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Development of Productivity and Performance in German Dairy and Pig Farms

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1. Introduction

- **Different methods**
- **Non Parametric**
  - ï **Index based**
    - Å **Fischer based on** Laspeyres, Paasche **(approaching quadratic function)**
    - Å **Tornqvist (approaching Translog function)**
  - ï **DEA based**
    - Å **Malmquist**
    - Å **Hicks-Moorsteen**
    - Å **Lowe /** Färe-Primont
- **Parametric**
  - ï **Stochastic Frontier Analysis (SFA)**

Introduction (2)

- **CEPA of Queensland University AU provides DPIN software standard version free-of-charge; computes i.e. Malmquist, Hicks-Moorsteen and Färe-Primont Indexes**
  (http://www.uq.edu.au/economics/cepa/dpin.php)

- Färe-Primont **Indexes (O'Donnell 2011)**
  - **Based on DEA**
    - Multi-outputs / inputs**, combining** monetary and physical variables
    - No price vector required**; instead use of** shadow prices **of the LP model**

2 Method and data: Färe-Primont index (distance function)

$$TFP_{hs,it} = \frac{D_O(x_0, q_{it}, t_0)}{D_O(x_0, q_{hs}, t_0)} \frac{D_I(x_{hs}, q_0, t_0)}{D_I(x_{it}, q_0, t_0)}$$

Index referring to a reference farm_k in period_s (s=1)

Å TFP index calculation in 2 steps:

- Å After 1st run: select farm_k with TFP close to the average TFP in period_s
- Å Farm_ks used as reference for the 2nd run

Data: Balanced farm panels based on nat. FADN

Dairy farms in the North of Germany (Lower Saxony and Schleswig Holstein)

- > 30 dairy cows in 2009/10; N = 170, (1996/97 ï 2010/11)
  - ï 3 outputs: milk (ú), other returns (ú), subsidies (ú);
  - ï 5 inputs: var. inp crops (ú), livestock (ú), other (ú, excl. land rentals and hired labour costs); UAA (ha), AWU

Pig farms (fattening / piglets) Germany

- 2000/1 to 2010/11, based on national FADN
  - ï Fattening N = 364; Piglets N = 195
  - ï Outputs: pigs (ú); other (ú);
  - ï Inputs: livestock (ú); crops (ú); other [ú); land (UAA ha); labor (AWU)

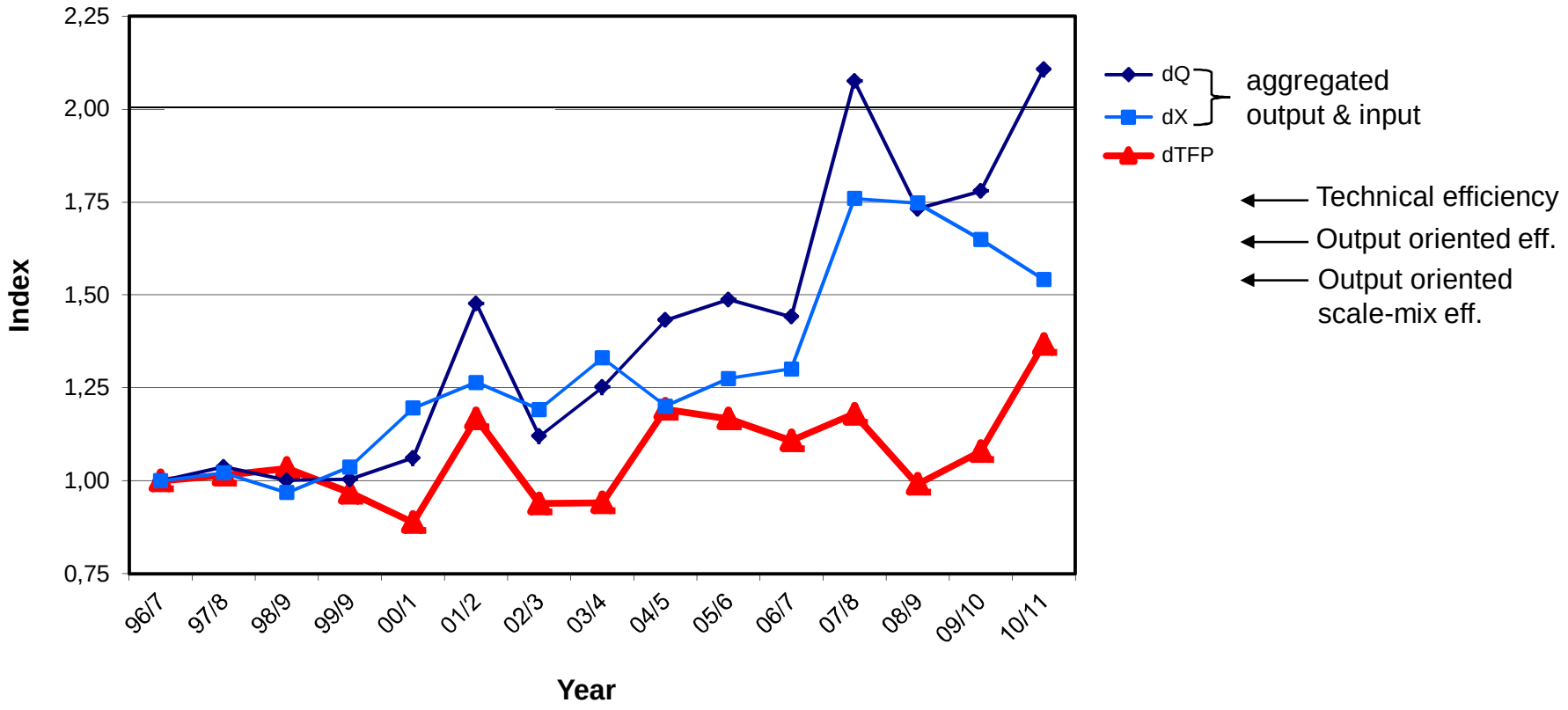
3 Results

3.1 TFP Dairy farms

3.2 TFP Pig farms

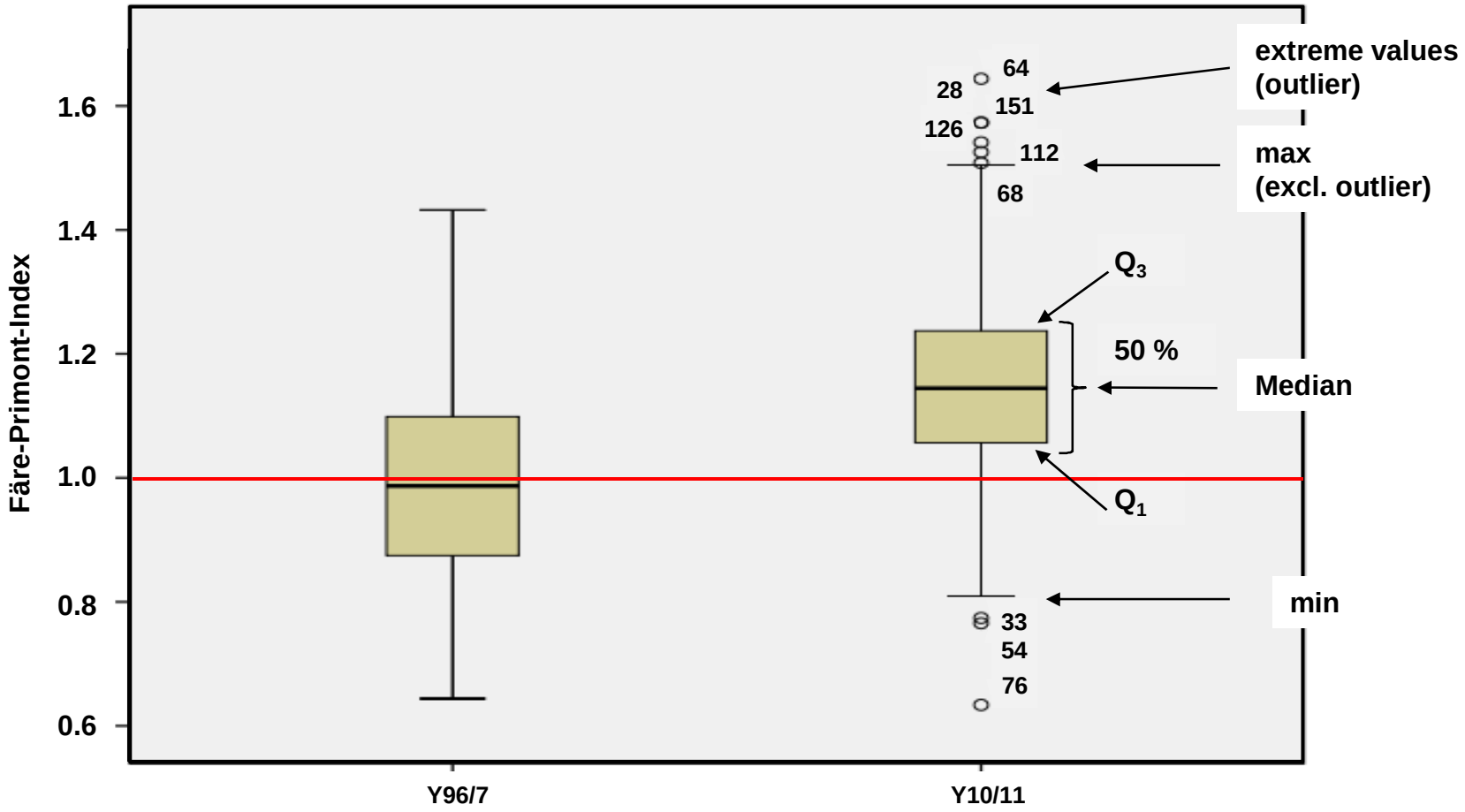
3.3 TFP versus development of income

3.1 Development and decomposition of productivity (example of one farm)



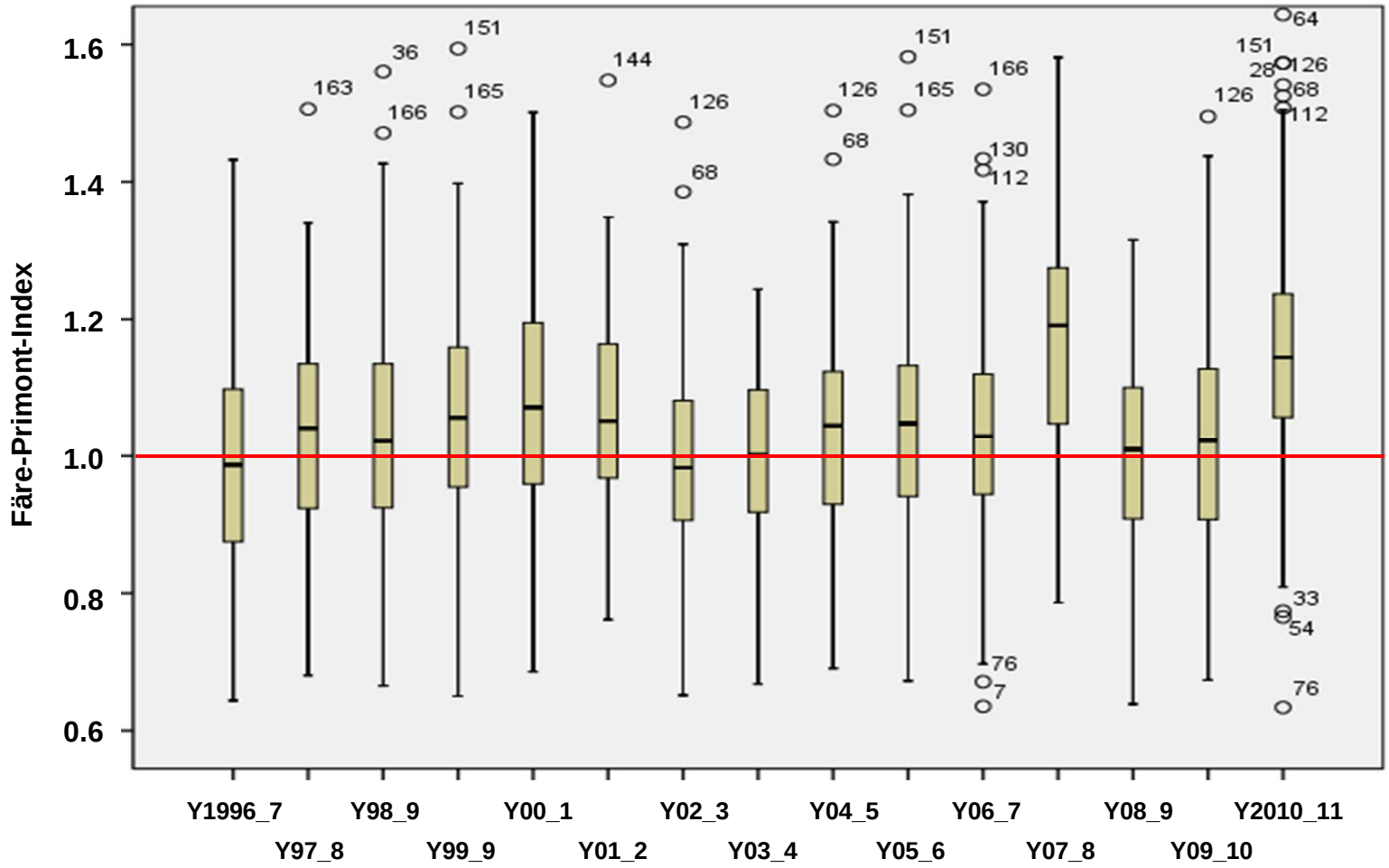
Source: Own Calculations based on BMELV Testbetriebe.

3.1 Variation of TFP between 1996/07 and 2010/11 (sample of dairy farms)



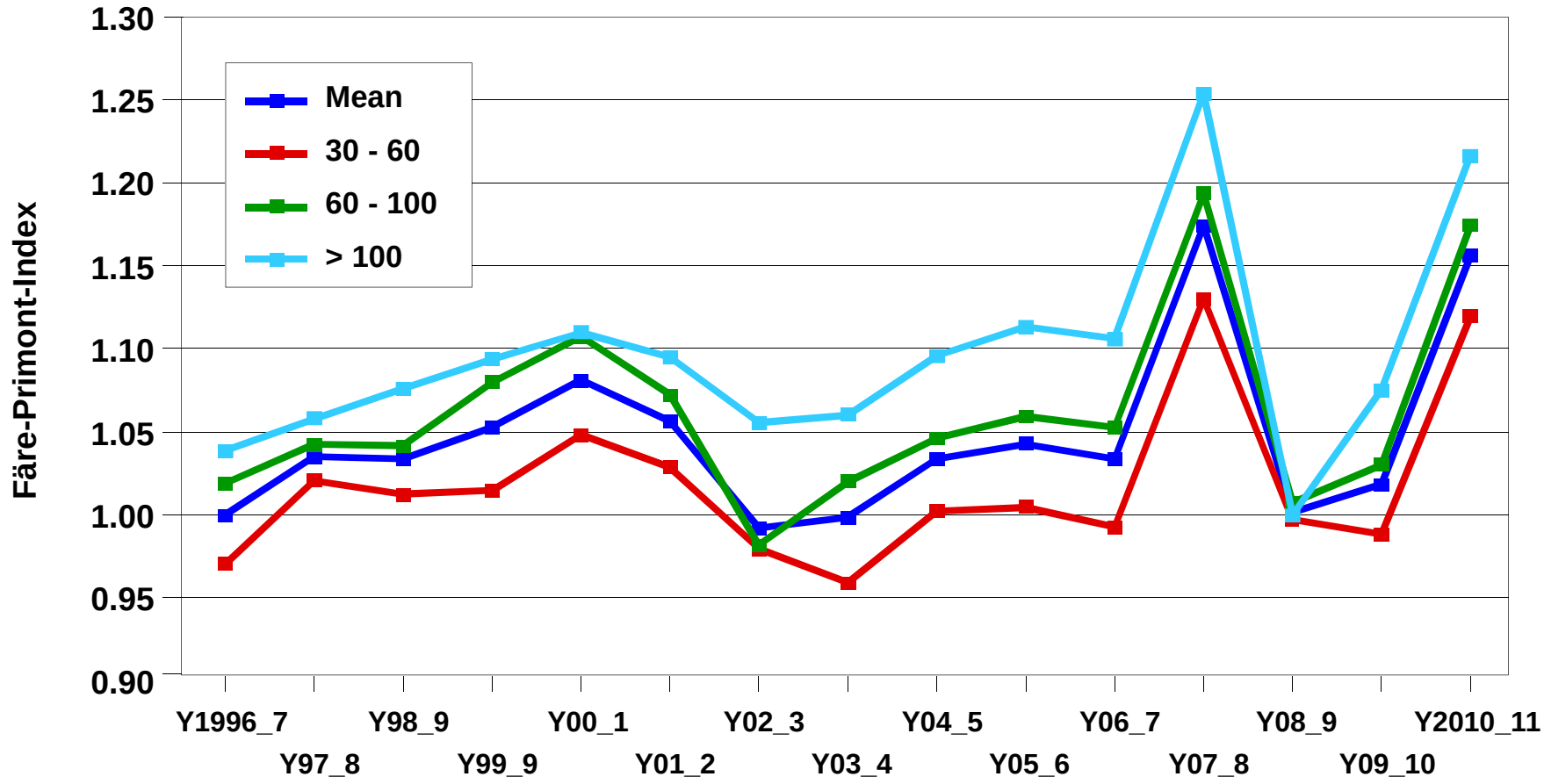
Source: Own Calculations based on BMELV Testbetriebe.

Development and variation of TFP dairy farms



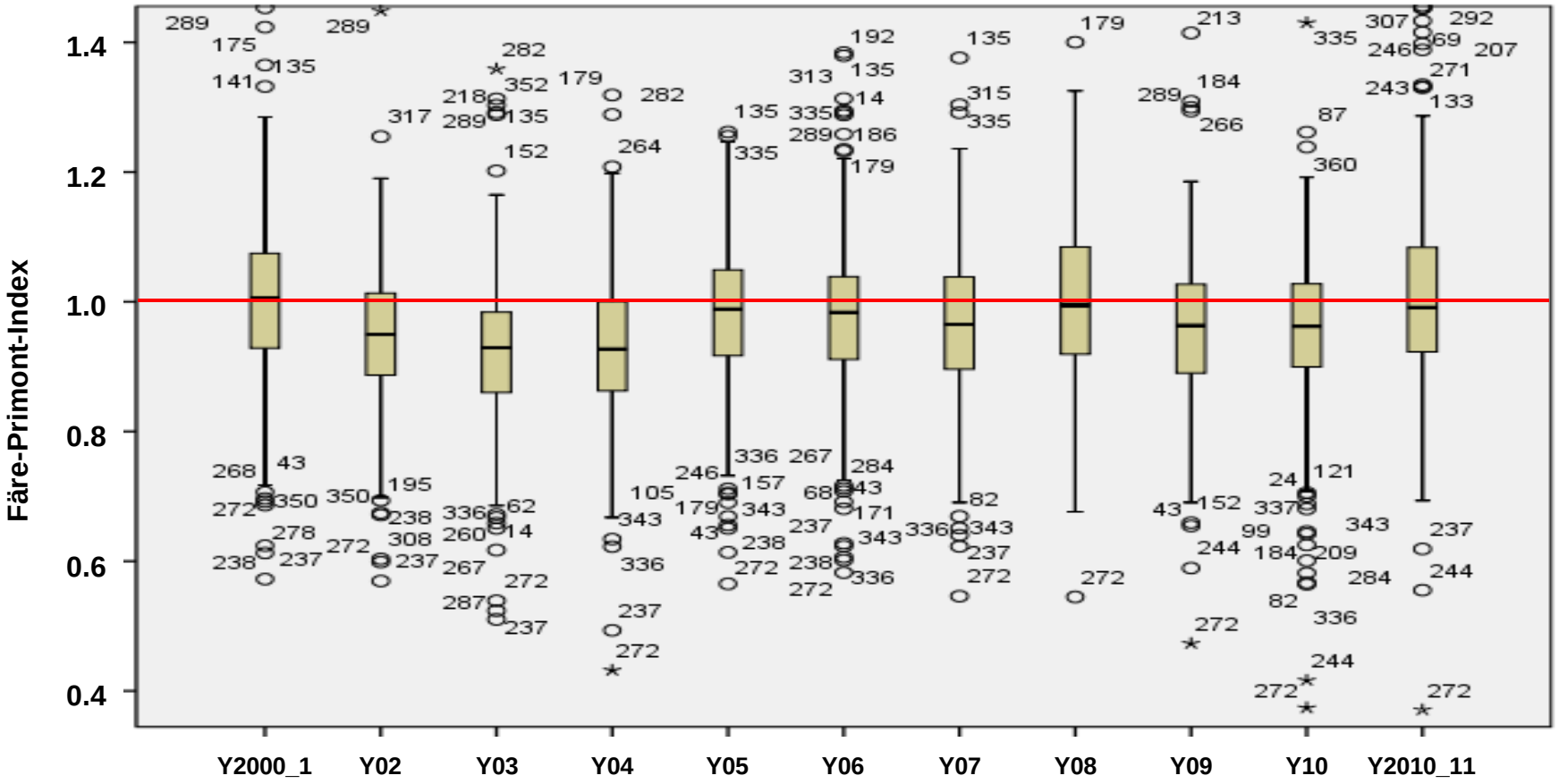
Source: Own Calculations based on BMELV Testbetriebe.

Development of TFP dairy farms by farm size (dairy cows)



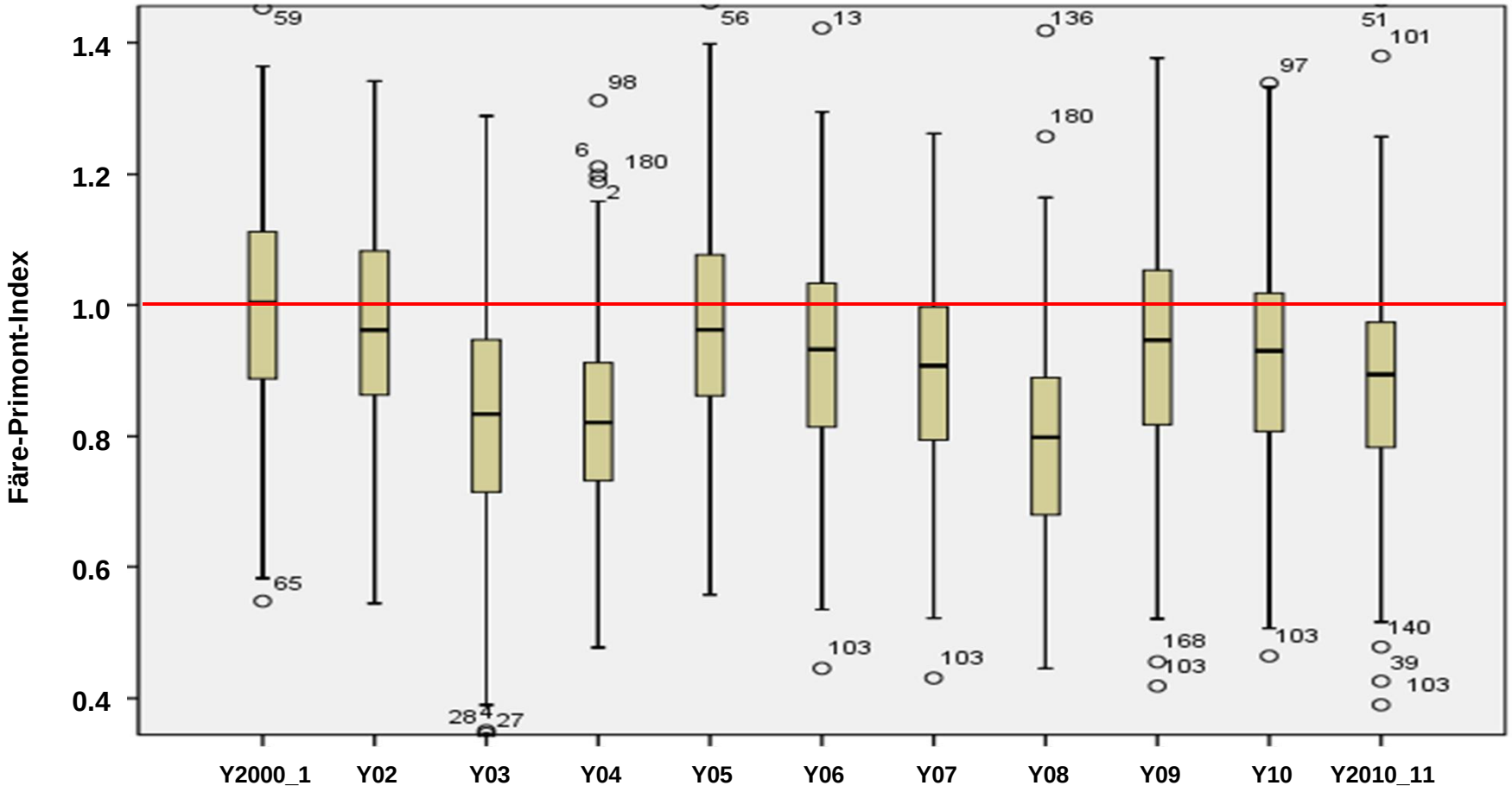
Source: Own Calculations based on BMELV Testbetriebe.

3.2 Development and variation of TFP of farms specialized in pig fattening



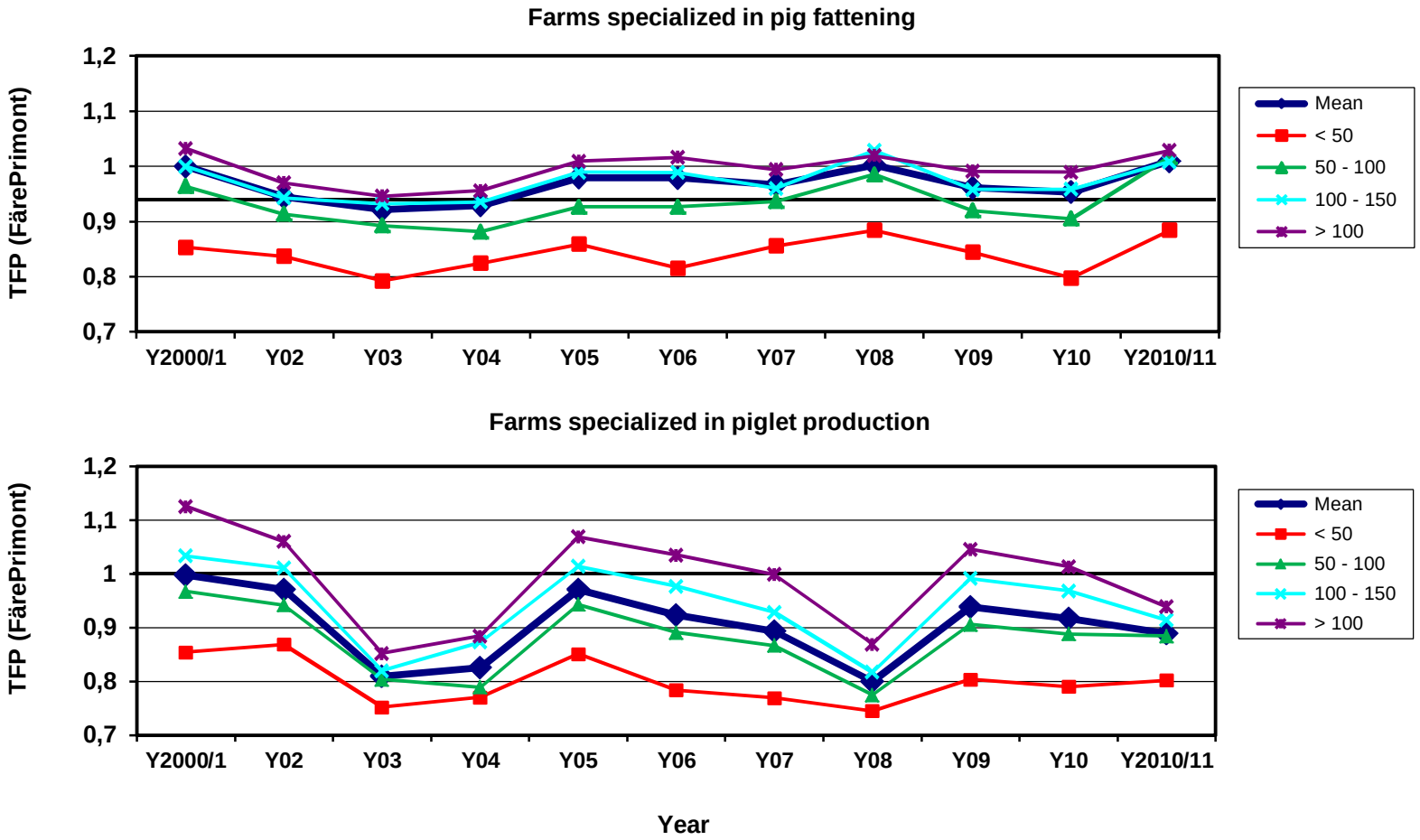
Source: Own Calculations based on BMELV Testbetriebe.

Development and variation of TFP of farms specialized in piglet production



Source: Own Calculations based on BMELV Testbetriebe.

TFP of farms specialized in fattening / piglet production é by farm size (LU-pig)

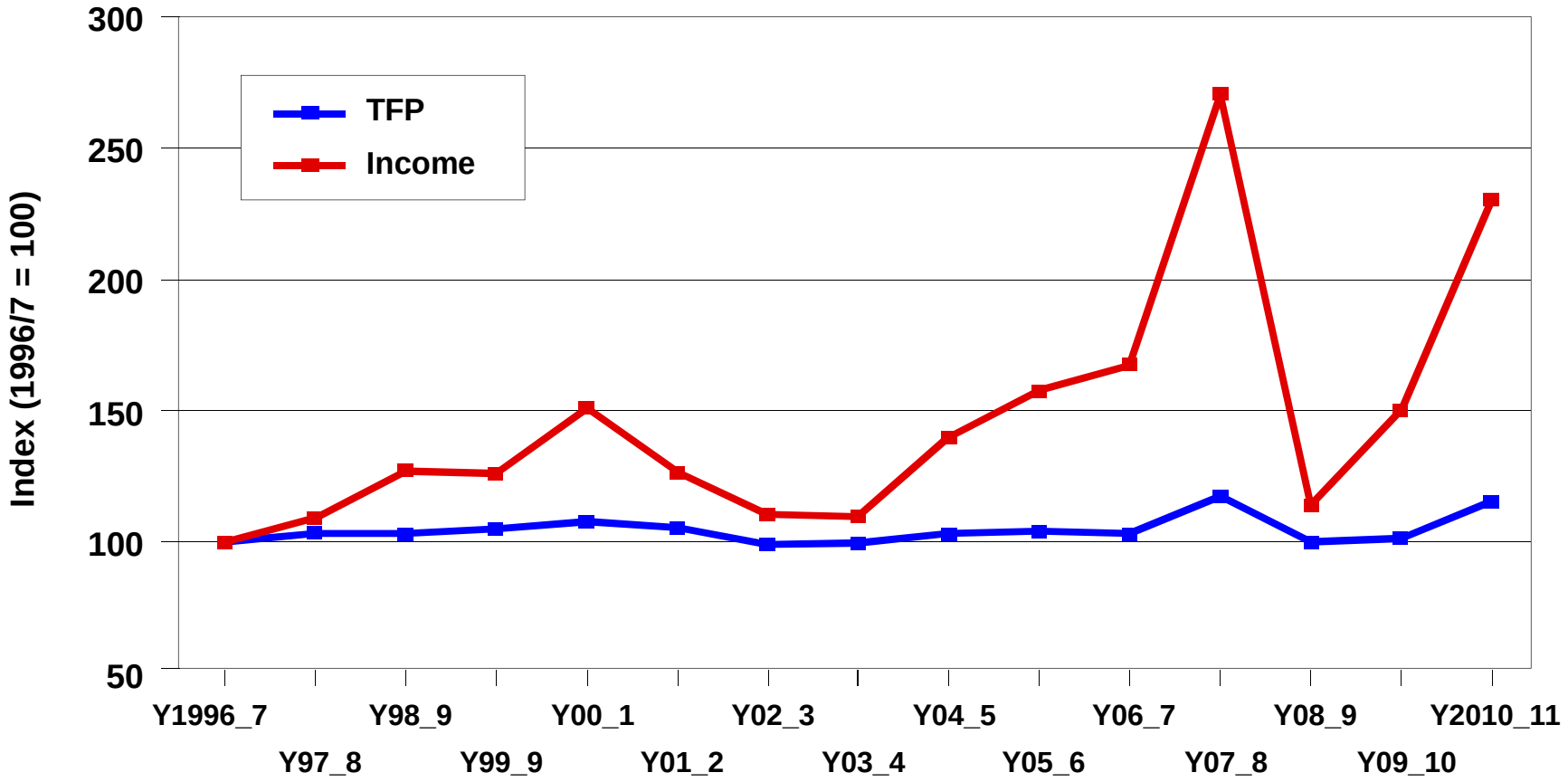


Source: Own Calculations based on BMELV Testbetriebe.

3.3 Comparing income (FFI) and TFP

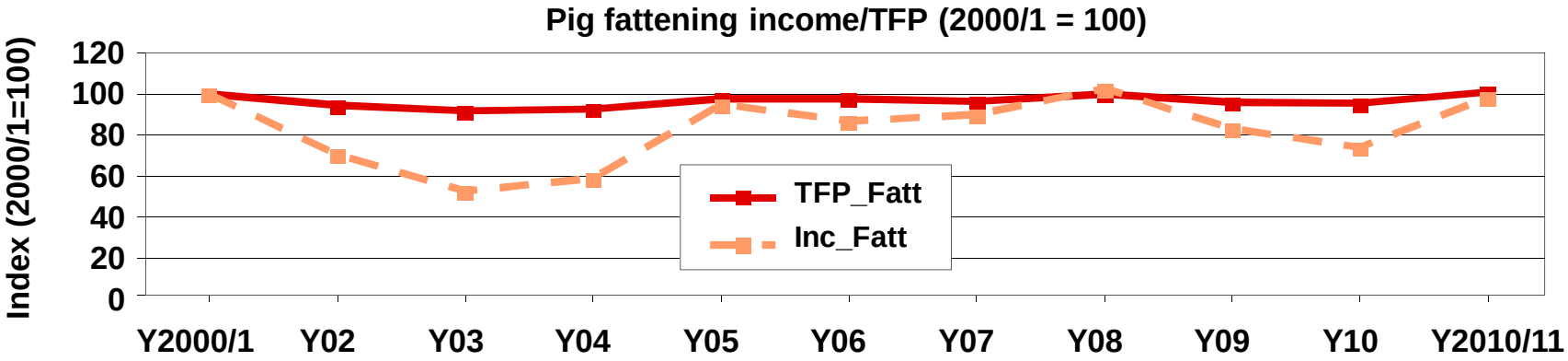
- **Dairy farms**
- **Pig farms**

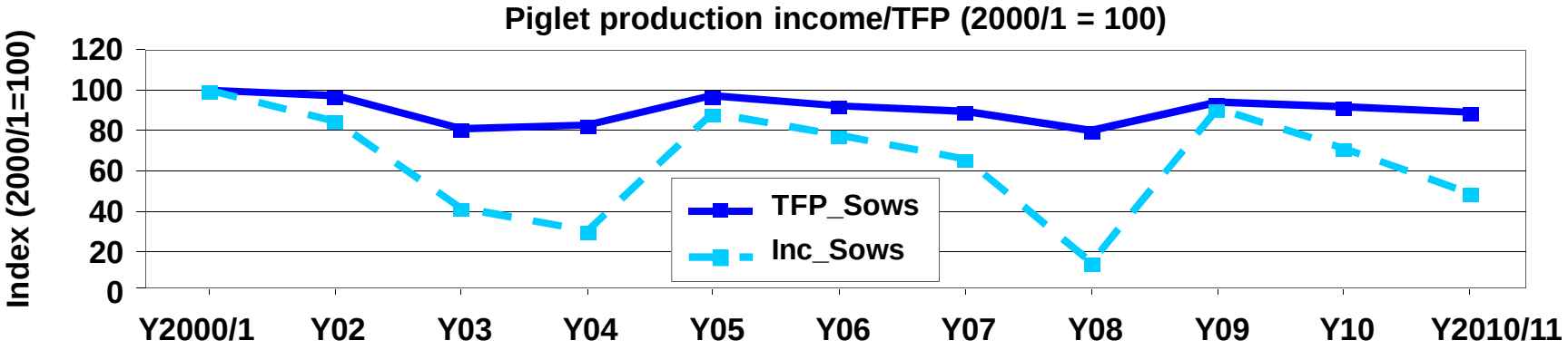
3.3 Dairy farms: development of TFP and income (FFI)



Source: Own Calculations based on BMELV Testbetriebe.

Pig farms: TFP versus income (FFI)





Source: Own Calculations based on BMELV Testbetriebe.

4 Conclusion

- **Rather low changes of TFP**
  - ï **High variation of TFP between farms**
    - Å **Dairy farms: increase**
    - Å **Pig fattening: constant**
    - Å **Piglet production: decreasing**
  - ï **Variation in time rather low compared to income, especially in the last few years. Reasonsé**
    - Å **TPF model highly aggregated wrt outputs and inputs (inclusion of more variables)**
  - ï **TFP results should be compared / validated with other methods, i.e. Fischer Index**

References

- **O'Donnell (2011) DPIN 3.0 A PROGRAM FOR DECOMPOSING PRODUCTIVITY INDEX NUMBERS**
  http://www.uq.edu.au/economics/cepa/dpin.php
- **O'Donnell, C. J. (2010). "Nonparametric Estimates of the Components of Productivity and Profitability Change in U.S. Agriculture."** ***Centre for Efficiency and Productivity Analysis Working Papers WP02/2010.*** **University of Queensland.**
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- **O'Donnell, C. J. (2011) "The Sources of Productivity Change in the Manufacturing Sectors of the U.S. Economy."** ***Centre for Efficiency and Productivity Analysis Working Papers WP07/2011.*** **University of Queensland.**
  http://www.uq.edu.au/economics/cepa/docs/WP/WP072011.pdf.
- **O'Donnell, C. J. (2012)** Econometric estimation of distance functions and associated measures of productivity and efficiency change. J Prod Anal
- DOI 10.1007/s11123-012-0311-1,
  http://www.springerlink.com/content/e711457qp8541733/

Annex

Calculation of Färe-Primont Index (solving LP; aggregate output and inputs; Shadow prices)

Solving LP´s

$$D_o(x_0,q_0,t_0)^{-1} = \min_{\alpha,\gamma,\beta}\{\gamma + x_0'\beta : \gamma\iota + X'\beta \geq Q'\alpha; q_0'\alpha = 1; \alpha \geq 0; \beta \geq 0\}$$ **Output oriented**

$$D_I(x_0,q_0,t_0)^{-1} = \max_{\phi,\delta,\eta}\{q_0'\phi - \delta : Q'\phi \leq \delta\iota + X'\eta; x_0'\eta = 1; \phi \geq 0; \eta \geq 0\}$$ **Input oriented**

Aggregated output and inputs

$$Q_{it} = (q_{it}'\alpha_0)/(\gamma_0 + x_0'\beta_0)$$ **Output**

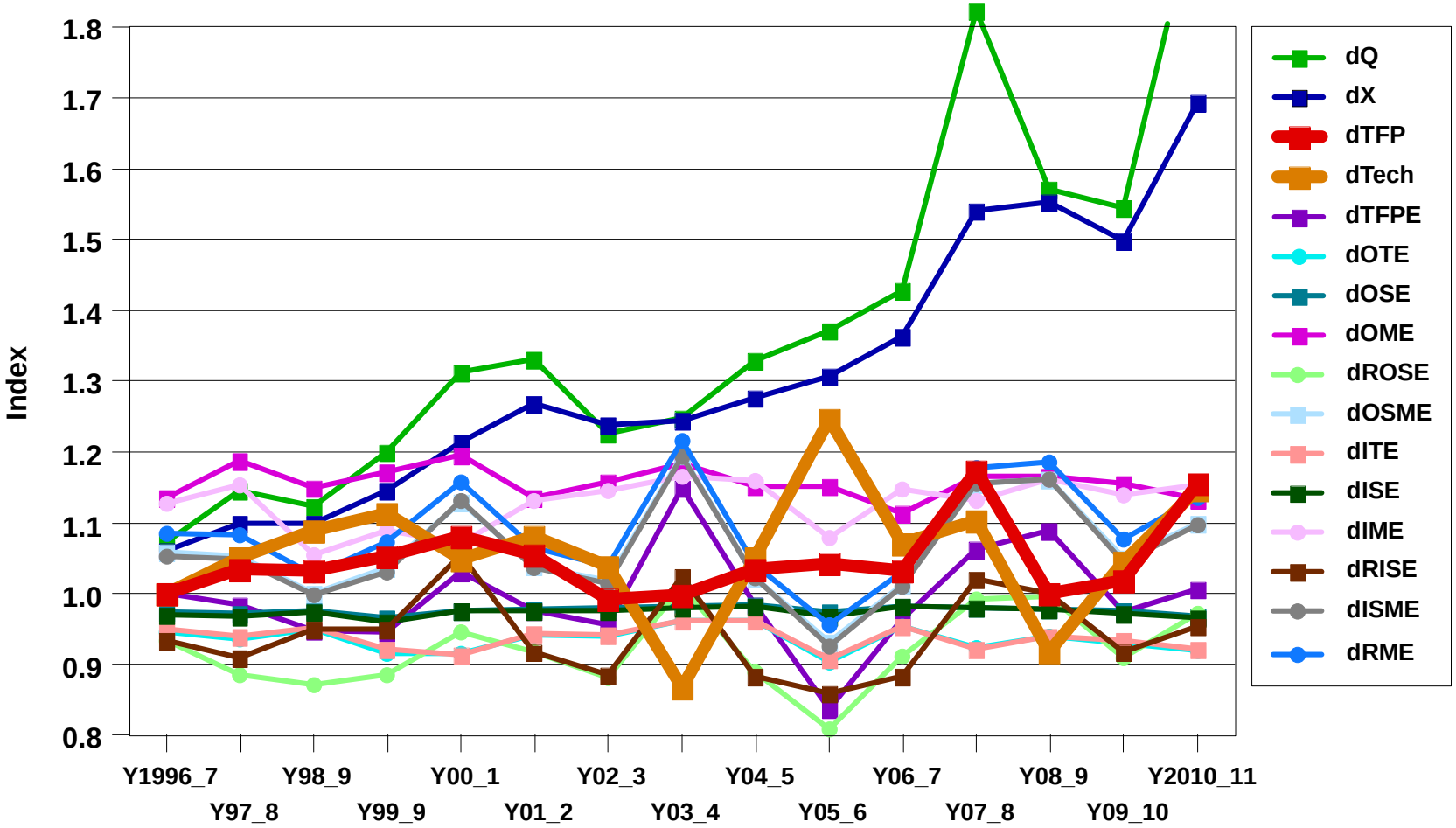
$$X_{it} = (x_{it}'\eta_0)/(q_0'\phi_0 - \delta_0)$$ **Input**

Shadow prices

$$p_0^* = \partial D_O(x_0,q_0,t_0)/\partial q_0 = \alpha/(\gamma + x_0'\beta)$$ **Output**

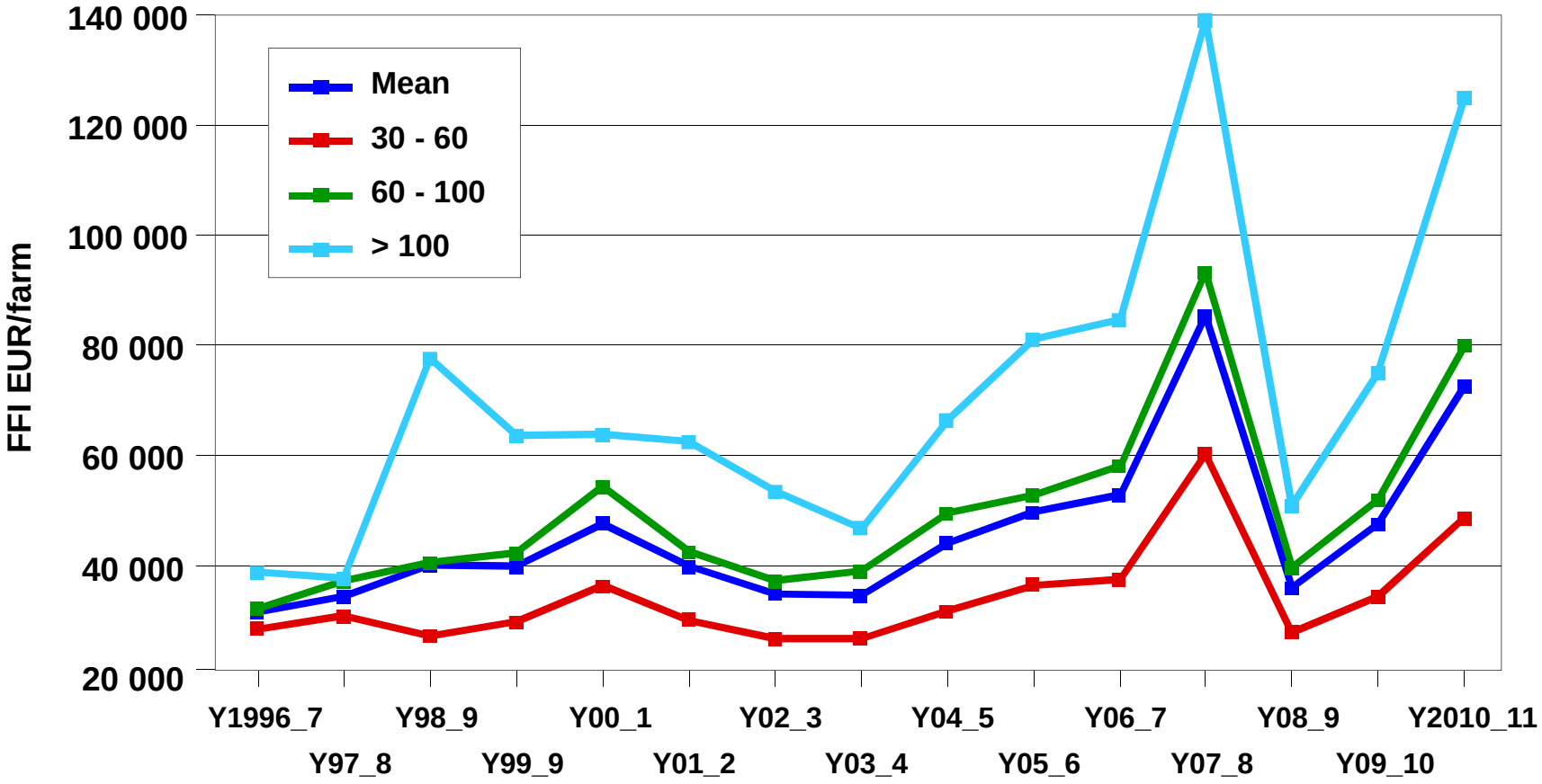
$$w_0^* = \partial D_I(x_0,q_0,t_0)/\partial x_0 = \eta/(q_0'\phi - \delta).$$ **Input**

Partial TFP indicators (average of dairy farms)



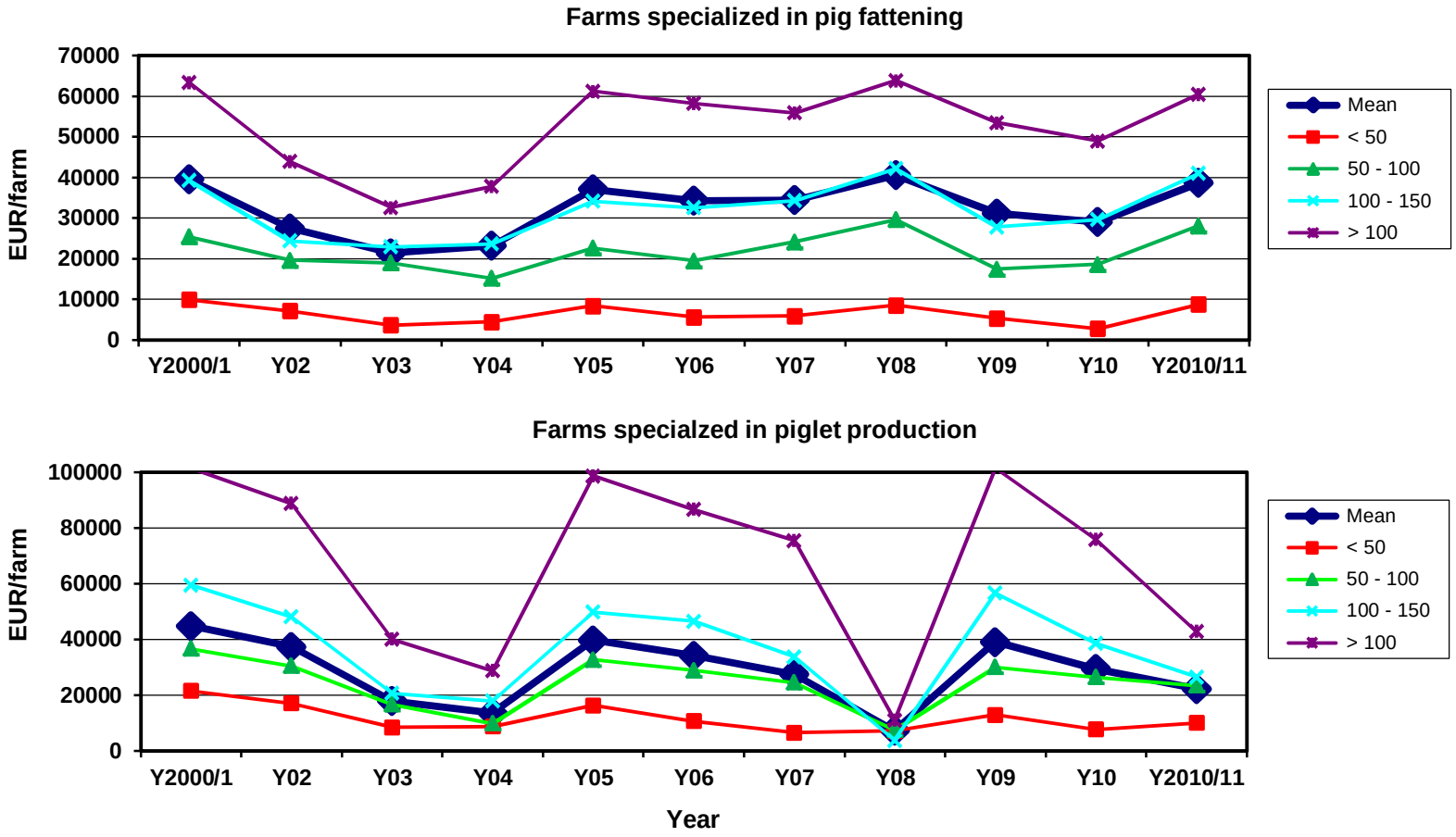
Source: Own Calculations based on BMELV Testbetriebe.

Development of Income (FFI) dairy farms by farm size



Source: Own Calculations based on BMELV Testbetriebe.

Development of income (FFI) (finshed pigs / sows) by size classes (LU-pigs)



Source: Own Calculations based on BMELV Testbetriebe.