# Persistence of firm-level profitability in the European dairy industry

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***Abstract* - Based on autoregressive (AR) models and Arellano-Bond dynamic panel estimation this article analyses profit persistence in the European dairy industry. The sample comprises 590 dairy processors from the following five countries: Belgium, France, Italy, Spain and the UK. The AR models indicate that cooperatives which account for around 20% of all firms in the dairy sector are not primarily profit oriented. In addition, the results point towards a high level of competition as profit persistence is rather low even if cooperatives are excluded. The panel model reveals that short as well as long run profit persistence is influenced by firm and industry characteristics.**

## INTRODUCTION

While the competitive environment hypothesis postulates that firm profits which deviate from the competitive norm cannot exist in the long run, such persisting 'abnormal profits' are rather the normal case in the real world. Although there is a great quantity of studies analyzing profit persistence in entire manufacturing sectors (e.g. Mueller, 1986; Gschwandtner, 2005), empirical evidence for the European food industry and its subsectors is still scarce. Therefore, this paper tries to fill this gap by analyzing the phenomenon of profit persistence in the European dairy industry. The study is based on a large sample of 590 European dairy processors.

## THE MODEL

Starting with Mueller (1986) the simple autoregressive process of order one AR(1) has become the econometric cornerstone of the empirical profit persistence literature. The AR(1) is a simple regression of firm *i*'s abnormal profit at time *t* ($\pi_{i,t}$) on the immediate previous level:

$$\pi_{i,t} = \alpha_i + \lambda_i \pi_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$

where $\varepsilon_{i,t}$ is a white noise error term with zero mean and constant variance. We extent this approach according to Gschwandtner (2005) by estimating up to four lags for each firm and afterwards using Schwarz-Bayesian Information Criterion (SBC) in order to decide which model describes the adjustment path best.

Equation 1 yields two profit persistence measures. The first one is $\hat{\lambda}_i$ which indicates the speed of convergence of profits to the long run level. Since $\hat{\lambda}_i$ also reflects the fluctuations in profits, it can be interpreted as short run persistence. Small (Large) values of $\hat{\lambda}_i$ imply that competitive forces on firm *i* are rather strong (weak) while profit persistence is low (high). In the literature the mean value of $\hat{\lambda}_i$ across all analyzed firms has become the main measure for persistence. The second measure is long run persistence. It is reflected by the long run average of the autoregressive process $\hat{p}_i = \hat{\alpha}_i / (1 - \hat{\lambda}_i)$. $\hat{p}_i$ is a measure of 'permanent rents', which are not eroded by competitive forces in the long run. The percentage of $\hat{p}_i$'s significantly different from zero in a given sample can therefore be interpreted as an additional indicator of the degree of persistence within it.

In order to explain the persistence measures $\hat{\lambda}_i$ and $\hat{p}_i$ the majority of previous studies implements a second estimation step where several firm and industry characteristics are regressed on $\hat{\lambda}_i$ and $\hat{p}_i$. However, as this method is plagued by econometric flaws (Baltagi, 2008) a dynamic panel model according to equation (2) was estimated instead, using Arellano and Bond's GMM estimator.

$$\pi_{i,t} = \sum_j \alpha_j (X_{j,i,t}) + \sum_j \beta_j (X_{j,i,t}) \pi_{i,t-1} + \varepsilon_{i,t} \qquad (2)$$

The ($X_j$'s) are specific firm and industry characteristics that are expected to influence profit persistence. The impact of the $X_j$'s on short-run persistence can be evaluated by the $\hat{\beta}_j$'s. The $\hat{\alpha}_j$'s reflect the impact of the $X_j$'s on abnormal profits over the entire time period analyzed and it can be assumed that the direction of this impact prevails in the long-run. It is therefore possible to assess the direction of change in long-run profit persistence for a given change in the variables $X_j$ by means of the algebraic signs of the $\hat{\alpha}_j$'s.

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## DATA AND RESULTS

Firm level data was taken from AMADEUS, a commercial balance sheet database while industry data is constructed from the Eurostat database. This study is based on the 13 year period 1996 through 2008 since this is the longest available for the European dairy industry. Abnormal firm profits ($\pi_{i,t}$) are measured by return on assets (ROA) in year *t* normalized by mean ROA of that year as a proxy for the competitive norm. The screened sample contains 590 firms from Belgium, France, Italy, Spain and the UK.

Table 1 shows that the mean value of $\hat{\lambda}_i$ for the dairy industry is 0.094 which is rather low compared to other manufacturing sectors and to the entire European food industry. Hirsch and Gschwandtner (2013) find for the entire food industry mean values for $\hat{\lambda}_i$ of 0.057 in Belgium, 0.143 in Italy, 0.188 in France, 0.201 in Spain and 0.232 in the UK.

If cooperatives which are not mainly profit oriented are excluded from the sample, the mean $\hat{\lambda}_i$ resembles the ones for the entire food industry.

About 41% of the firms in the sample are estimated to earn long- run profits that deviate from the competitive norm. However, only one quarter of these firms is earning long-run profits above the competitive norm while all significant long-run values for cooperatives are negative. Without cooperatives 32% of the firms are achieving abnormal profits in the long run. This value is, however, lower than in the entire European food industry where Hirsch and Gschwandtner (2013) find values of around 40%.

**Table 1.** An overview of the persistence parameters.

| | All firms | Coop.[b] | All other[c] |
|---|---|---|---|
| Mean $\hat{\lambda}_i$ | 0.094 | -0.184 | 0.163 |
| % of $\hat{\rho}_i$'s sign.[a] ≠ 0 | 41.2 | 77.3 | 32.2 |
| % of $\hat{\rho}_i$'s sign.[a] >0 | 9.8 | 0.0 | 12.3 |
| % of $\hat{\rho}_i$'s sign.[a] <0 | 31.4 | 77.3 | 19.9 |

[a]significant at the 5% level or less; [b]Cooperatives; [c]All other legal forms except cooperatives

The results of the dynamic panel estimation in Table 2 show that firm size and firm growth have a positive impact on profit persistence while age and R&D have a negative impact on the short-run value. The negative impact of age can be attributed to a corporate aging problem with organizational rigidities, slower growth and assets, which become obsolete with time (Loderer and Waelchli, 2010) while the negative impact of R&D could be a consequence of the fact that innovations in the dairy industry are in most cases only minor product extensions. The consistently negative impact of firm risk contradicts standard risk theory. However, a negative risk-profit relationship, known as Bowman's (1980) 'risk-return paradox', is also a long-established fact and could explain the present results.

While the degree of concentrations within the industries in which the dairy processors operate has a positive impact on short-run persistence, concentration in the food retail sector has a negative impact on short- and long-run persistence. This result is not surprising as high retailer concentration likely leads to strong bargaining power, putting dairy processors under pressure.

**Table 2.** Dynamic panel estimation of equation 2.

| Variable | Coeff. ($\beta_j$) | Variable | Coeff. ($\alpha_j$) |
|---|---|---|---|
| MS*$\pi_{i,t-1}$ | **0.001**** | MS | **-0.000**** |
| Age*$\pi_{i,t-1}$ | **-0.045***** | Age | [a] |
| Ln TA*$\pi_{i,t-1}$ | **0.136*** | Ln TA | 0.007 |
| Gr. TA*$\pi_{i,t-1}$ | **0.006**** | Gr. TA | **0.001**** |
| Gear*$\pi_{i,t-1}$ | **-0.000*** | Gear | **-0.000*** |
| 1/Curr*$\pi_{i,t-1}$ | **-0.408***** | 1/Curr | **-0.023***** |
| HHI*$\pi_{i,t-1}$ | **9.060***** | HHI | 0.177 |
| NF*$\pi_{i,t-1}$ | -0.605 | NF | **-0.092***** |
| Gr. NF*$\pi_{i,t-1}$ | **-2.211***** | Gr. NF | 0.014 |
| R&D*$\pi_{i,t-1}$ | **-1.961***** | R&D | 0.024 |
| CR5*$\pi_{i,t-1}$ | **-11.925***** | CR5 | **-0.137***** |
| Wald | $\chi^2(21) = 222.86$*** p=0.000 | | |
| Hansen | $\chi^2(36) = 45.48$ p=0.134 | | |
| AR(2) | z = -1.61 p=0.108 | | |

Dependent variable: $\pi_{i,t}$ (abnormal profit)
Firm variables: MS = firm sales/industry sales; Age = firm age; Ln TA = natural logarithm of total assets; Gr.TA= growth rate of total assets; Gear = gearing ratio; 1/Curr = 1/current ratio. Industry variables: HHI = Herfindahl-Hirschman Index; NF = number of firms in industry divided by industry sales; Gr.NF = Growth rate of NF; R&D = Share of R&D expenditure in industry value added; CR5 = Five-firm concentration ratio of the retail sector.
[a]Age was dropped from the model due to multicollinearity.
***, **, *significant at the 1%, 5%, 10% level respectively.

## CONCLUSIONS

To summarize, the results show that profit persistence in the dairy industry is essentially lower compared to other sectors outside the food industry. The low mean $\hat{\lambda}_i$'s in the food industry can be attributed to a high degree of market saturation, strong price competition and a highly concentrated retailing sector whose bargaining power is even strengthened by a high and still increasing share of private labels. Similar to previous results for the whole food industry firm size has a positive impact on profit persistence while R&D has a negative effect.

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