Analyzing the Impact of the Sample Renewing Effect on Aggregate Productivity: Evidence from the Greek Olive Oil FADN Data

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Introduction

The Farm Accounting Data Network (FADN) data set has been extensively (48 journal papers during the period 1996-2011) for performance evaluation of agricultural holdings in EU-27

Previous studies analyze efficiency and productivity differences and changes over a given period of time

Also infer aggregate (industry-level) efficiency and productivity by usually taking simple arithmetic averages of the farm-level estimates

Motivation

In rotated panels, as the EU FADN, farms are replaced in the sample after a period of five years by seemingly similar farms in terms of some observable characteristics such as location, size, and type of farming to maintain the stratified nature of the data.

However, farms may have different efficiency and productivity levels that are not directly observable by the designers of the replacement process and this may affect our estimates of aggregate productivity

Research Question & Hypothesis

examine the impact that the replacement process in rotated panels may have on industry-level productivity changes

If the unobserved performance heterogeneity is perfectly or highly correlated with the observable characteristics used for the replacement process then the impact of entering and dropped from the sample farms on aggregate productivity changes will be near zero or negligible

Otherwise, the replacement process will affect changes in aggregate productivity

Sample Renewing Effect

that part of of aggregate productivity change that is related to the replacement process (i.e., stratification and rotation)

It contains the effects of

1. Entering to the sample (selected and voluntarily participate)
2. Exit the market (self selection)
3. Voluntarily withdraw from the sample
4. Replaced

The FADN data set

it is a harmonized, stratified, rotated and unbalanced data set

It is drawn from the population of commercial farms, defined as those that are large enough to provide a main activity to the farmer and e level of income sufficient to support his/her family.

This is determined by the imputation of a economic size threshold = { sum of scale x SGM } / ESU , which is different for each member state

the coverage range from a low of 5% in Slovakia to a high of 83% in Ireland, with the average being around 45%

The FADN data set

Stratification Criteria: location of the farm
economic size
type of farming

A farm is classified into a particular type of farming when at least 2/3 of its total SGM is coming from a particular activity

Stratification matrix = 140 regions x 72 types of farming x 9 economic classes

For each cell a representative number of farms are included in the FADN sample

The FADN data set

Sample fractions may differ depending on the number of available observations as sometimes it is difficult to find farms for particular cells

The agricultural holdings included in the FADN sample are selected at random conditional upon availability of farm accounts in order to be able to complete the EU FADN *Farm Return* and on that participation is voluntary

Farms usually stay for a period of five years in the sample and then are replaced with similar ones in terms of observable characteristics (location, size and type of farming

Our Sub-sample: Olive producers in Greece

6,004 observations available for olive producers during the period 1991-2002, corresponding to 1,281 farms

around 14% of farms are dropped from the sample and replaced every year

<u>Variables</u>

Output = deflated revenue by an industry price index
Land = hectares
Labour = annual working hours of family and paid labor
Intermediate inputs = deflated expenditures by a sector price index
Capital = deflated end-of-the-year booking value

	Staying in the sample		Entering to the sample		Dropped from the sample	
	Number	%	Number	%	Number	%
1991-1992	444	86.2	71	13.8	49	9.9
1992-1993	436	85.4	87	14.6	65	12.6
1993-1994	402	79.9	101	20.1	125	23.7
1994-1995	361	68.9	163	31.1	142	28.2
1995-1996	404	81.8	90	18.2	120	22.9
1996-1997	447	91.6	41	8.4	47	9.5
1997-1998	458	91.8	41	8.2	30	6.1
1998-1999	464	92.2	39	7.8	35	7.0
1999-2000	484	92.0	42	8.0	19	3.8
2000-2001	398	85.4	68	14.6	128	24.3
2001-2002	411	88.2	55	11.8	55	11.8
Average		85.8		14.2		14.5

	Staying in the sample		Entering to the sample		Dropped from the sample	
	Number	%	Number	%	Number	%
1991-1995	199	24.3	325	39.7	294	35.9
1992-1996	172	20.5	322	38.5	343	41.0
1993-1997	184	22.1	304	36.6	343	41.3
1994-1998	236	30.8	263	34.3	267	34.9
1995-1999	328	46.9	175	25.0	196	28.1
1996-2000	380	59.4	146	22.8	114	17.8
1997-2001	296	45.0	170	25.8	192	29.2
1998-2002	310	47.3	156	23.8	189	28.9
Average		37.0		30.8		32.2

Analytical Framework

$$A_t = \sum_{i=1}^{N} \theta_{it} A_{it}$$

Θ is specified according to the denominator rule to guarantee consistency in aggregation (van Biesebroeck, 2008; Fare and Karagiannis, 2013)

partial factor productivity measures to be aggregated using the shares of the reference input and TFP using the share of aggregate (real) input

the resulting aggregate measure has exactly the same interpretation as the farm-level measures and there are no monotonicity violations

Analytical Framework

$$A = A_t - A_{t-1} = \sum_{i=1}^{N} \theta_{it} A_{it} - \sum_{i=1}^{M} \theta_{it-1} A_{it-1}$$

$$= \left(\sum_{s} \theta_{it} A_{it} - \sum_{s} \theta_{it-1} A_{it-1} \right)$$

$$+ \left(\sum_{n} \theta_{it} A_{it} - \sum_{d} \theta_{it-1} A_{it-1} \right)$$

= contribution of remaining in the sample farms +

+ the sample renewing effect

Analytical Framework

we use the symmetric weighting scheme suggested by Griliches and Regev (1995) to decompose the contribution of the remaining in the sample farms

$$\Delta A = \sum_{s} \bar{\theta}_i \Delta A_i + \sum_{s} \bar{A}_i \Delta \theta_i + \left(\sum_{n} \theta_{it} A_{it} - \sum_{d} \theta_{it-1} A_{it-1} \right)$$

(a) productivity changes of farms being in the sample for both periods

(b) share weights shift among staying in the sample farms

Analytical Framework

Since entering farms essentially replace dropped farms in order to guarantee the representativeness of the sample, to properly account for the contribution of this replacement effect we should compare productivity between entering and exiting units

Moreover, as long as farms that dropped from the sample look very much like the new entrants, the share of entrants will in general be quite similar to the market share of drops

Aggregate all farms that exit into a single unit and all farms that enter into another single unit and measure their productivity using share within each group

Analytical Framework

$$\Delta A = \sum_{s} \bar{\theta}_i \Delta A_i + \sum_{s} \bar{A}_i \Delta \theta_i + \frac{A_{dt-1} + A_{nt}}{2} \left(\sum_{n} \theta_{it} - \sum_{d} \theta_{it-1} \right) + \frac{\sum_n \theta_{it} + \sum_d \theta_{it-1}}{2} (A_{nt} - A_{dt-1})$$

(a) reallocation of market share between the entering to and dropped from the sample farms

If stratification by economic size is reflected in their market share, then this term will be small in magnitude and will reflect the changes (if any) in the sample size

(a) Productivity difference between entering and dropped farms

Farm-level Productivity Measurement

$$FP_{it}^{j} = \left(lny_{it} - \overline{lny}_{t}\right) - \left(lnx_{jit} - \overline{lnx}_{jt}\right) + \sum_{r=2}^{t}\left(\overline{lny}_{r} - lny_{r-1}\right) - \sum_{r=2}^{t}\left(\overline{lnx}_{jr} - \overline{lnx}_{jr-1}\right)$$

the first two terms of this index measure cross-sectional productivity differences (i.e., a catching-up effect) and the other two times-series productivity changes that result from the shift in the productivity distribution over time

the resulting productivity index measure the proportional difference in productivity between for a particular farm at year t relative to the hypothetical unit in the base period

Empirical Results

For 1991-1992

Change in Aggregate Productivity	Change in the Productivity of Staying in the Sample Farms	Reallocation among Staying in the Sample Farms	Productivity Differences between Entering to and Dropped from the Sample Farms	Reallocation between Entering to and Dropped from the Sample Farms
		Land productivity		
-0.590	-0.532	0.013	-0.061	-0.010
			10.3%	1.7%
		Labor productivity		
-0.564	-0.505	0.043	-0.089	-0.013
			15.8%	2.3%

Further Work….

Analysis with 5-years rolling windows

Analysis by region

TFP estimates based on econometric estimation

Other products, countries