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Are labour productivity, specialisation and efficiency of livestock production systems compatible?



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Context

❖ **Productivity**

- ✓ Major source of growth and competitiveness

❖ **Labour productivity gains and specialisation in agriculture (since 50's)**

- ✓ Increase in farms' size and decrease in working population
- ✓ Specialisation, concentration, agglomeration

❖ **Cattle farms**

- ✓ Labour productivity → heavy workload
- ✓ Animal productivity → milk yield, live-weight
- ✓ Land productivity → Feed self-sufficiency ?
- ✓ Practices' simplification

❖ **Mixed crop-livestock farming system**

- ✓ Usually seen as ideal, a virtuous farming system → more efficient

Questions and objectives

❖ Productivity of what?

- ✓ Partial factor productivity
- ✓ Total factor productivity

❖ Efficiency of what?

- ✓ Technical, managerial, economic efficiency

→ Definition of these concepts

→ Indicators and evaluation

❖ Evolution and determinants of livestock (with more or less crop) farms productivity and efficiency

- ✓ Over 36 years (1980-2015) for Charolais suckler beef farms (INRA network) - 87 farms per year on average - Constant sample: 22 over 36 years, 48 over 16 years (2000-2015)
- ✓ 70 organic livestock farms (cattle, sheep and goat for meat and milk) in French Massif central, for 2014 and 2015

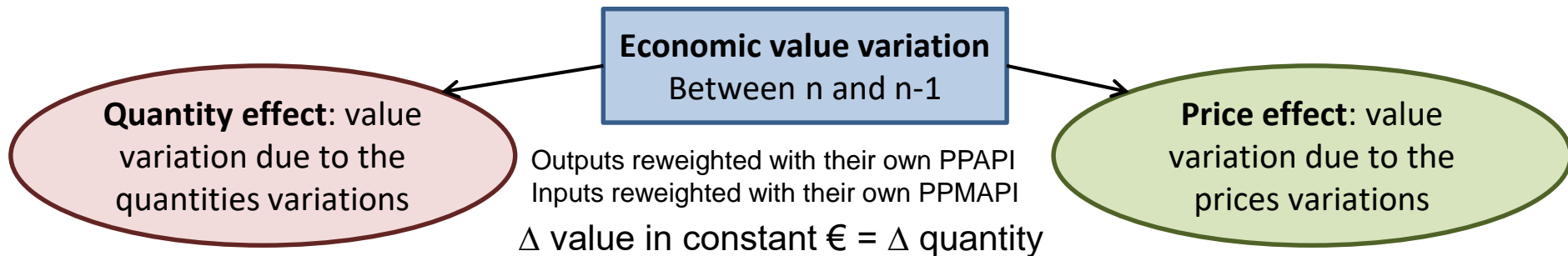
Production factors productivity = Output quantities / Input quantities

❖ Partial factor productivity

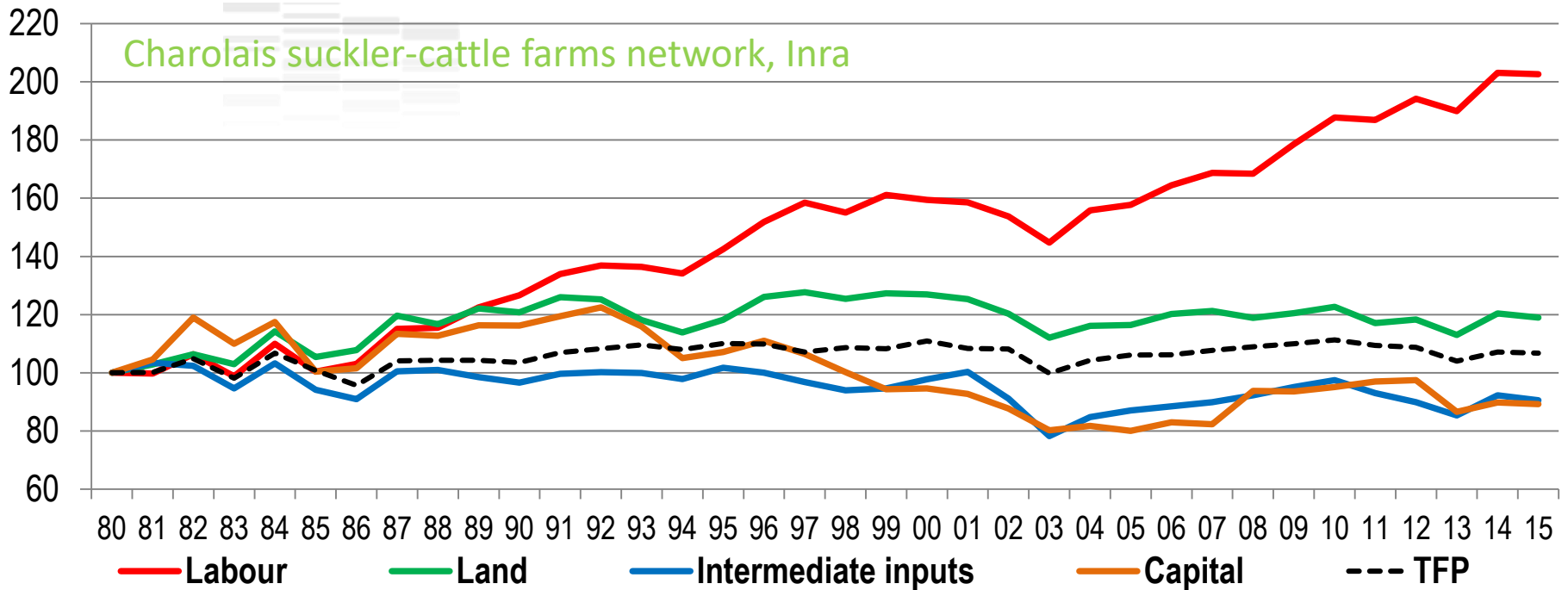
- ✓ Labour = Output quantities / Number of workers
- ✓ Land = Output quantities / Ha of agricultural area
- ✓ Equipment = Output quantities / Equipment quantities
- ✓ Intermediate inputs = Output quantities / Intermediate inputs quantities
- Intermediate inputs + equipment → indicator of **technical efficiency**
 - Express in € → **techno-economic efficiency**

❖ Total factor productivity (TFP)

- ✓ Output quantities / (Labour + Land + Equipment + I) quantities
- Indicator of **technical and managerial efficiency**



Partial and total factor productivity



| Annual growth rate %/year | 1980-2015 | |
|----------------------------------|--------------|--------------------------|
| Labour | 2.03 | } ↘ Technical efficiency |
| Land | 0.29 | |
| Intermediate inputs | -0.37 | |
| Equipment | -0.85 | |
| Total Factor Productivity | +0.17 | |

Veysset et al., 2018

Grass-based suckler-cattle systems (GF) vs mixed crop-livestock systems (MC-L)

Years 2010 and 2011

❖ Grassland-based farms (n=7)

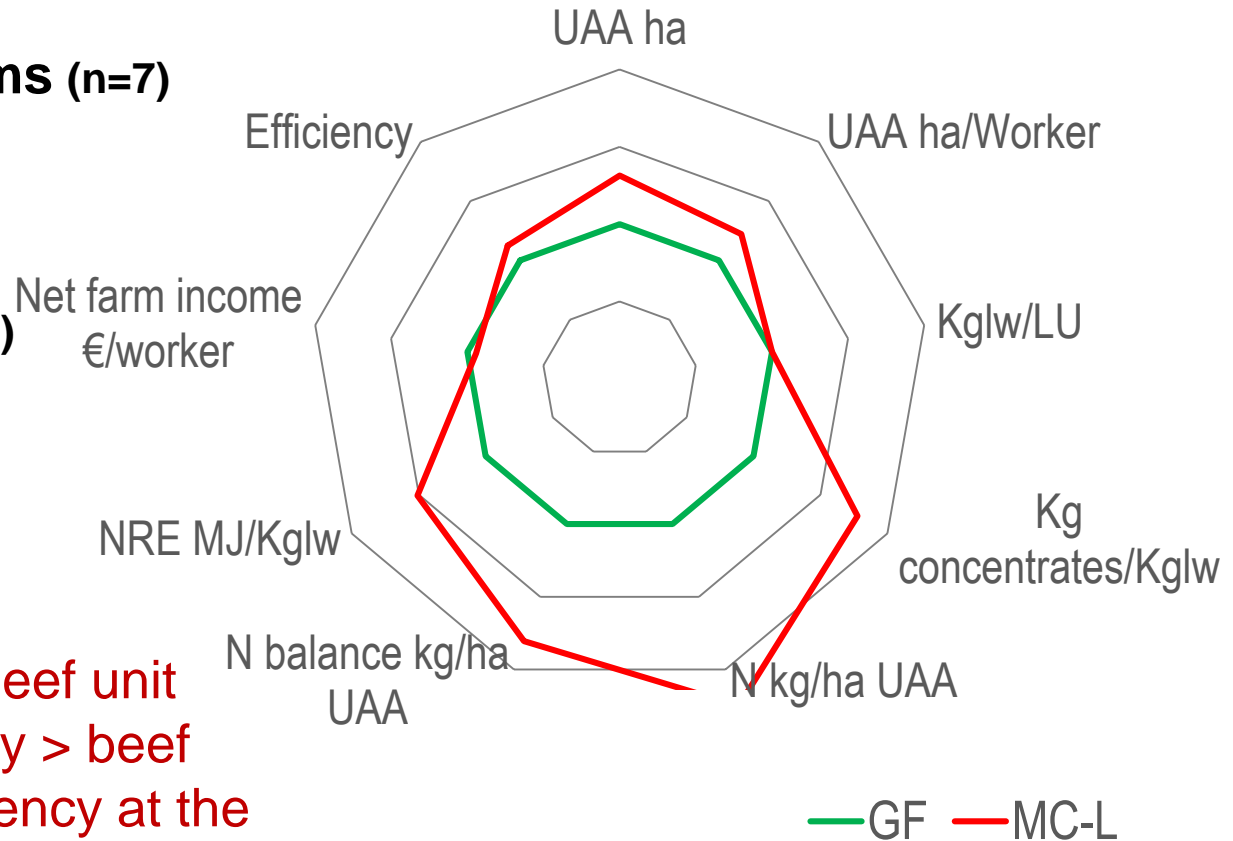
- ✓ 160ha
- ✓ 100% fodder area
- ✓ 100% grass

❖ Mixed C-L farms (n=21)

- ✓ 180ha
- ✓ 68% fodder area
- ✓ 9% crops for cattle
- ✓ 23% cash crops

- MC-L less efficient on beef unit
- Crop technical efficiency > beef
- Techno-economic efficiency at the farm level =

Veysset et al., 2014



Efficiency of organic livestock farming systems

❖ 70 farms in French Massif central, 2014 and 2015

- ✓ 20 dairy cattle, 16 beef cattle
- ✓ 12 dairy sheep, 13 meat sheep
- ✓ 9 goats

❖ Variable to be explained

- ✓ techno-economic efficiency

Gross farm product without aids, € / (Intermediate consumption + equipment depreciation), €

❖ Explanatory variables

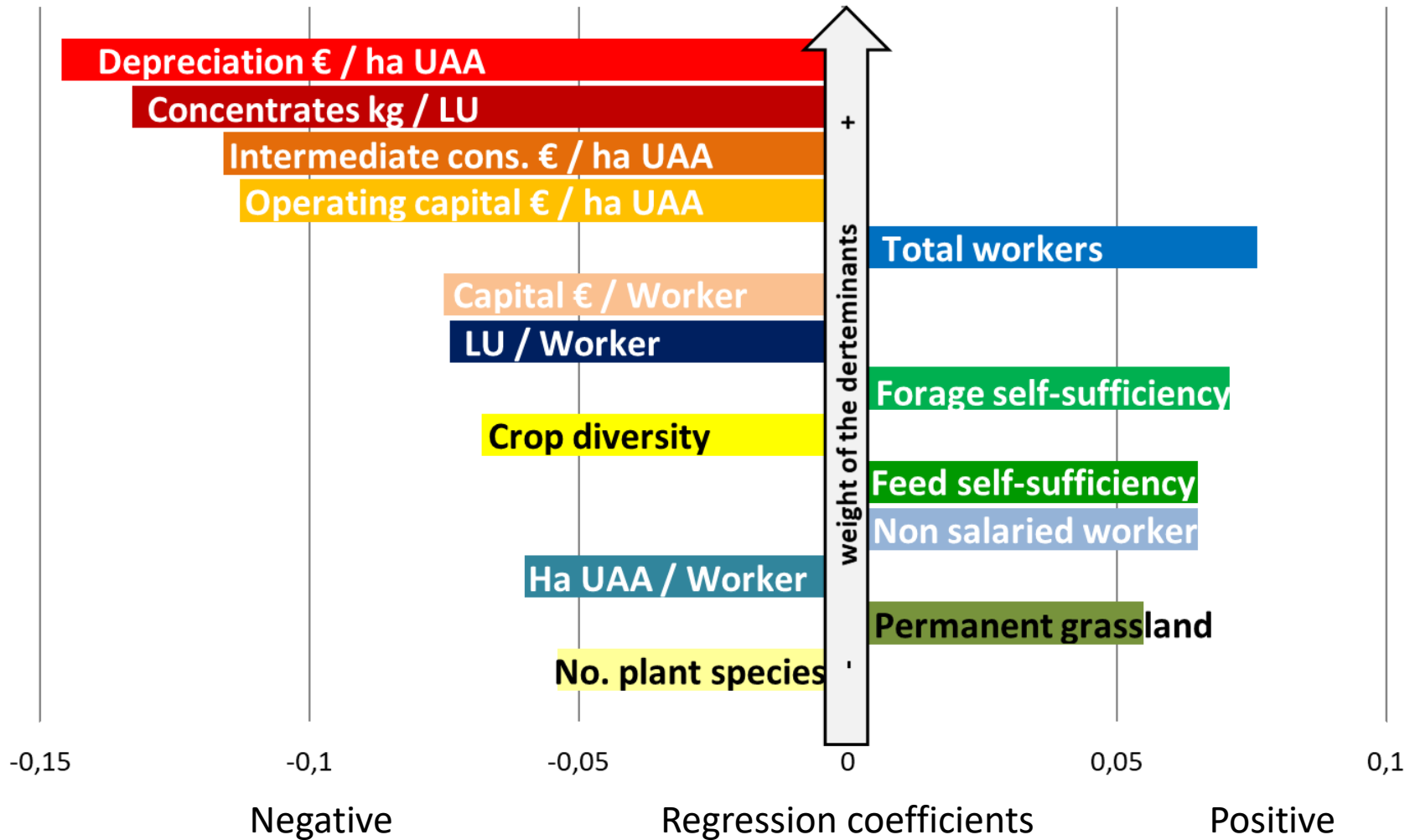
- ✓ 18 structural variables
- ✓ 25 technical variables

❖ Data analysis on standardized (per production) variables

- ✓ Component analysis, clustering
- ✓ Partial Last Square regression



Determinants of the efficiency PLS-regression



Typology * Determinants → Profiles

Large specialized, self-sufficient grassland farms

Small specialized economical farms, with workforce

Intensive farms, with high land and animal productivity

Large mixed crop-livestock farms, with high land and animal productivity

Farm size

Specialisation

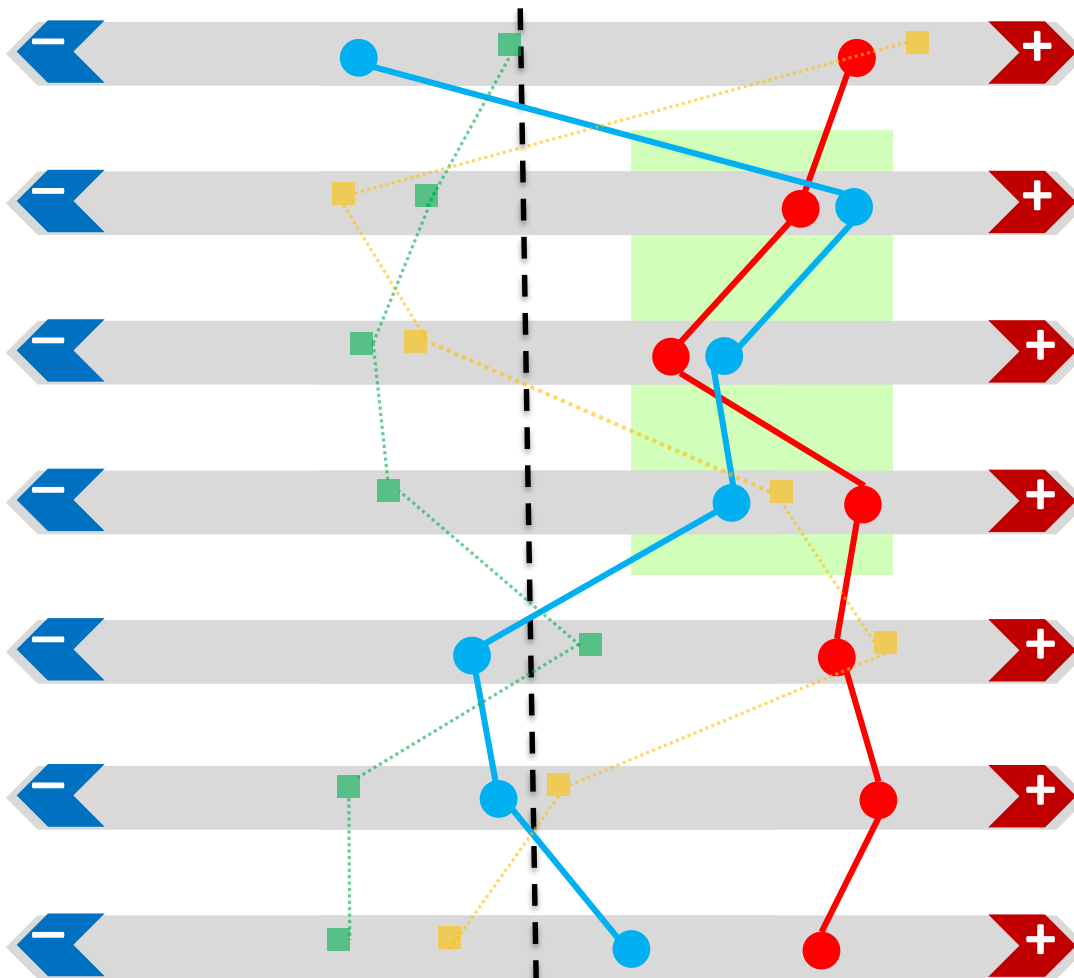
Forage self-sufficiency

Inputs efficient

Labour productivity

Farm income €/worker

EFFICIENCY



Average of 70 farms sample

Discussion, conclusion

- ❖ **Expansion of farm size with simplification of practices led to lower technical efficiency**
 - ✓ Lower use of on-farm resources: decrease in self-sufficiency
 - ✓ Heavier equipment needs: substitution labour / capital
- ❖ **Genetic, technical, technological and knowledge progress**
 - ✓ To increase labour productivity?
- ❖ **Economies of scale and economies of scope**
 - ✓ Suckler-cattle farms: NO ECONOMIES OF SCALE!
 - ✓ Large conventional and organic livestock farms appear unable to translate a mixed crop-livestock strategy into economies of scope

Discussion, conclusion

❖ Forage self-sufficiency: key factor

- ✓ Herbivore = grass → forage self-sufficiency
- ✓ Productive and economic gain to produce own concentrates??

❖ Enlargement and complex farming systems

- ✓ High labour productivity, heavy workload, combination of skills

➤ **Simplification of practices**

➤ **Incompatible with efficiency and sustainability**

❖ Agroecological transition

- ✓ Encouraging “small” specialized farms? Public policies?
- ✓ Encouraging exchanges between farms in a territory?
- ✓ Specialization of the farms and diversification of the territory?
- ✓ Limiting the labour productivity increase?