

Productivity and Efficiency Analysis

8) Structural change

8c) Application to Finnish agriculture

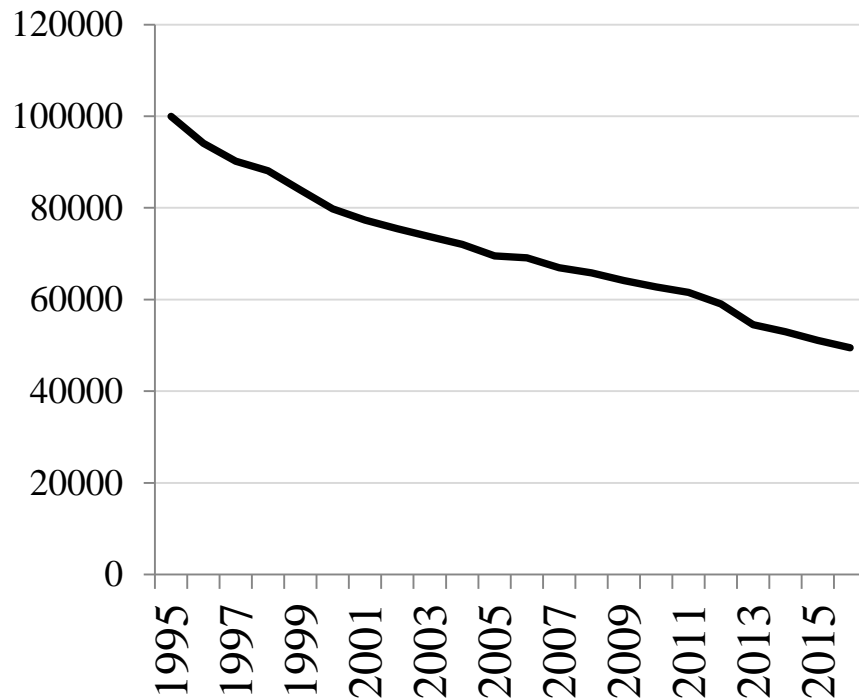
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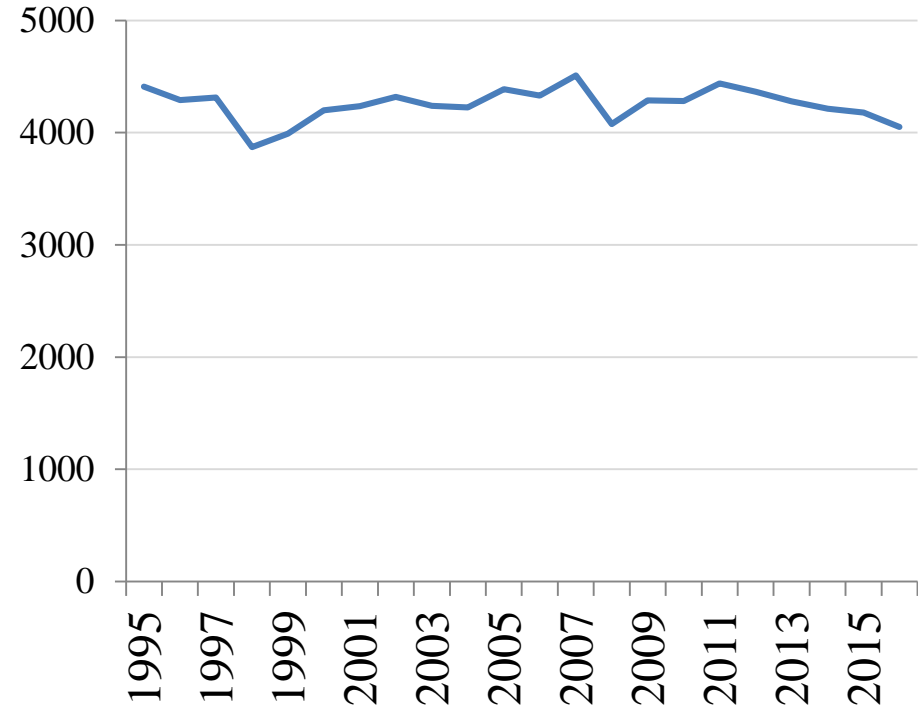
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Consolidation of the Finnish agricultural sector

Number of farms



Total output (2010 prices)



Large gap between sector-level vs. farm-level TFP estimates

Agricultural sector:

- Statistics Finland: TFP growth of agricultural sector **6.85 %** per year (2004-2013)

Farm level studies (examples):

- Myyrä et al. (2009): TFP of Finnish crop farms **0.6-1.7 %** per year
- Sipiläinen (2007): TFP of Finnish dairy farms **0.15 %** per year
- Niemi and Ahlstedt (2009): TFP of Finnish crop farms **1.7 %** per year and dairy farms **1.9 %** per year

What explains the gap between sector-level and farm-level TFP estimates?

- Farm-level productivity studies focus on surviving farms observed throughout the study period
- Previous studies ignore structural changes in the sector:
 - Reallocation of resources and market share between surviving farms
 - Entry and exit of farms
 - Product switch (change of farm type)

(one exception is Kimura and Sauer (2015) who study structural change in Estonian, Dutch, and UK dairy farming)

Decomposing industry-level TFP

- **Entry and exit:** Baily et al. (1992), Griliches and Regev (1995), Foster et al. (2001)
- **Reallocation of resources and market share:** Olley and Pakes (1996)
- **Combining** Olley-Pakes with entry and exit: Maliranta (2003), Böckerman and Maliranta (2007), Diewert and Fox (2009), Hyytinen and Maliranta (2013), Maliranta and Määttänen (2015)

New decomposition: productivity levels

Industry productivity (P_t)

= Productivity of non-switching surviving firms ($\bar{p}_{Sn,t}$)

+ Product switch effect ($\bar{p}_{S,t} - \bar{p}_{Sn,t}$)

+ Entry and exit effect ($\bar{p}_t - \bar{p}_{S,t}$)

+ Reallocation effect ($P_t - \bar{p}_t$)

For further details, see: Kuosmanen & Kuosmanen (2019): Measuring the contribution of structural change on productivity growth without share weights

New decomposition: productivity change

$$\frac{P_t}{P_{t-1}} = \frac{\bar{p}_{Sn,t}}{\bar{p}_{Sn,t-1}} + \left[\frac{\bar{p}_{S,t}}{\bar{p}_{S,t-1}} - \frac{\bar{p}_{Sn,t}}{\bar{p}_{Sn,t-1}} \right] + \left[\frac{\bar{p}_t}{\bar{p}_{t-1}} - \frac{\bar{p}_{S,t}}{\bar{p}_{S,t-1}} \right] + \left[\frac{P_t}{P_{t-1}} - \frac{\bar{p}_t}{\bar{p}_{t-1}} \right]$$

- Unlike DOPD by Melitz and Polanec (2015), this decomposition allows one to add up percentage changes (%) of the components

For further details, see: Kuosmanen & Kuosmanen (2019): Measuring the contribution of structural change on productivity growth without share weights

Application to Finnish agriculture in 1995-2014

Data source: EU Farm Accountancy Data Network (FADN), DG AGRI

- Unbalanced rotating panel of approximately 900 farms per year
- Variables:
 - gross output (constant prices) and
 - 3 inputs: labor (hours), capital (€), land (ha)
- Method:
 - **Shadow-price Törnqvist** TFP-index: shadow prices of inputs estimated using the Cobb-Douglas production function

Results: the starting point

Average TFP growth of the Finnish agricultural sector and its components

	1995-2004	2004-2013
Surviving farms, same type	0.36	1.79
the gap		
TFP of the sector	1.91	2.31

Results: add reallocation (Olley & Pakes, 1996)

Average TFP growth of the Finnish agricultural sector and its components

	1995-2004	2004-2013
Surviving farms, same type	0.36	1.79
+ Re-allocation effect	+0.54	+1.74
= TFP of the sector	1.91	2.31

Results: add entry and exit

Average TFP growth of the Finnish agricultural sector and its components

	1995-2004	2004-2013
Surviving farms, same type	0.36	1.79
+ Re-allocation effect	+0.54	+1.74
+ Entry & exit effect	+1.43	-0.37
= TFP of the sector	1.91	2.31

Results: add entry and exit

Average TFP growth of the Finnish agricultural sector and its components

	1995-2004	2004-2013
Surviving farms, same type	0.36	1.79
+ Re-allocation effect	+0.54	+1.74
+ Entry & exit effect	+1.43	-0.37
+ Product switch effect	-0.42	-0.85
= TFP of the sector	1.91	2.31

Measurement issues in TFP

Melitz and Polanec (2015): “our focus is on the contrast between decomposition methods for a given set of productivity measures and weights. Addressing the numerous measurement issues for firm productivity will lead to a different starting point for the decompositions; but the contrast between the decompositions that we highlight will remain.”

Further research needed:

- Consistent aggregation of firm-level TFP to industry level; correct share weights (e.g., Zelenyuk, 2006)
- Productivity estimation

New directions

- Combining the structural change decompositions with the Malmquist-type decompositions remains an unexplored avenue
- Examples of interesting research questions:
 - Does OP reallocation effect correlate with the change in allocative efficiency, scale efficiency or price effect components of the Fisher index?
 - Do new entrants contribute to technical progress? If yes, how quickly and how much?
 - Can the level or change of firm's technical or scale efficiency predict its survival or exit probability?