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

Patrick Veysset

To cite this version:

Patrick Veysset. Are labour productivity, specialisation and efficiency of livestock production systems compatible?. 69. Annual Meeting of the European Federation of Animal Science (EAAP), Aug 2018, Dubrovnick, Croatia. hal-02733579

HAL Id: hal-02733579
https://hal.inrae.fr/hal-02733579
Submitted on 2 Jun 2020

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

Veysset P.

INRA Auvergne-Rhône-Alpes, UMRH, 63122 St Genès-Champanelle
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 $\rightarrow$ heavy workload
  - Animal productivity $\rightarrow$ milk yield, live-weight
  - Land productivity $\rightarrow$ Feed self-sufficiency?
  - Practices’ simplification

- **Mixed crop-livestock farming system**
  - Usually seen as ideal, a virtuous farming system $\rightarrow$ 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 + II) quantities
  - Indicator of technical and managerial efficiency

Economic value variation Between n and n-1

Quantity effect: value variation due to the quantities variations
Price effect: value variation due to the prices variations

Outputs reweighted with their own PPAPI
Inputs reweighted with their own PPMAPI
\( \Delta \) value in constant € = \( \Delta \) quantity
Partial and total factor productivity

Charolais suckler-cattle farms network, Inra

<table>
<thead>
<tr>
<th>Partial and total factor productivity</th>
<th>1980-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>2.03</td>
</tr>
<tr>
<td>Land</td>
<td>0.29</td>
</tr>
<tr>
<td>Intermediate inputs</td>
<td>-0.37</td>
</tr>
<tr>
<td>Equipment</td>
<td>-0.85</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>+0.17</td>
</tr>
</tbody>
</table>

Veysset et al., 2018

Technical efficiency

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

- Depreciation € / ha UAA
- Concentrates kg / LU
- Intermediate cons. € / ha UAA
- Operating capital € / ha UAA
- Capital € / Worker
- LU / Worker
- Crop diversity
- Ha UAA / Worker
- No. plant species
- Total workers
- Forage self-sufficiency
- Feed self-sufficiency
- Non salaried worker
- Permanent grassland

Regression coefficients

- Negative
- Positive
Patrick VEYSSET / Efficiency Livestock systems
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?
Charolais suckler-cattle farms
Labour productivity and farm income

Base 100 in 1980
Income constant euros

Farm income €/worker
Agricultural area ha/worker
Live-weight produced kg/worker

Same trends for France FADN OTEX46

Veysset et al., 2018

+2.37%/year
+1.74%/year
±0%/year ≈ 22 k€/worker/year