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Short Communication

Market concentration and the healthiness of packaged food and non-alcoholic beverage sales across the European single market

Iris Van Dam[1,2], Olivier Allais[1] and Stefanie Vandevijvere[2,*]
[1]Université Paris-Saclay, INRAE, UR ALISS, Ivry-Sur-Seine, France: [2]Sciensano, Service of Lifestyle and Chronic Diseases, Ernest Blerotstraat 1, 1070 Anderlecht, Brussels, Belgium

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Abstract

Objective: To assess the relationship between market concentration and diversity, as indicators of market structure, and the healthiness of food and beverage sales across Europe.

Design: Market share (MS) data per country were used to calculate market concentration, assessed by the four-firm concentration ratio and market diversity, and by the number of companies with ≥1 % MS and the number of companies uniquely present in one European country. The healthiness of food sales was assessed by applying the NOVA classification (level of processing). Simple and multiple linear regressions were performed to assess the relationship between market concentration, diversity and the healthiness of food and beverage sales.

Setting: The European single market.

Participants: The twenty-seven European single market member states for which Euromonitor sales data were available at the most fine-grained Euromonitor packaged food and non-alcoholic beverage product subcategory level.

Results: Increased market concentration with a country and a product category fixed effect significantly predicted increased sales of ultra-processed packaged food products. There was insufficient data variability in the level of processing of non-alcoholic beverage product categories to formulate conclusions for non-alcoholic beverages. Increased market diversity in turn significantly predicted reduced country-level sales of ultra-processed products.

Conclusions: The results indicated a relationship between market structure and the healthiness of packed food products sold on the European market. However, more research with detailed nutritional data is warranted to document and quantify this interaction.

Keywords
Europe
Food industry
Food environments
Food supply
Market structure
Market power
NOVA

Food environments are defined as 'the collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people's food and beverage choices and nutritional status'[1]. Currently, these environments are characterised by easily available unhealthy food products[2–4] with ultra-processed foods contributing to 10 % up to 51 % of the purchased dietary energy across Europe[5]. Ultra-processed foods are products such as soft drinks and confectionery that contain substances that are not commonly found at home[6]. A growing body of literature shows an association between overweight and the consumption of such ultra-processed foods[4,5,7,8]. Nonetheless, ultra-processed foods are extensively promoted, with markets expanding and several political strategies being used to protect ultra-processed food markets[9,10].

Market structure describes the degree at which competition takes place between different companies for specific goods and services within (product) markets[11,12]. A key metric to assess the market structure and power of companies is market concentration[13]. When concentration increases, this translates into an increasing part of the market being held by a decreasing number of companies[4,14]. Other market structure indicators, measuring the market

*Corresponding author: Email stefanie.vandevijvere@sciensano.be

diversity, are the number of companies with ≥1 % market share (MS) and the number of unique companies having presence in only one European country[14].

Across countries in Europe, packaged food and non-alcoholic beverage product markets have shown to be moderately to highly concentrated with a low number of unique companies and companies with ≥1 % MS[14]. While the food industry publicly positions itself as part of the solution to create healthier food environments[15,16], they at the same time shape markets in ways that fit their private interests[11]. High levels of market concentration and reduced diversity may provide dominant companies with the opportunity to shape markets in ways that benefit them financially and economically (e.g. through the increased sales of ultra-processed foods), something that does not benefit population health[3,4,11,12,17–19]. Examples of how the food industry may influence food environments include the framing of policy debates, intensive marketing, nutritional positioning (*i.e. focus on single nutrients instead of whole foods, an approach that could promote the sales of heavily processed foods*), focus on individual responsibility and unenforceable self-regulatory codes[4,15,16]. Nonetheless, research assessing the influence of market structure on food environments remains limited.

This study sets out to assess whether market structure, assessed by levels of market concentration and diversity within the packaged food and non-alcoholic beverage industry across European countries, is associated with the healthiness of products sold, measured by the proportion of sales of ultra-processed food products according to the NOVA classification.

Methods

The Euromonitor International Passport database was used to obtain MS data per European single market member state, per packaged food and drink product category and per year[20]. Data were obtained at the most fine-grained Euromonitor product categorisation level over the period 2009–2018. For Cyprus, Iceland, Liechtenstein, Luxembourg and Malta, no Euromonitor data were available. A total of twenty-seven European countries were included in the analysis.

Market concentration

Levels of market concentration and its changes over time (2009–2018) were assessed by calculating the four firm concentration ratio (CR4) per country for fourteen packaged food product markets and eight non-alcoholic beverage product markets (Table 1; Annex 1). The CR4 is calculated by combining the MS of the top four firms per country active within a product market. The higher the CR4, the more concentrated the product market. CR4 values below 40 are considered to represent a competitive market. Values above 40 are considered to represent markets with limited competition and above 60 limited competition with potential dominant firms[21].

The number of companies with ≥1 % MS and the number of unique companies per country were assessed to estimate levels of diversity within packaged food and non-alcoholic beverage product markets. Unique companies were defined as companies having presence in only one European single market member state. Similar to previous research, the higher the number of companies with ≥1 % MS and unique companies, the more diverse the industry was assumed to be[14].

Products sold

To assess the proportion of sales coming from ultra-processed products, the NOVA classification[6] was applied to the most fine-grained Euromonitor product subcategory sales data within abovementioned packaged food and non-alcoholic beverage product categories. An overview of how the Euromonitor product subcategories were classified according to the NOVA classification can be found in Annex 1. For five countries (Croatia, Estonia, Latvia, Lithuania and Slovenia), data were only available for the most fine-grained product subcategories within eight (out of the twenty-two) Euromonitor product categories ('Baked Goods', 'Concentrates', 'Dairy', 'Energy Drinks'; 'Ice Cream and Frozen Desserts', 'RTD Coffee', 'Rice, Pasta and Noodles' and 'Sports Drinks').

The NOVA classification makes a distinction between products based on the level of processing, namely non-ultra-processed (unprocessed/minimally processed foods, processed culinary ingredients and processed foods) and ultra-processed products[6]. Per Euromonitor product category, the proportion of sales coming from ultra-processed subcategories was calculated by expressing the ultra-processed sales per country and product category on the total sales within the same country and product category. Finally, also the change over the past 10 years (2009–2018) of the proportion of sales coming from ultra-processed products was assessed.

The relationship between market concentration, diversity and healthiness of packaged food and drink products sold across European countries

Analyses were conducted separately for packaged food and non-alcoholic beverage product categories. A multiple linear regression was calculated across selected countries and product categories to assess whether and to what extent market concentration measured by the CR4 influences the proportion of sales of ultra-processed products. The product categories containing 100 % ultra-processed products were removed from the analysis.

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Table 1 The proportion of sales from ultra-processed products (NOVA) and levels of market concentration according to the four firm concentration ratio (CR4) per country and product category. Euromonitor data 2018

Country	Asian Speciality Drinks		Baked Goods		Breakfast Cereals		Carbonates		Concentrates		Confectionary		Dairy		Energy Drinks		Ice Cream and Frozen Desserts		Juice		Processed Fruit and Vegetables	
	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4
Austria			86	8	100	62	100	70	100	55	100	58	36	37	100	70	100	76	61	50	23	49
Belgium			99	7	99	63	100	77	100	50	100	38	42	28	100	68	100	50	68	32	23	26
Bulgaria			95	20	100	74	100	77	100	54	100	54	12	26	100	81	100	87	97	47	24	46
Croatia			100	20		43		81	100	63		56	17	62	100	94	100	94		69		65
Czech Republic			98	22	96	71	100	76	100	59	100	70	31	39	100	49	100	75	90	52	16	36
Denmark			99	23	68	58	100	71	100	63	100	46	29	64	100	84	100	51	73	47	35	25
Estonia			100	64		48		87	100	60		61	13	65	100	85	100	83		66		40
Finland			98	35	64	39	100	72	100	45	100	74	37	53	100	73	100	83	84	60	25	30
France	100	84	99	8	95	70	100	82	100	59	100	48	32	38	100	84	100	64	48	48	21	29
Germany	100	38	100	16	95	55	100	56	100	34	100	41	48	14	100	66	100	47	88	26	23	27
Greece			93	12	85	68	100	84	100	77	100	71	21	35	100	91	100	70	97	68	8	45
Hungary			99	7	93	47	100	82	100	41	100	53	33	34	100	78	100	54	97	58	8	25
Ireland			98	24	74	68	100	86	100	67	100	75	42	35	100	93	100	73	60	40	34	57
Italy	100	91	97	11	100	80	100	67	100	57	100	61	35	29	100	88	100	23	95	43	10	30
Latvia			100	50		81		68	100	78		69	10	62	100	85	100	75		76		65
Lithuania			100	43		68		84	100	57		60	14	66	100	54	NA	69		56		49
Netherlands	100	76	99	11	69	50	100	63	100	62	100	37	41	30	100	76	100	71	78	43	26	43
Norway			86	32	69	62	100	89	100	85	100	72	28	86	100	81	100	90	50	53	21	25
Poland			94	5	96	60	100	77	100	58	100	47	31	35	100	76	100	66	79	61	8	36
Portugal	100	58	99	9	87	56	100	79	100	52	100	43	36	49	100	57	100	76	90	53	10	18
Romania			98	9	100	68	100	66	100	40	100	66	28	48	100	72	100	63	100	49	11	38
Slovakia			99	16	97	72	100	67	100	42	100	69	38	35	100	64	100	67	93	48	15	35
Slovenia			100	32		43		88	100	66		57	10	54	100	84	100	68		69		47
Spain			99	21	99	49	100	80	100	79	100	40	41	34	100	65	100	56	88	41	9	21
Sweden			94	42	78	44	100	85	100	74	100	58	20	60	100	83	100	65	77	59	29	24
Switzerland			93	5	99	42	100	75	100	43	100	28	28	26	100	67	100	54	67	34	27	17
United Kingdom	100	12	93	28	84	60	100	80	100	57	100	66	54	21	100	87	100	46	45	43	44	35

	Processed Meat and Seafood		RTD Coffee		RTD Tea		Ready meals		Rice, Pasta and Noodles		Sauces, dressings and condiments		Savoury Snacks		Soup		Sports Drinks		Sweet Biscuits, Snack Bars and Fruit Snacks		Sweet Spreads	
	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4	NOVA	CR4
Austria	11	28	100	74	100	67	99	44	6	39	89	49	70	54	100	76	100	72	95	41	87	66
Belgium	23	17	100	81	100	72	93	23	3	33	90	41	88	53	100	76	100	72	99	38	93	43
Bulgaria	4	61	100	74	100	66	91	54	1	43	73	39	64	32	100	85	100	77	95	43	63	41
Croatia		72	100	85		78		47	0	49		65		38		89	100	79		59		50
Czech Republic	29	39	100	87	100	64	100	53	21	37	80	44	88	42	100	84	100	93	93	62	57	43
Denmark	19	35	100	85	100	68	98	43	13	23	89	45	78	54	100	70	100	80	68	38	78	54
Estonia		56	100	83		94		49	0	31		32		46		64	100	92		49		43
Finland	8	49	100	67	100	57	98	53	13	37	85	43	79	53	100	54	100	77	88	54	47	45
France	12	24	100	92	100	65	78	34	4	54	86	40	77	45	100	76	100	86	86	50	75	56
Germany	36	10	100	35	100	44	96	38	1	30	82	44	74	40	100	66	100	24	88	26	76	48
Greece	34	34	100	85	100	82	94	47	1	55	93	57	91	51	100	100	100	99	95	56	68	28
Hungary	13	28	100	55	100	68	86	35	11	31	81	41	77	39	100	84	100	64	94	43	48	30
Ireland	13	57	100	74	100	65	91	34	38	44	97	44	96	58	100	72	100	90	93	46	65	49
Italy	14	19	100	63	100	52	64	29	0	33	91	37	87	38	100	63	100	82	90	44	89	51
Latvia		51	NA	57		93		40	0	33		65		56		67	100	72		70		44
Lithuania		44	100	93		77		47	0	41		43		59		75	100	43		58		55
Netherlands	47	10	100	70	100	64	99	27	11	34	85	43	85	40	100	68	100	53	95	37	81	35
Norway	11	57	100	93	100	82	95	73	18	44	87	57	82	62	100	89	100	79	87	61	81	67
Poland	20	42	100	49	100	61	96	30	21	33	78	45	84	43	100	75	100	93	91	39	62	33
Portugal	58	24	100	100	100	37	88	18	5	40	85	31	71	34	100	56	100	23	88	25	51	33
Romania	24	36	100	91	100	83	73	36	1	49	75	37	75	45	100	63	100	75	99	33	60	46
Slovakia	26	42	100	76	100	59	98	51	38	26	82	29	88	31	100	67	100	78	98	61	60	42
Slovenia		60	100	66		85		48	0	61		33		47		87	100	56		33		30
Spain	43	20	100	66	100	83	74	25	19	33	90	22	78	38	100	50	100	85	95	42	81	38
Sweden	23	45	100	94	100	73	99	44	3	29	87	46	79	55	100	82	100	95	78	32	78	40
Switzerland	21	9	100	85	100	38	96	10	4	20	94	52	94	48	100	66	100	71	94	32	75	36
United Kingdom	30	17	100	85	100	70	93	13	41	33	95	33	95	45	100	53	100	88	85	37	76	42

Red indicates CR4 values >60 % and proportion of sales >80 %.
Yellow indicates CR4 values >40 %.

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Table 2 Results of the two multiple linear regressions and the predictor variables included

Predictor variable	Regression	95 % CI
Intercept	17·03	9·21, 24·85
CR4	0·13	0·002, 0·25
Country fixed effect	Yes	
Product category fixed effect	Yes	

No significant correlations were detected between changes over the past 10 years in levels of market concentration and the proportion of sales of ultra-processed products (data not shown).

Among packaged food products these were 'Confectionary', 'Ice Cream and Frozen Desserts' and 'Soup'. Among the non-alcoholic beverages, all product categories were 100 % ultra-processed apart from 'Juice'. Consequently, there was not enough variability in the model and no multiple linear regression was calculated for non-alcoholic beverages. The final multiple regression model for packaged foods included the CR4, a country fixed effect and a category fixed effect as predictor variables (Table 2). The product category 'Rice, Pasta and Noodles' was used as reference category as, on average, this was the least processed product category.

Simple linear regression analyses were performed to determine whether the number of companies per country with ≥1 % MS and the number of unique companies within packaged food and non-alcoholic beverage product markets significantly predicted the proportion of sales from ultra-processed products at country level in 2018.

Correlations of changes over time in the proportion of sales from ultra-processed products with changes in levels of market concentration were assessed. *R*-values >0·5 were considered to represent a strong correlation. *P*-values <0·05 were considered statistically significant.

All analyses were performed using Microsoft Excel and SAS 9.4 (2018).

Results

The product categories 'Asian Speciality Drinks', 'Carbonates', 'Concentrates', 'Confectionary', 'Energy Drinks', 'Ice Cream and Frozen Desserts', 'RTD Coffee', 'RTD Tea', 'Soup' and 'Sports Drinks' were for 100 % ultra-processed across all European countries. Within the remaining twelve product categories, the proportion of ultra-processed sales varied per country. The level of market concentration, as measured by the CR4, varied per product category and country (Table 1). Several companies were included in the CR4 in multiple countries and across multiple product categories. Detailed information on the companies included in the CR4 of more than one product category as well as the number of countries in which the company was within the CR4 of this product category can be found in Annex 3.

Market concentration and sales of less healthy products

A multiple linear regression model including the CR4, a country fixed effect and a product category fixed effect (Table 2) was significant and explained 93 % of the variance in sales of ultra-processed packaged foods ($F(37\ 219) = 78{\cdot}13$, $P < 0{\cdot}0001$).

The CR4 ($P = 0{\cdot}046$), the country ($P = 0{\cdot}004$) and the product category ($P < 0{\cdot}0001$) were all significant predictors of sales of ultra-processed packaged food products. It was estimated that the proportion of sales of ultra-processed packaged food products increased with 0·13 for a one unit increase of the CR4, in addition to the increase caused by product category or the decrease caused by country, relative to the product category 'Rice, Pasta and Noodles' and the United Kingdom as reference country (Table 2, Annex 2). The fixed effect estimates, together with the *P*-values and 95 % CI, per product category and per country can be found in Annex 2.

Market diversity and sales of less healthy products

The number of companies with ≥1 % MS and the number of unique companies per country both significantly predicted sales of ultra-processed packaged food products ($\beta = -2{\cdot}73$, $P = 0{\cdot}004$ and $\beta = -3{\cdot}06$, $P = 0{\cdot}003$, respectively). This was not the case for non-alcoholic beverages. Concretely, when per country the number of packaged food companies with ≥1 % MS and the number of unique packaged food companies increased, the sales of ultra-processed foods significantly decreased. Results are visually represented in Fig. 1.

Discussion

This study set out to assess if market concentration, as measured by the CR4, and market diversity, assessed by the number of companies with ≥1 % MS and the number of unique companies per country, can predict the proportion of sales from ultra-processed products. A multiple linear regression model with the CR4, the country and the product category as predictor variables found that all three predictor variables significantly predicted the proportion of sales attributed to ultra-processed packaged food products. Increased market diversity in turn showed to significantly reduce sales of ultra-processed packaged food products but not non-alcoholic beverages. These results imply that increased market concentration, as measured by the CR4, may favour the increase in sales of ultra-processed packaged food products when taking into account both the product category and country. In contrast, increased market diversity in turn might be able to reduce sales of ultra-processed packaged food products.

Similar to our findings, a study in Asia found that market forces, including market concentration, were significant but variable drivers of the increase in sales of

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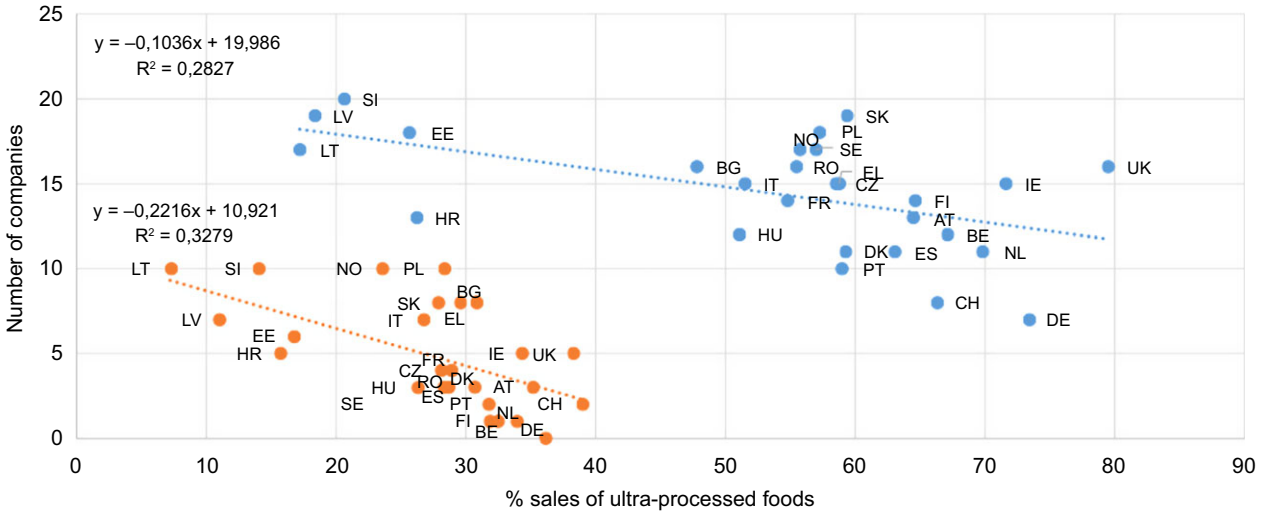

Fig. 1 Regression of sales ultra-processed packaged food products (NOVA) with the number of companies with ≥1 % market share (MS) (blue) and the number of unique companies (orange). Countries are indicated to the right of the blue dots (the number of companies with ≥1 % MS) and to the left of the orange dots (the number of unique companies. NA means no sales of that category in that country in 2018 according to the Euromonitor data. Empty cells are countries for which no data were available at the most detailed level of the Euromonitor product categorisation system and as such products could not be classified. ●, Companies with ≥ 1% market share; ●, unique companies

ultra-processed products. This study also observed that concentration was highest in ultra-processed product markets such as soft drinks, biscuits and snack foods[22]. This matches our finding that the product category had a strong effect in predicting sales of ultra-processed packaged food products.

A potential explanation for the decreased sales of ultra-processed products when more companies with ≥1 % MS and unique companies are present on the market could be that smaller companies lack both the financial and political resources to shape food environments and undermine public health[3,23]. Nonetheless, the sales of ultra-processed products is expanding worldwide, according to a study at global level using Euromonitor data[4]. To increase the healthiness of food environments, the food industry would need to reduce marketing and sales of ultra-processed products. This however inherently opposes the aim to maximise profits, especially for companies that rely on the sales of ultra-processed foods[24,25]. This conflict of interest may result in the food industry resorting to political activities to protect their markets and profitability[4,9,24], something that becomes more attainable for dominant companies in highly concentrated markets with low market diversity[9].

This study documents the possible impact of market structure on the healthiness of packaged foods and non-alcoholic beverages while highlighting the importance of looking beyond food policy to improve the healthiness of food environments. Nevertheless, this study has several limitations. Levels of market concentration may be an underestimation. The Euromonitor database focuses on brand ownership rather than companies. Consequently, companies that are considered independent in Euromonitor (and for the calculation of market concentration) may still sell brands from other companies through licensing agreements. Due to the lack of nutritional data at European level, there was insufficient variability to formulate conclusions for non-alcoholic beverages. Towards the future, more research is required using country-level data and detailed nutritional information to strengthen our understanding of the nutritional implications of market structures across Europe.

In conclusion, our results suggest that increased market concentration and reduced market diversity may predict increased sales of ultra-processed packaged food products across Europe. It is therefore recommended to take into account the market structure, in addition to policy effectiveness, when developing policies to improve food environments.

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Supplementary material

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