# Product differentiation and cost pass-through

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**Abstract**

Many food products show a high level of vertical and horizontal product differentiation. Manufacturers may instrument product differentiation to limit competition and to increase price dispersion. In this paper, we estimate a panel error correction cost pass-through model for the German yoghurt market over a six year period (t = 312) to determine the impact of product differentiation on price competition between individual brands and varieties of yoghurt. We find that more differentiated products show higher markups, reduced equilibrium cost pass-through and lower speed of cost-price adjustments. The results indicate that manufacturers (and/or retailers) use product differentiation to limit price competition.

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# Product differentiation and cost pass-through Evidence for the German yoghurt market

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## Contribution

Many food products show a high level of vertical and horizontal product differentiation. Mnufacturers may instrument product differentiation to limit competition and to increase price dispersion. In this paper, we estimate a random effects panel error correction cost pass-through model for the German yoghurt market over a six year period (t=312) to determine the impact of product differentiation on price competition between individual brands and varieties of yoghurt.

## Hypotheses

(1) More differentiated products may receive c.p. higher prices.

(2) More differentiated products are supposed to show a lower rate of cost pass-through (long-term) (Zimmermann 2004)

(3) More differentiated products are supposed to show a reduced speed of dynamic cost pass-through process (dynamic) (Borenstein and Shepard 2002)

## Data

Symphony IRI retail scan panel data for Germany from 2005 to 2010 (t = 312, n = 6606), average farm price for milk paid by dairies (t: 312), top 30 different yoghurts (maret share 20 %), 8 dairies (food processor), 11 brands, 15 tastes, fat content, probiotic, outlet.
Product differentiation (PD) measure is based on calories (normalized, Euclidian distance), fat content (normalized, Euclidian distance) taste (dummy), processor (dummy), and probiotic (dummy). PD is the average distance over all criteria compared to all other products. 1-PD simplifies the interpretation of the PD measure.

Descriptive statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max | |
|---|---|---|---|---|---|---|
| Retail price | 2067678 | 29.10 | 10.58 | 1.60 | 74.17 | ct per 100 g. |
| Farm price | 2067678 | 2.92 | 0.46 | 2.19 | 4.17 | ct per 100 ml |
| PD (1-ϕ) | 2067678 | 0.61 | 0.03 | 0.56 | 0.67 | |
| FP * PD | 2067678 | 1.78 | 0.29 | 1.23 | 2.78 | |
| Fat in milk | 2067678 | 3.32 | 1.02 | 0.10 | 5.00 | percent |
| Probiotic | 2067678 | 1.29 | 0.45 | 1.00 | 2.00 | 2 = Probiotic |
| Plain yoghurt | 2067678 | 0.18 | 0.38 | 0.00 | 1.00 | 1 = Plain |
| Discounter | 2067678 | 0.16 | 0.37 | 0.00 | 1.00 | 1 = DC |

## Results

Random effects panel model estimation

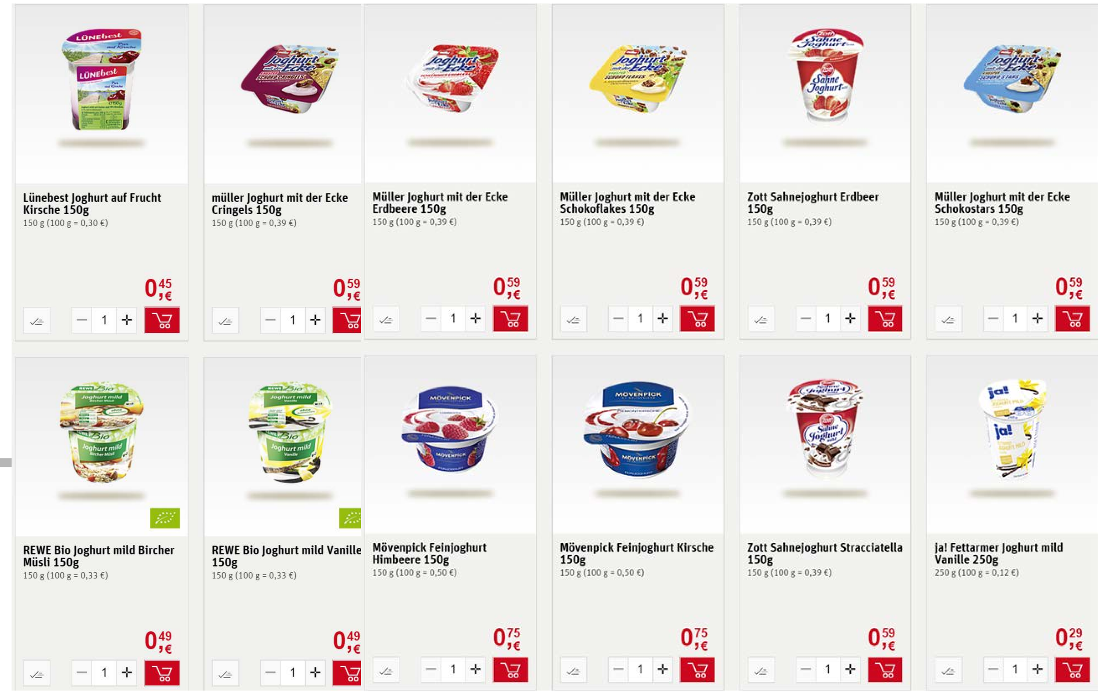
| Dependent variable: Retail price | | | |
|---|---|---|---|
| | Coefficient | Std. Error | t-value |
| Farm price (FP) | 3.352 | 0.112 | 29.950 |
| PD (1-ϕ) | 46.770 | 4.696 | 9.960 |
| FP * PD | -4.389 | 0.183 | -23.990 |
| Fat in milk | 2.264 | 0.124 | 18.180 |
| Probiotic | 12.459 | 0.253 | 49.160 |
| Plain yoghurt | -6.189 | 0.308 | -20.070 |
| Discounter | -2.937 | 0.277 | -10.610 |
| Constant | -23.399 | 3.261 | -7.180 |

Random effects panel error correction model estimation

| Dependent variable: d.Retail price (RT) | | | |
|---|---|---|---|
| | Coefficient | Std. Error | t-value |
| ECt-1 | -0.420 | 0.005 | -78.040 |
| ECt-1 * PD | 0.639 | 0.009 | 74.480 |
| d.FP | 0.342 | 0.033 | 10.270 |
| L.d.RP | -0.734 | 0.001 | -1052.740 |
| L.d.FP | 0.085 | 0.033 | 2.550 |
| Constant | 0.021 | 0.002 | 12.010 |

## Conclusions

The German yoghurt market is highly differentiated. The market exhibits a strong dispersion of prices. Product differentiation is vertical and horizontal. The (objective) measure of product differentation significantly correlates with the averge price level, the long-term cost pass-through, and the speed of the dynamic cost pass-through. According to the theory, the long-term cost pass-through and the speed of the process are reduced for more differentiated products, and average prices are higher.



Definition PD

In a loose sense, any set of commodities closely related in consumption and/or production may be regarded as differentiated products (product differentiation, PD).

(Eaton and Lipsey, 1989: 725)

Theory I

Linear demand model with product differentiation
ϕ = 0 no subsitution; ϕ = 1 perfect substitution

$$p_i = \alpha - q_i - \phi \sum_{j \neq i} q_j$$

$$p_i q_i = \alpha q_i - q_i^2 - \phi \sum_{j \neq i} q_j q_i$$

$$MR_i = \alpha - 2q_i - \phi \sum_{j \neq i} q_j$$

$$MC = c$$

$$q_i^{SC} = \frac{\alpha - c}{2 + \phi(n-1)}$$

Symmetric marginal cost
Cournot-Nash equilibrium

Theory II

Linear model: ϕ = 0 no subsitution; ϕ = 1 perfect substitution

$$p_i^{sc} = \frac{\alpha + (1 + \phi(n-1))c}{2 + \phi(n-1)}$$ Equilibrium price

$$\frac{\partial p_i^{sc}}{\partial \phi} = (n-1)(c-\alpha) < 0$$ PD impact

$$\frac{\partial p_i^{sc}}{\partial c} = \frac{1 + \phi(n-1)}{2 + \phi(n-1)} > 0$$ Cost pass-through

Theory III

Linear model: ϕ = 0 no subsitution; ϕ = 1 perfect substitution

$$\frac{\partial p_i^{sc}}{\partial \phi} = \frac{(n-1)(c-\alpha)}{(2 + \phi(n-1))^2} < 0$$

If products are less (more) differentiated, retail prices increase (decrease).

$$\frac{\partial^2 p_i^{sc}}{\partial c \partial \phi} = \frac{(n-1)}{(2 + \phi(n-1))^2} > 0$$

If products are less (more) differentiated, CPT increases (decreases).

Model specification

(1) Rate of cost pass-through:

$$p_{it} = \alpha_i + \beta_1 MC_t + \beta_2 MC_t \sum_{j \neq i} (1 - \phi_{i,j}) + .... + \varepsilon_{it}$$

(2) Speed of dynamic cost pass-through process:

$$dp_{it} = \alpha_i + \beta_1 EC_{it-1} + \beta_2 EC_{it-1} \sum_{j \neq i} (1 - \phi_{i,j}) + .... + \varpi_{it}$$

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