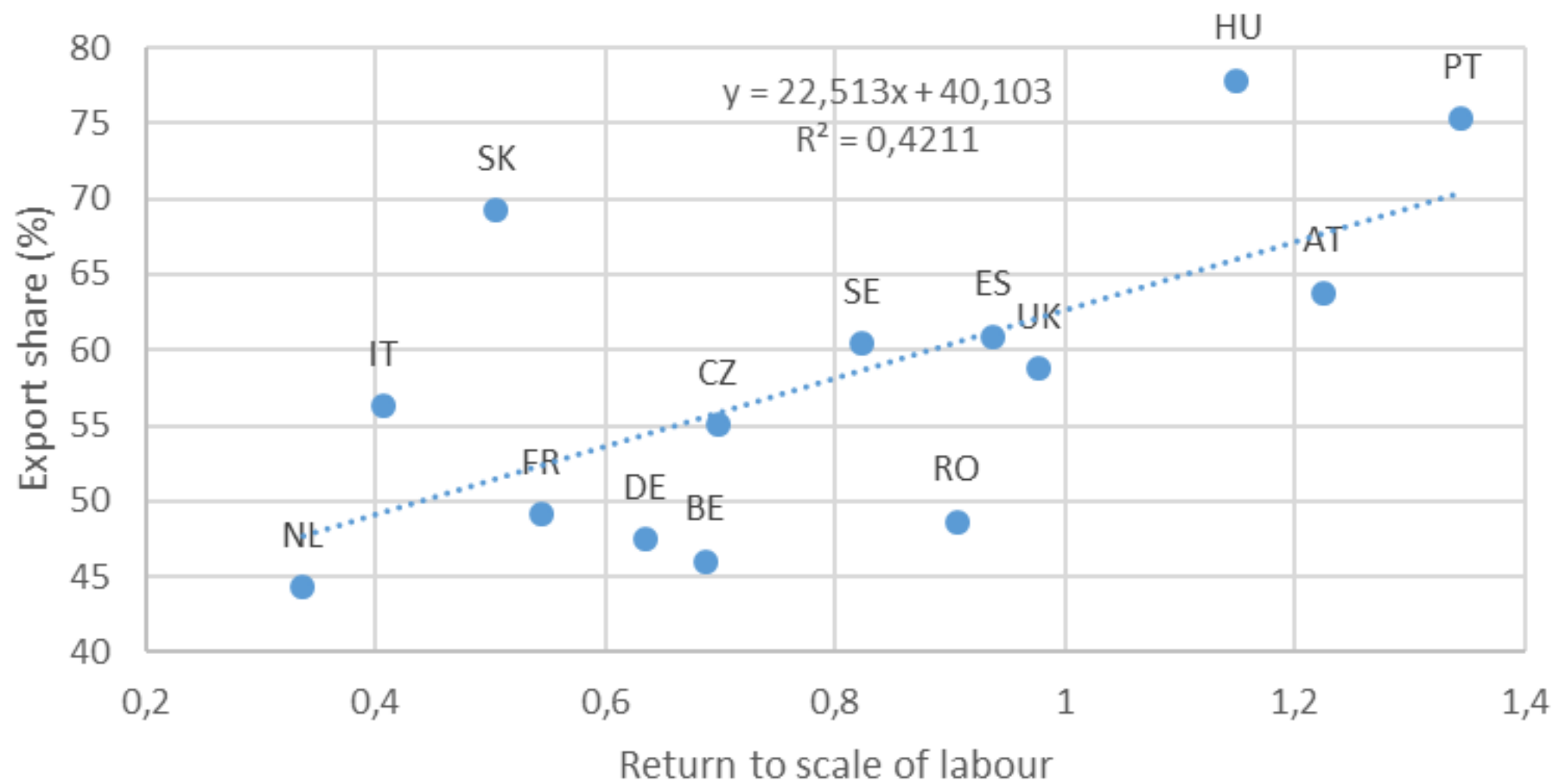




### Backward linkage and return to scale of labour



Export share of industry output and return to scale of labour



# Summary

- Automotive firms in the value chain form a heterogeneous group. There are significant differences between the countries and within the country.
- Return to scale is not constant and in most of the cases it's less than 1.
- Returns to scale is not independent from the position in the value chain:
  - Capital has higher return to scale in countries that export more domestic value added.
  - Return to scale of labour can not be linked to the position in the value chain.
  - Control for production sequence would be required.

Thank you for your  
attention!

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