



Cross-country Comparison of Dairy Farm Productivity Growth

Shingo Kimura

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OECD Network for Farm-level Analysis

- OECD set up a farm-level analysis network, which meets twice a year since 2008, to promote farm-level analysis by:
 - exchanging experience in using farm-level data to develop indicators and analyse policy issues
 - Undertaking common projects allowing for cross-country comparison: ToR defines common definition of population, farm categories (e.g. size, type), and variables (e.g. income).
- Website: www.oecd.org/agriculture/farm-level-analysis-network/



Working methods

- The networks meets twice a year
- To discuss common projects: objective, ToR, data availability, timing, progress, results of analysis, etc.
- In most cases, countries provide data and OECD makes the analysis and draws policy conclusions
- To discuss data developments (e.g. EU FLINT project to collect additional data to evaluate new aspects, e.g. agri-environmental performance) and analysis done in countries (this demonstrates the usefulness of data)
- Contact persons nominated by government, and experts invited on an ad hoc basis, including consultants

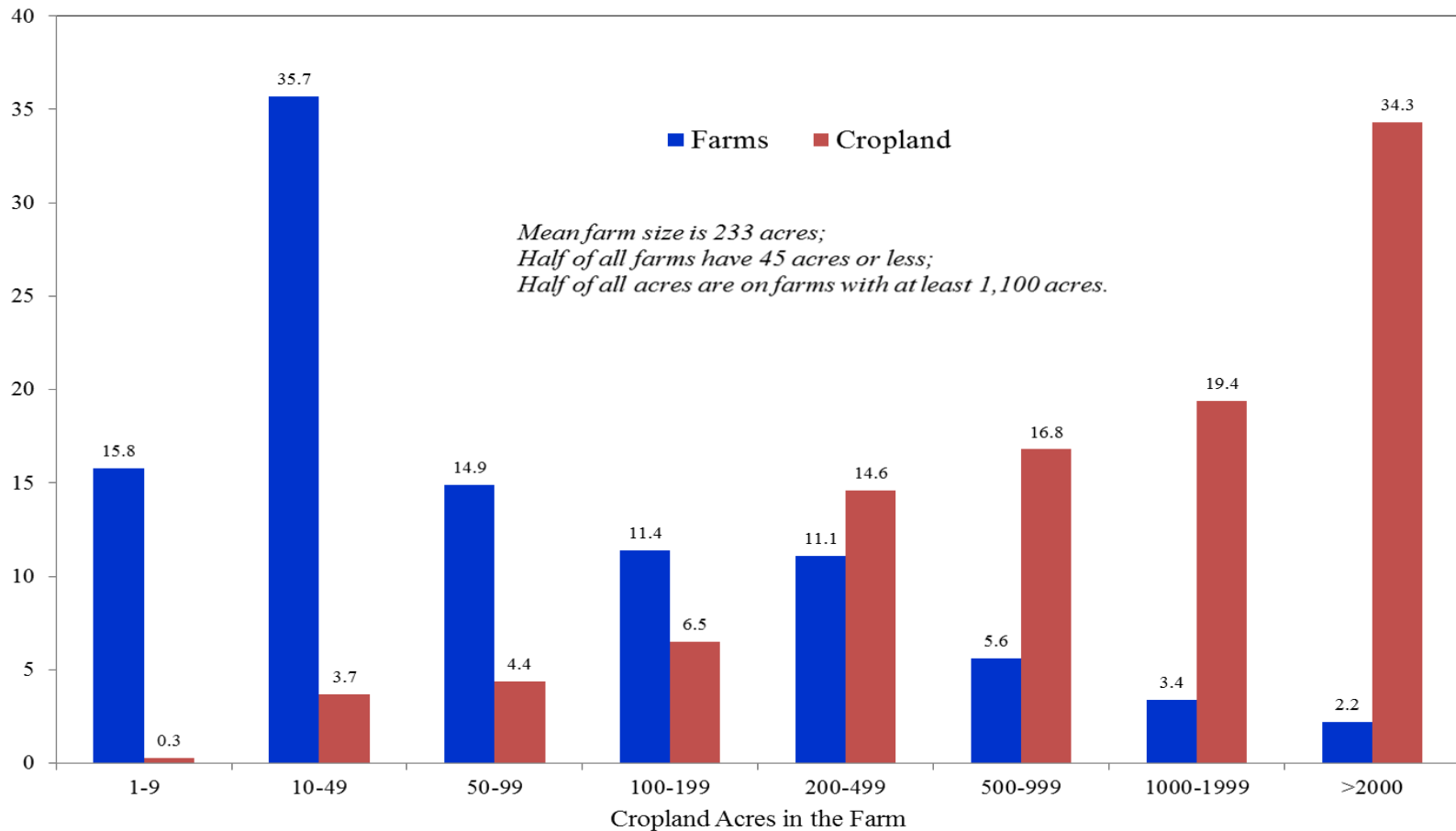
» Measuring changes in farm size

- Measuring farm size and consolidation is challenging
 - Farm size distributions are complex
 - Such that hardly any farm is “average”
- The OECD network of Farm Level Analysis develops an alternative measure for better cross-country comparisons
- Mid-point size (splits the distribution of acreage/animal: half is on larger farms, and half is on smaller)

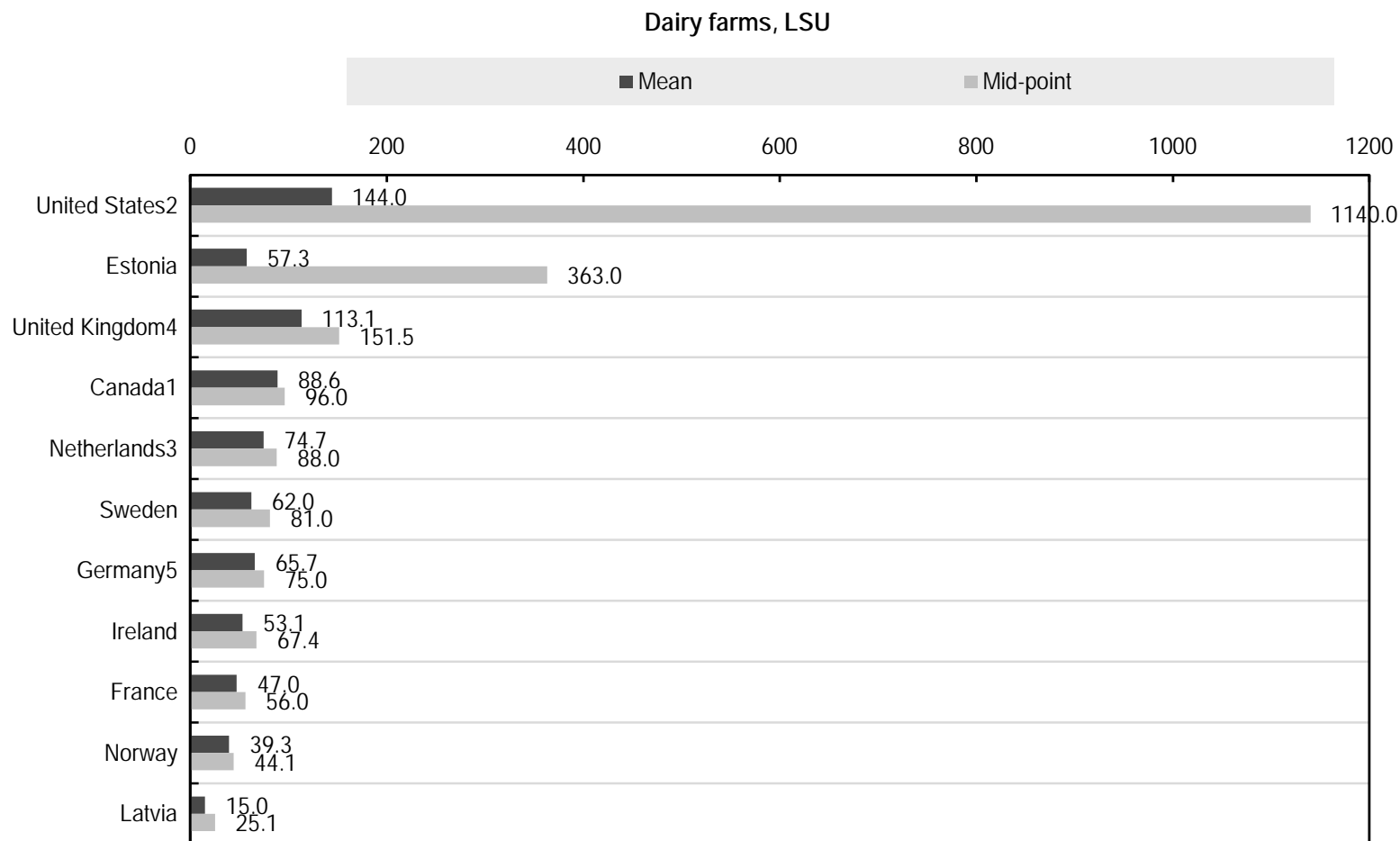


The Size Distribution of U.S. Crop Farms, 2011

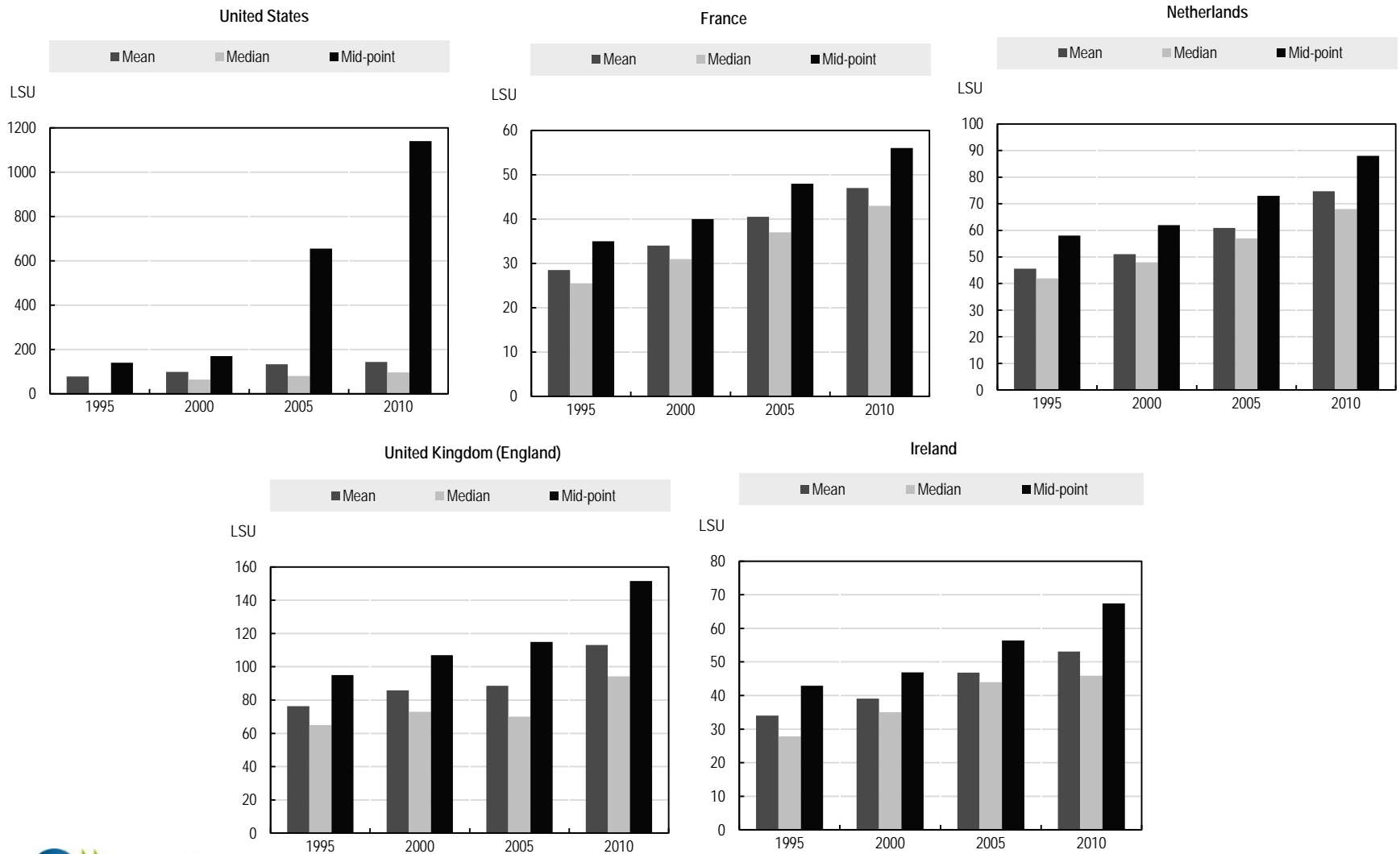
Percent of farms or acres



» Comparison of dairy farm size (2010)



» Evolution of dairy farm size (1995-2010)





Motivation of the dairy farm productivity study

- What are the dynamics of the productivity growth of the dairy farm sector?
 - change in output/input
 - farm-level productivity improvement
 - resource reallocation to productive farms
 - entry and exist of farms
- What are the determinants of farm-level productivity?
 - farm management practice
 - investment behaviour
 - payments and subsidy
 - off-farm activity



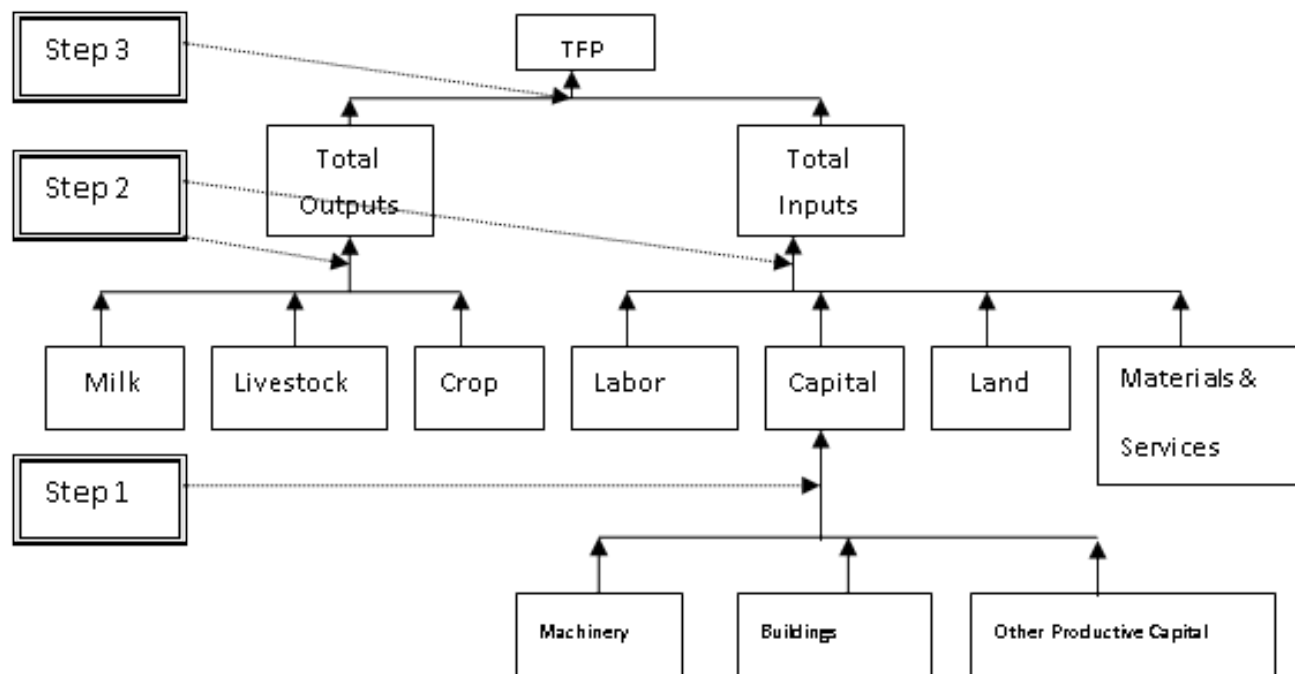
Sector and farm-level TFP

- Sector level TFP is computed by aggregating farm-level inputs and outputs using sample weight information.
- Farm-level TFP is computed multilateral Fisher index (EKS adjusted index) to assure comparability of TFP across farm and time.



Productivity measurement based on farm-survey data: Fisher Index Method

- Multilateral Fisher index method is applied to measure both sector and farm-level TFP estimates





Average dairy farm in three countries

Characteristics of the average specialised dairy farm

	2004	2006	2009	2011
Estonia				
Number of dairy cows	49	51	72	61
Full-time equivalent labour input	5.5	5.5	6.0	4.5
Utilised Area of Land (ha)	193	196	253	202
Milk yield per cow (kg per cow)	5 655	6 613	7 312	7 445
The Netherlands				
Number of dairy cows	65	68	81	82
Full-time equivalent labour input	1.6	1.6	1.7	1.7
Utilised Area of Land (ha)	43	44	49	50
Milk yield per cow (kg per cow)	7 473	7 749	7 837	7 984
England and Wales				
Number of dairy cows	95	99	119	121
Full-time equivalent labour input	2.3	2.3	2.6	2.6
Utilised Area of Land (ha)	89	91	107	106
Milk yield per cow (kg per cow)	6 812	6 904	7 036	7 429



Evolution of sector level TFP

- Average annual productivity growth is the highest in NED.
- TFP growth is led by the improvement in labour productivity in all three countries
- Decline in labour input is complemented by increase in capital input in all three countries

Average annual % growth rate of productivity of the specialised dairy farm sector

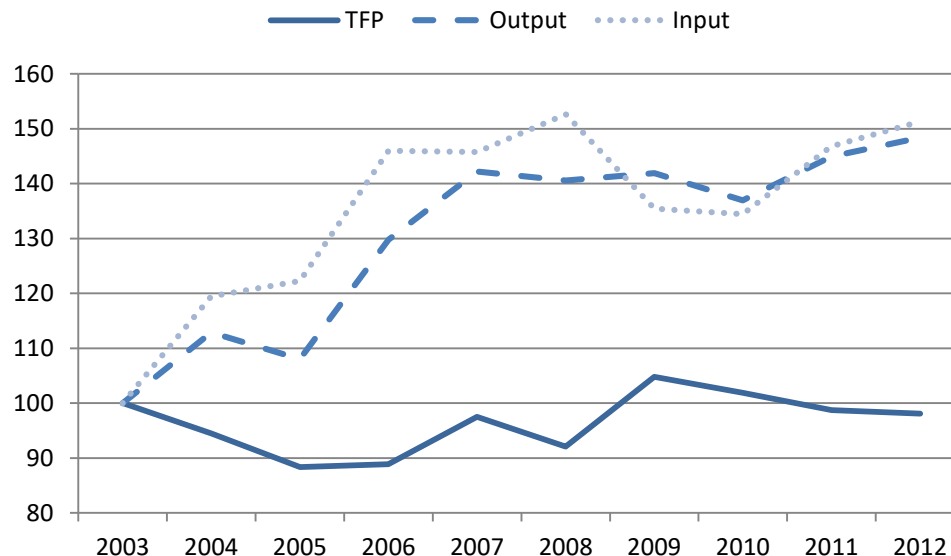
Period	Estonia	Netherlands	United Kingdom
	2003-12	2001-12	2000-12
Total factor productivity	-0.2	1.3	0.0
Partial factor productivity			
Labour	11.9	3.3	2.3
Land	5.0	1.0	1.2
Capital	-4.0	-1.8	-1.4
Material	-1.6	1.4	-0.3
Service	-4.2	1.1	-0.9



Evolution of sector level TFP in Estonia

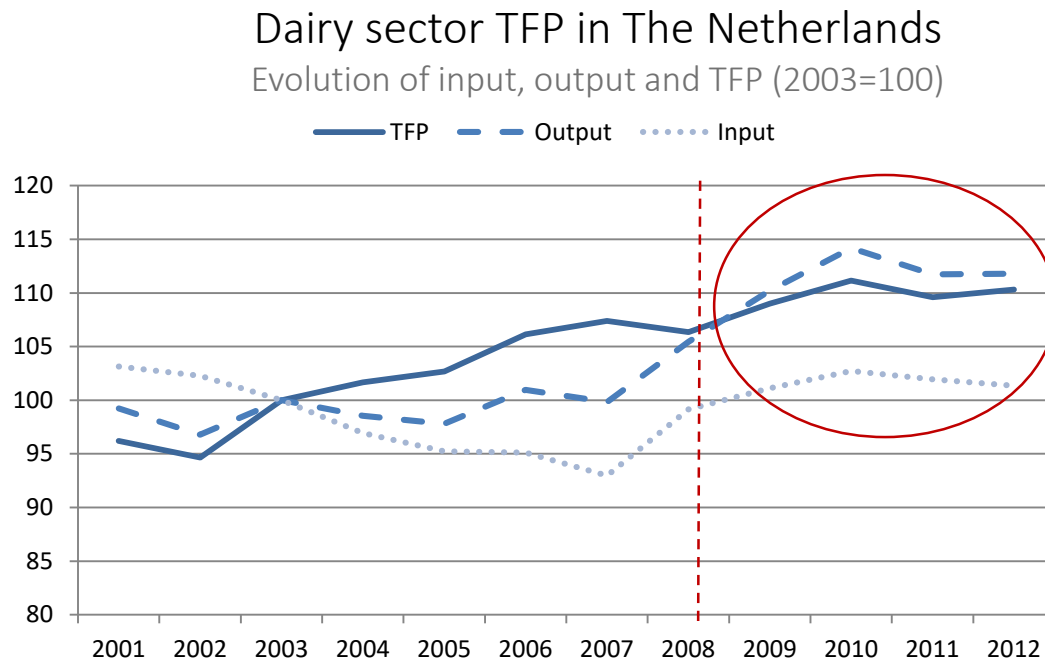
- Sector expanded significantly after EU accession, but not necessarily accompanied with overall productivity improvement

Evolution of input, output and TFP (2003=100)



» Evolution of sector level TFP in the Netherlands

- The Netherlands: Continuous increase in TFP; first driven by reduced input use, then by increased output
- Marked change after 2008: output rises much faster than inputs

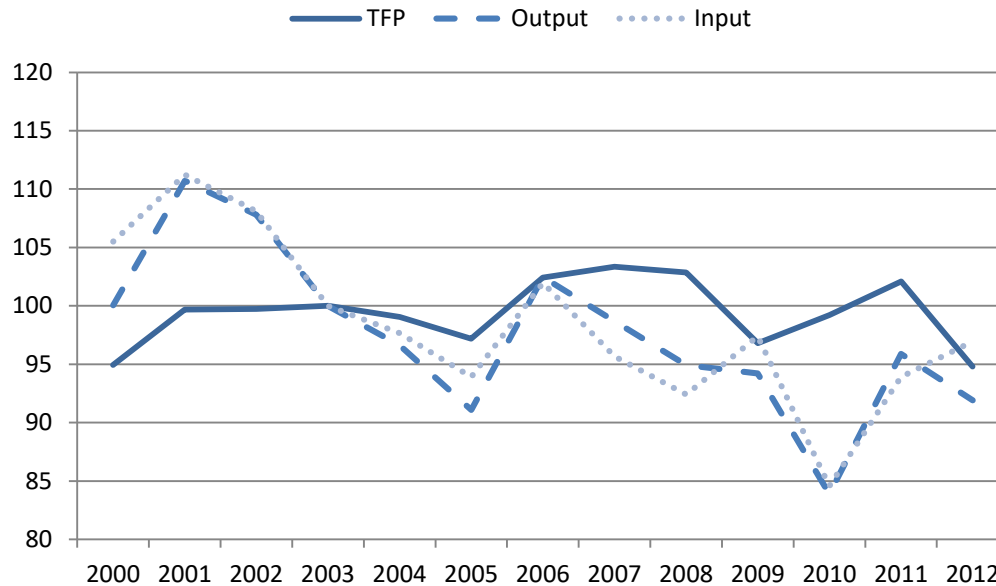




Evolution of sector level TFP in England and Wales

- Productivity remained stable across time, despite variability of output and input
- Overall declining trend of output

Evolution of input, output and TFP (2003=100)





Change in farm and market structure

	Number of dairy cows				% market share			
	2003	2006	2009	2012	2003	2006	2009	2012
Estonia								
Large size farm	132	141	186	202	83	86	89	92
Middle size farm	11	12	14	12	13	11	10	8
Small size farm	7	6	5	2	4	3	1	1
Netherlands								
Large size farm	107	118	138	153	42	43	45	46
Middle size farm	60	64	70	75	46	45	45	44
Small size farm	32	33	35	37	12	11	11	10
England and Wales								
Large size farm	186	207	248	273	54	56	51	49
Middle size farm	74	79	108	130	38	37	41	43
Small size farm	34	38	50	57	8	7	8	8



Productivity and farm size in EU dairy

	Average TFP				Average TFP growth (%)	
	100 = unweighted average in 2003					
	2003	2006	2009	2012		
Estonia					(2003-12)	
Unweighted average	100	87	94	96	-0.48	Few very large farms drive TFP
Market share weighted average	121	113	139	131	0.85	
Large size farm	127	119	141	126	-0.11	
Middle size farm	95	83	89	91	-0.41	
Small size farm	85	69	62	76	-1.25	
Netherlands					(2001-12)	
Unweighted average	100	105	109	110	1.18	Growth and size distribution homogeneous (quota constraint)
Market share weighted average	108	114	119	120	1.17	
Large size farm	116	123	125	127	0.79	
Middle size farm	102	108	112	111	1.23	
Small size farm	79	83	89	89	1.74	
UK					(2000-12)	
Unweighted average	100	101	100	99	0.32	TFP of large size farm declined
Market share weighted average	110	110	104	102	-0.26	
Large size farm	117	117	108	105	-0.36	
Middle size farm	101	100	98	99	0.05	
Small size farm	78	80	84	83	0.75	

◆ EU milk sector reform:

- deregulation in the dairy sector, effectively implemented in 2008
- significant productivity increasing effects both in Estonia and the Netherlands, slightly negative effect in UK





Decomposition of productivity growth in dairy farm sector

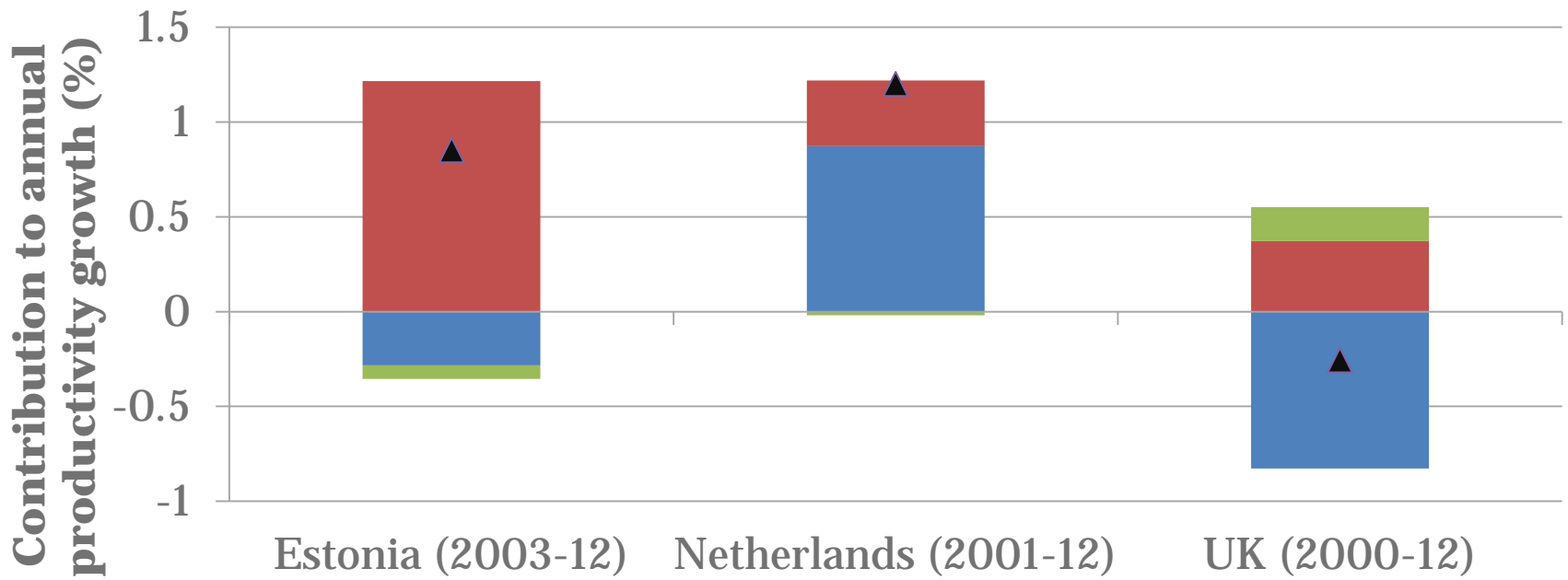
- Dynamic OP decomposition method decompose the sector level productivity change into four components
 1. Productivity improvement of continuing farms
 2. Resource reallocation between continuing farms
 3. Impact of new farm entry
 4. Impact of farm exit

$$\begin{aligned} \Delta LP_t &= [\overline{LP}_{cont,t} - \overline{LP}_{cont,t-1}] \\ + \sum_{cont} & [(s_{it} - \bar{s}_t)(LP_{it} - \overline{LP}_t) - (s_{it-1} - \bar{s}_{t-1})(LP_{it-1} - \overline{LP}_{t-1})] \\ + \sum_{entry} & [s_{entry,t}(LP_{entry,t} - \overline{LP}_{cont,t})] \\ + \sum_{exit} & [s_{exit,t-1}(\overline{LP}_{cont,t-1} - LP_{exit,t-1})] \end{aligned}$$



Decomposition of productivity growth in dairy farm sector

- Exit and entry
- Resource reallocation between farms
- Productivity growth at the farm level
- ▲ Market share weighted productivity growth



$$tfp_{it} = \alpha + \sum_K \beta^K X_{it}^K + \sum_t \gamma^t D^t + \mu_i + \varphi_{it}$$

tfp – the level of productivity of farm i at time t

X – vector of k farm characteristics

[herd, farm structure, farmer, management style, investment, technology, environment, financial structure etc.]

D – time related binary variables indicating potential policy etc. related shifts

[policy reforms, macroeconomic shocks, other binary coded shifts etc.]

μ – unobserved farm-specific determinants (time invariant)

[previous experiences, location/farm/farmer specifics etc.]

φ – unobserved farm-specific and time variant determinants

[herd disease, technology failure, network effects etc.]

	Estonia	Netherlands	United Kingdom
Farm size			
Number of dairy cow	++	++	++
Farm management			
Milk yield	++	++	++
Stocking density (per ha)	++	++	++
Purchased feed per cow (EUR)	--	--	--
Labour input per cow (hour)	--	--	--
Hired labour share (%)	++	++	--
Characteristics of manager			
Age	-	++	0
University education	na	--	--
Corporate organization (%)	0	na	--
Investment and technological choice			
Net investment per cow (EUR)	--	--	--
Milk robot	0	++	na
Milk parlor	na	++	na
Adoption of organic practice (%)	--	--	++
Natural condition			
Less favoured area (%)	--	na	--
Payments and other source of income			
Share of payments in farm income	-	++	0
Non-farm income	na	--	--
Milk quota reform	++	++	-

na: not available, ++/-- positive/negative and significant at 1%, +/- positive/negative and significant at 5%

All countries:

- (++) herd size significant positive impact
- (++) milk yield positive impact by definition and after controlling
- (++) stocking density (LU/ha) positive impact
- (--)
- feed & labor per cow significant negative impacts

England and Wales

- labor intensive dairy farming is less productive
- less hired labor leads to higher farm productivity
- recent investments (3y) show negative impact
- organic farms are more productive
- less favorable areas show lower dairy productivity
- off-farm income significantly decreases farms' productivity