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# **Information quality of the Nutri-Score and companies' communication strategies**

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# Information quality of the Nutri-Score and companies' communication strategies

## Abstract

Our paper addresses the research question whether the Nutri-Score is an informative tool for consumers to make healthier food choices. Economic logic would have companies reformulate their products to achieve improved Nutri-Scores, using higher values to increase sales. We address our research questions using data on ultra-processed products from Mintel's Global New Product Database. We focus on meat and dairy substitutes as these are relatively new on the market and could both lower dietary quality and raise caloric intake. We apply several regression models to the samples of meat and milk alternatives.

## Introduction

Excessive consumption of unhealthy foods combined with reduced energy expenditure has led to the global rise in obesity, and has resulted in a higher incidence of non-communicable diseases (Gortmaker et al. 2011). Ultra-processed food presents one of the main categories of food products with an adverse impact on human health (Lane et al., 2021) which even shows up in vegetarian diets, e.g., in meat substitutes (Gehring et al. 2021). However, consumers face difficulties to judge the health impact of food products due to the multitude of nutritional characteristics and related trade-offs, e.g., less sugar but more saturated fat versus less salt but also less fiber (Franco-Allerano et al., 2020). This highlights consumers' need for a comprehensive measure to evaluate the healthiness of food products to allow more informed buying decisions. The Nutri-score is one example of a front-of-package label communicating the nutritional quality of food products in a simple way. The Nutri-Score classifies products on a green to red scale from A (best) to E (worst), and has proven to be particularly effective compared to other comparable labels (Temmermann et al. 2021; Hau and Lange 2023). Yet, as with most labeling choices, labeling with Nutri-Scores is voluntary, and thus a strategic decision made by the producer.

Companies deciding to label their products with the Nutri-Score will try to make them (appear) healthier, and, if necessary, reformulate their products to achieve improved Nutri-Scores. However, stronger nutrition-related commitments by companies do not necessarily lead to better Nutri-Score metrics (Van Dam and Vandevijvere 2022). This prompts the question of whether foods with a Nutri-Score of A or B are superior to comparable foods without a Nutri-Score. Consumers will benefit from the information provided by the Nutri-Score only if the

products labelled with a Nutri-Score were superior to their counterparts without a Nutri-Score. In addition, the categorial nature of the Nutri-Score, i.e., the ranking from A to E, may incentivize companies to strategically improve the nutritional composition of their products gradually to just reach the next better category (Bauner and Rahman, 2024). The label may then signal a superiority of products not fully justified by their nutritional composition leading consumers to lose trust in the label.

We examine the relationship between nutritional quality, companies' decision to use the Nutri-Score label and company characteristics at the example of meat and milk substitutes introduced to the German market. First, we analyze whether products with a high Nutri-Score (A or B) have a superior nutritional composition compared with products without a Nutri-Score label. Second, we answer the question whether products with a high Nutri-Score (A or B) have a shorter list of ingredients compared to products without a Nutri-Score, and can thus be perceived as more natural. Third, we investigate the relationship between companies' decision to use the Nutri-Score label and company characteristics such as size and age. This allows us to identify which firm characteristics are related to the decision to label products with the Nutri-Score. Last, we analyze whether companies use formulation strategies to just surpass the threshold to the next better Nutri-Score category, and what type of companies are more likely to engage in such behavior. We choose meat and milk substitutes for our study since consumers perceive these products as less natural compared to meat and milk, respectively (Haas et al., 2019; Hartmann et al., 2022).

## **Data and Methods**

We address our research questions using data on meat and milk substitute products from Mintel's Global New Product Database. Our sample contains 562 milk substitute products, and 950 meat substitute products introduced in Germany from 2016 to 2022. The data contains information on product type, labeling, brand, nutritional information, and ingredients. We match the product data with data on company characteristics, such as size and sales volume, derived from Bureau van Dijk's Orbis database.

We apply regression models separately to the samples of meat and milk alternatives to address our research questions. First, we regress the presence of a Nutri-Score label on the quantity of the nutrients per reference unit (100g), e.g., sugar, fiber, energy content or proteins. We define the dependent variable being equal to one for products with a Nutri-Score of A or B and zero for products without a Nutri-Score. We also include a dummy being equal to one for products with a Nutri-Score of C, D or E so that our reference group is the set of products not labelled with a Nutri-Score.

To investigate the second research question, we use a count variable for the number of ingredients and regress it on the Nutri-Score dummy variables (A or B and C, D or E) using a binomial regression model for count data.

To address question three, we use logistic regressions to test whether the characteristics of the companies offering the product are related to the probability that the products carry a Nutri-Score. Company characteristics include its size (measured by revenue) and its age.

To address question four, we create a binary variable to indicate whether the Nutri-Score meets the minimum requirements to cross over to a higher rank, which is then regressed on the company characteristics i) size and ii) age.

Table 1 shows the descriptive statistics of all variables used in our models. It can be observed that meat substitutes have higher protein content, more salt and a higher energy density per 100g compared with milk substitutes. Moreover, meat substitutes are more expensive than milk substitutes expressed in the price per 100g. Further, we see that the number of ingredients for meat substitutes exceeds the number of ingredients for milk substitutes. In addition, companies producing milk substitutes are older and smaller, on average, than companies in the meat substitutes sector.

**Table 1:** Descriptive statistics

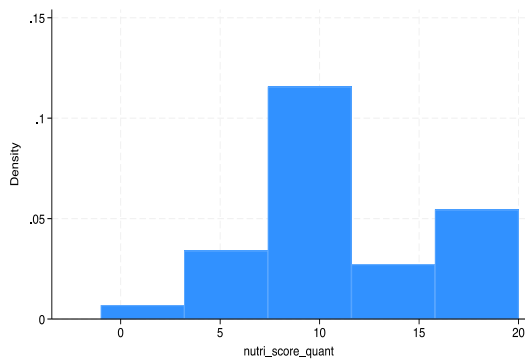
Variable	Meat substitutes		Milk substitutes	
	Mean	SD	Mean	SD
Nutri Score (yes=1; 0=No)	0.060		0.143	
Nutri-Score A or B (yes=1; 0=No)	0.043		0.143	
fat/100g	10.310	5.559	1.923	1.497
sat_fat/100g	1.853	2.290	0.531	0.935
unsat_fat/100g			1.391	1.188
sugar/100g	2.316	2.484	4.225	5.406
protein/100g	16.016	10.890	1.306	1.933
salt/100g	1.581	0.851	0.113	0.089
carbohydrates/100g	12.113	12.477	7.301	10.733

energy kcal/100g	214.771	74.910	52.473	52.309
price €/100g	1.537	0.709	0.340	0.427
# of ingredients	14.826	9.297	5.857	3.264
firm size (total assets mio €)	5.588	20.116	2.311	10.630
firm age	38.111	44.309	54.879	60.176

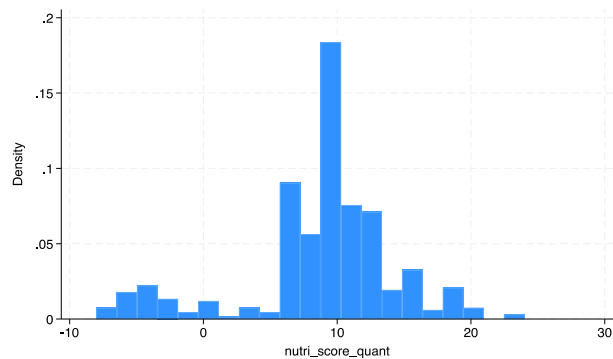
Figure 1 shows the Nutri-Score value distribution for products with and without the Nutri-Score for meat and milk substitutes, respectively. For products without a Nutri-Score label we manually calculated the underlying value according to Santé publique France (2024). The figures show that there is a cluster of products around the threshold of 10 (for Nutri-Score C) for meat substitutes with and without a Nutri-Score. For milk substitutes, we observe for labelled products a gap between A and B. However, for non-labelled products we also only have very few products having C, D or E.

### Meat substitutes

With Nutri-Score



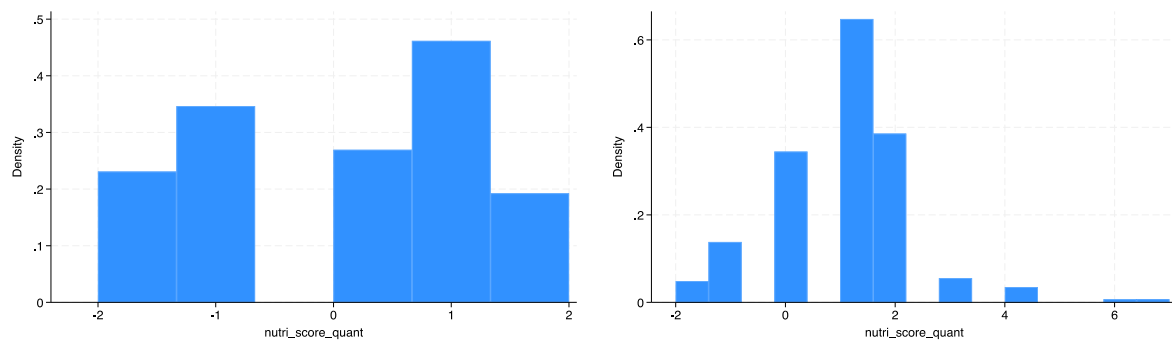
Without Nutri-Score



### Milk substitutes

With Nutri-Score

Without Nutri-Score



**Figure 1:** Distribution of quantitative Nutri-Score values for products with and without Nutri-Score

### Preliminary results and discussion

*Research question 1: Do products that carry a Nutri-Score of A or B have a superior nutritional composition to comparable products without a Nutri-Score label?*

Overall, we find evidence that meat substitutes with a Nutri-Score A or B have a better nutrient composition (less saturated fat, sugar, salt and carbohydrates) than products without a Nutri-Score. For milk substitutes, we cannot find a clear tendency that products with a Nutri-Score A or B have a superior nutrient composition compared to products without a Nutri-Score except for saturated fat.

Table 2 shows our results for the differences in nutritional quality between products that carry a Nutri-Score of A or B compared to products without Nutri-Score as well as price effects. We find that Nutri-Score labelled meat substitutes contain less saturated fat, sugar, salt and carbohydrates per 100g compared to the set of products without a Nutri-Score. Moreover, lower Nutri-Scores of C, D and E indicate a poorer nutrient composition with regard to fat, saturated fat, salt and energy per 100g in the case of meat substitutes. Beyond, more expensive products have a higher protein content, contain more salt and more energy. Thus, per se, more expensive products do not show a better nutritional profile.

For milk substitutes, our results reveal that Nutri-Scores of A and B are associated with lower levels of saturated fat compared to products without a Nutri-Score label. Therefore, the Nutri-Score might indeed help consumers to make better informed buying decisions. However, the price per 100g for milk substitutes is higher if the product contains more fat, unsaturated fat, sugar, protein, carbohydrates and energy per 100g respectively. Prices for milk substitutes are highly correlated with sugar and energy content.

**Table 2:** Differences in nutritional quality between products that carry a Nutri-Score of A or B compared to products without Nutri-Score

Nutrient (Dependent variable)	Meat substitutes						Milk substitutes					
	Constant	Nutri-Score A/B	Nutri-Score C/D/E	Price/100 g	R <sup>2</sup>	F	Constant	Nutri-Score A/B	Nutri-Score C/D/E	Price/100 g	R <sup>2</sup>	F
fat/100g	10.731*** (0.440)	-0.988 (0.704)	3.871*** (1.391)	-0.285 (0.266)	0.011	3.81***	1.403*** (0.173)	-0.068 (0.114)	-	1.481** (0.588)	0.162	3.660**
sat_fat/100g	1.850*** (0.135)	-0.450** (0.193)	1.591* (0.929)	0.002 (0.069)	0.010	2.89**	0.411*** (0.048)	-0.224*** (0.047)	-	0.398*** (0.134)	0.040	13.970** *
unsat_fat/100g	8.881*** (0.389)	-0.539 (0.635)	2.280 (1.429)	-0.287 (0.237)	0.006	1.66	.992*** (0.159)	0.156 (0.098)	-	1.083** (0.536)	0.140	2.810*
sugar/100g	2.218*** (0.221)	-0.836*** (0.276)	-0.140 (0.366)	0.093 (0.128)	0.006	3.69**	1.809** (0.806)	-0.190 (0.310)	-	7.076** (2.759)	0.313	4.31**
protein/100g	9.407*** (1.208)	-0.125 (1.138)	-1.821 (2.311)	4.309*** (0.823)	0.080	9.45***	0.845*** (0.133)	0.226 (0.155)	-	1.129** (0.470)	0.098	3.830**
salt/100g	0.984*** (0.108)	-0.226** (0.104)	0.434* (0.259)	0.391*** (0.074)	0.113	11.81***	0.105*** (0.007)	-0.005 (0.007)	-	0.026 (0.026)	0.014	0.760
carbohydrates/100g	13.691*** (0.957)	-2.664* (1.616)	-1.590 (2.049)	-0.921* (0.515)	0.005	1.92	2.128 (0.740)	-0.122 (0.433)	-	14.062*** (2.721)	0.444	13.450** *
energy kcal/100g	193.117** * (6.821)	-7.616 (14.322)	24.569* (13.114)	13.718*** (4.273)	0.019	4.73***	25.201*** (4.643)	-0.103 (2.128)	-	75.343*** (17.101)	0.445	9.820***

Notes: Nutri-Score A/B = 1 if product has a Nutri-Score of A or B and = 0 if it has now Nutri-Score; Nutri-Score C/D/E = 1 if product has a Nutri-Score of C, D or E and = 0 if it has now Nutri-Score; \*, \*\*, \*\*\* denotes significance at the 1, 5, 10% level; standard errors in parentheses



*Research question 2: Do foods with a Nutri-Score of A or B have shorter ingredient lists, i.e., can be perceived as more natural than those without a Nutri-Score?*

Table 2 shows the results of the regression of the number of ingredients on the presence of a Nutri-Score and the product price. We tested whether a Poisson or a negative binomial regression is appropriate. It can also be observed that in both cases the variance of the dependent variable far exceeds its mean values. Therefore, due to the high dispersion in the number of ingredients, we estimated the models using negative binomial regressions (see Figure 2 for an illustration of the dispersion of the number of ingredients by product group).

We find no significant difference between the number of ingredients of meat substitutes that have a Nutri-Score A or B and products without a Nutri-Score (Table 2). However, we do find that milk substitutes with a Nutri-Score of A or B contain more ingredients than products without a Nutri-Score. Hence, meat substitutes with a Nutri-Score of A or B can be perceived as equally natural as products without a Nutri-Score whereas milk substitutes with a Nutri-Score of A or B can be perceived as less natural than products without a Nutri-Score.

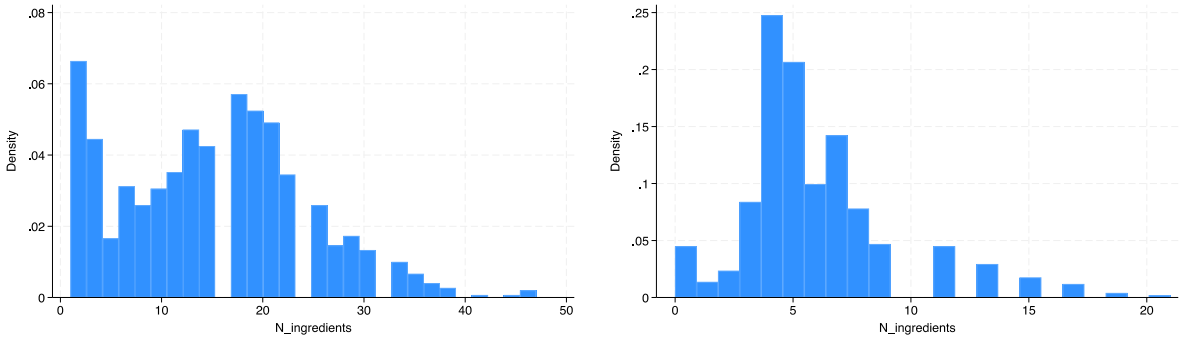
Moreover, for meat substitutes, products with a Nutri-Score of C, D or E have a longer ingredients list. From the consumer point of view, they thus have the image to be less natural. Product prices and the number of ingredients also appear to be not correlated with each other.

For milk substitutes we find that products with a Nutri-Score of A and B are the ones with a longer list of ingredients, and hence may be perceived as being less natural. It follows that the Nutri-Score might not be suitable to identify more natural products for those consumers to whom this is an important decision criterion.

**Table 2:** Negative binomial regressions for differences in length of ingredient list between products that carry a Nutri-Score of A or B as well as C, D or E compared to products without a Nutri-Score

	Meat substitutes		Milk substitutes	
	<i>Dependent variable: Number of ingredients</i>			
Variable	Coefficient	SE	Coefficient	SE
Constant	2.729***	0.057	1.744***	0.027
Nutri-Score A/B	-0.144	0.102	0.213***	0.063
Nutri-Score C/D/E	0.202**	0.094	-	-
Price/100g	-0.003	0.034	0.090*	0.055
Pseudo R <sup>2</sup>	0.001		0.010	
Wald chi <sup>2</sup> (2)	7.100*		12.790***	
obs.	914		523	
Deviance goodness-of-fit	6102.425***		995.715***	
Pearson goodness-of-fit	5521.623***		989.730***	

Notes: \*, \*\*, \*\*\* denotes significance at the 1, 5, 10% level;



**Figure 2:** Distribution of number of ingredients for meat substitutes (Left panel) and milk substitutes (right panel)

*Research question 3: Can the decision to label the product with a Nutri-Score be explained by company characteristics such as size or age?*

Tables 3 and 4 show the results for the logistic regressions with the dummy capturing the presence of the Nutri-Score as dependent variable and the firm characteristics as independent variables. For meat substitutes, we find that particularly younger and larger companies use the

Nutri-Score on their products (cf. Table 3). We also find that Nutri-Scores used are more likely to be of categories A or B for these firms (cf. Table 4). For milk substitutes, such an effect cannot be detected. This could be explained by the fact that milk substitutes producers tend to be older more traditional companies while a higher number of start-up companies can be found among the meat substitute producers in our sample.

**Table 3:** Logistic regressions for the decision to label the product with a Nutri-Score and company characteristics

	<b>Meat substitutes</b>		<b>Milk substitutes</b>	
	<i>Dependent variable: Presence of Nutri-Score label</i>			
<b>Variable</b>	Coefficient	SE	Coefficient	SE
Constant	-2.750***	0.265	-2.028***	0.206
Size	3.18e-08***	8.84e-09	-6.22e-08	5.90e-08
Age	-0.016***	0.006	0.001	0.003
Pseudo R <sup>2</sup>	0.038		0.01	
Wald chi <sup>2</sup> (2)	13.240***		1.140	
obs.	624		286	

Notes: \*, \*\*, \*\*\* denotes significance at the 1, 5, 10% level;

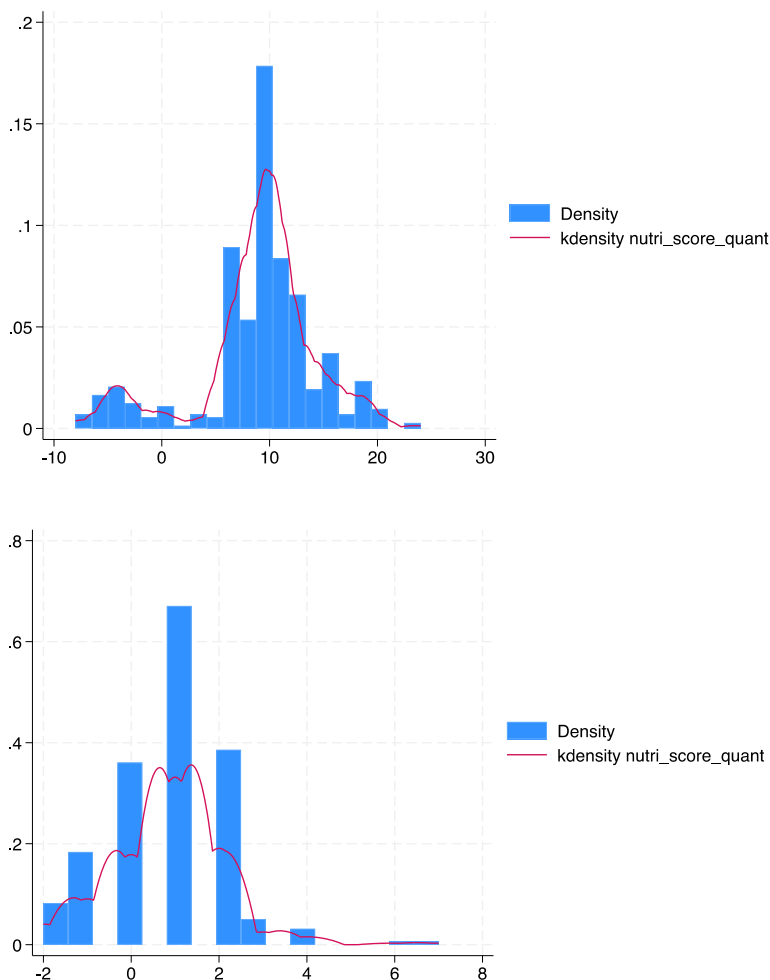
**Table 4:** Logistic regressions for the presence of a Nutri-Score of A/B and company characteristics

	<b>Meat substitutes</b>		<b>Milk substitutes</b>	
	<i>Dependent variable: Presence of Nutri-Score A or B</i>			
<b>Variable</b>	Coefficient	SE	Coefficient	SE
Constant	-2.862***	0.317	-2.028	0.206
Size	4.22e-08***	1.13e-08	-6.22e-08	5.90e-08
Age	-0.023***	0.009	0.001	0.003
Pseudo R <sup>2</sup>	0.056		0.008	
Wald chi <sup>2</sup> (2)	14.280***		1.140	
obs.	624		286	

Notes: \*, \*\*, \*\*\* denotes significance at the 1, 5, 10% level;

*Research question 4: Are companies more likely to use formulation strategies to just reach the cut-off of the next better Nutri-Score category? If so, can this strategy be explained by company characteristics?*

Figure 3 shows the densities of the manually calculated Nutri-Score values for meat and milk substitutes. Note that the cut-offs of the Nutri-Score are below values of 0 (A), 2 (B), 10 (C) and 18 (D). The cut offs are based on the calculation of the Nutri-Score provided by Santé publique France (2024). The Figures reveal that for both product categories there is a tendency to reformulate at the thresholds. This is particularly visible for meat substitutes with peaks in the density functions below 0, 10 and 18. For milk substitutes, the trend is less pronounced but values gather between 0 and 2.



**Figure 3:** Distribution of Nutri-Score values for meat substitutes and milk substitutes (below)

We further find that larger firms in the case of meat substitutes and older firms in the case of milk substitutes are more likely reformulate to be just below the thresholds of a better category. For higher priced products this tendency is lower. The detailed results are shown in Table 5 and Table 6 below. For milk substitutes the reasons might be that milk substitutes are less likely chosen because of convenience – as milk is as convenient as plant-based milk drinks – compared to meat substitutes. Thus, the nutritional value of milk substitutes might be more important for consumers’ food choice as convenience might be less important for food choice.

**Table 5:** Regressions for relationship of firm characteristics and bundling at thresholds

Variable	Meat substitutes		Milk substitutes	
	Coefficient	SE	Coefficient	SE
Constant	0.108***	.0254637	0.181	0.039
Size	2.26e-09**	9.51e-10	-6.27e-10	2.31e-09
Age	3.44e-04	2.51e-04	0.001	0.001
Price	-0.028***	0.010	-0.061***	0.018
R <sup>2</sup>	0.042		0.012	
F	6.930***		4.700***	
obs.	596		255	

Notes: \*, \*\*, \*\*\* denotes significance at the 1, 5, 10% level;

**Table 6:** Regressions for relationship of firm characteristics and bundling at (broader one below the threshold included) thresholds

Variable	Meat substitutes		Milk substitutes	
	Coefficient	SE	Coefficient	SE
Constant	0.140***	0.039	0.387	0.045
Size	2.49e-09**	1.02e-09	-1.85e-09	2.78e-09
Age	0.001	3.54e-04	0.002**	0.001
Price	0.001	0.021	-0.159***	0.028
R <sup>2</sup>	0.031		0.054	
F	4.40***		14.360***	
obs.	596		255	

Notes: \*, \*\*, \*\*\* denotes significance at the 1, 5, 10% level;

## Summary and outlook

Considering the rising obesity levels worldwide, it is crucial that consumers are able to make more informed decisions related to healthier food choices. Nutrition labels such as the Nutri-Score can be a tool to nudge healthier food choice behavior. However, based on our findings, we question whether introducing Nutri-Scores voluntarily can contribute to these better choices, as a good Nutri-Score is not necessarily associated with superior nutritional quality compared to products without a Nutri-Score. Further, a Nutri-Score is not associated with a shorter ingredients list. Thus, a better Nutri-Score does not indicate a less processed or more natural product. Beyond, we find indications that at least some companies do not try to reformulate food with the objective to produce the healthiest possible product but to meet the next cut-off value of the targeted Nutri-Score. Last, we find some tendencies that food companies characteristics such as age and size can influence the intended use of the Nutri-Score label.

In a next step we aim cluster the milk alternatives by main ingredient (e.g., soy) and meat substitutes into the homogenous categories i) sausages, ii) cold cuts, iii) minced meat, or burger patties to uncover potential differences in product categories. Further, we will include additional company characteristics such as its position as a national/retail brand.

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