

How does the price of different food products vary with the healthiness of that product?

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It may sound straightforward to establish whether healthy foods are more expensive than less healthy ones. However, it depends a lot on how we measure both the price and healthiness of foods. For example, a burger costs more than an apple, but you would need to eat a lot of apples to get the same number of calories as a burger. One way of measuring the cost of food is to calculate its *price per calorie*, which accounts for the fact that some products have a lot more calories in them.

How can we measure the healthiness of different food products? One convenient measure of healthiness of food products is the Nutritional Profile Model (NPM). The NPM is the measure used in the UK to categorise foods for regulatory purposes.² It combines measures of "unhealthy" characteristics (energy, saturated fat, sugars and sodium) and "healthy" characteristics (fruit, vegetable and nut content, fibre and protein) into a single index. Products are assigned a score between -15 and 30: a higher NPS indicates a less healthy food product. For example, fruits and vegetables mostly have NPS scores less than zero, while chocolate bars, sweets and crisps tend to have NPS scores that are above 5.

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/216094/dh_123492.pdf

Figure 1 shows the mean price across products within each NPM score. There are different numbers of products (and some products are purchased more than others) in each NPM score.

Figure 1: Price per calorie across products

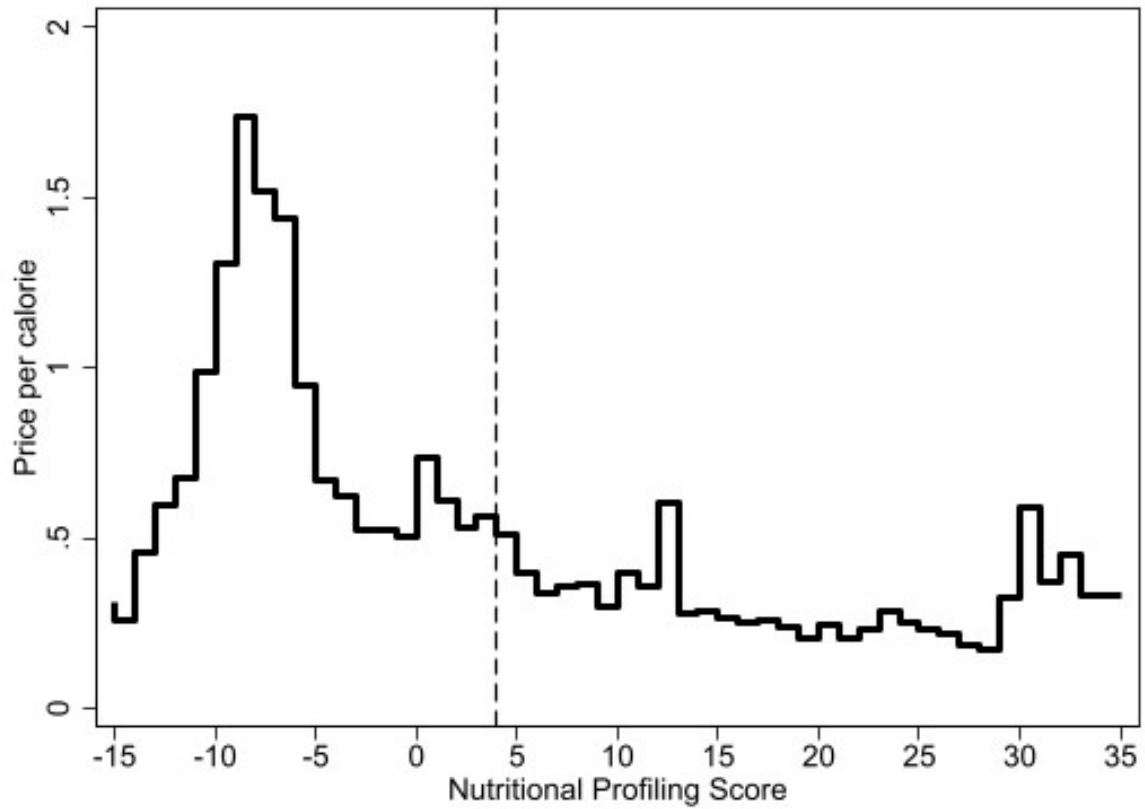


Figure 2 shows the mean price across products, weighted by transactions (to reflect the fact that there are more products and purchases at some NPM points), within each NPM score.

Figure 2: Price per calorie across transactions

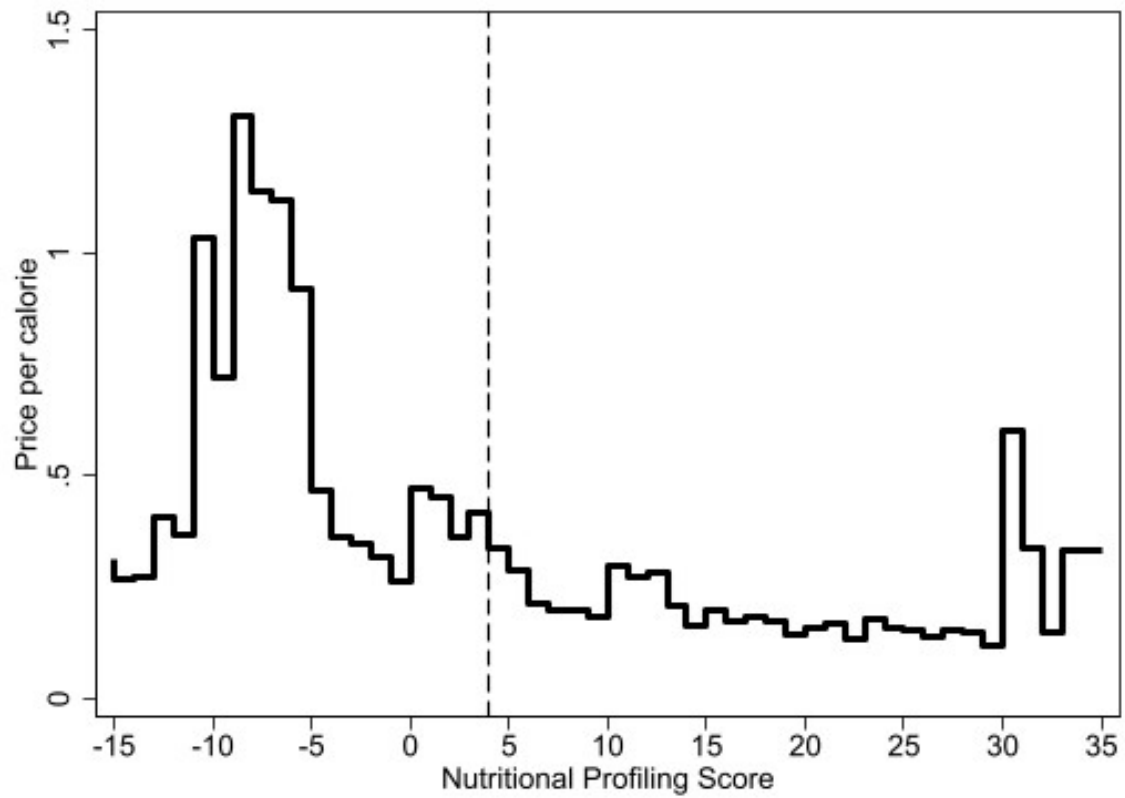


Figure 3 shows smoothed price across products by NPM score (using lowess, locally weighted scatterplot smoothing). It reflects the fact that there are more products and transactions at some NPM points.

Figure 3: Price per calorie across transaction (lowess smoothed)

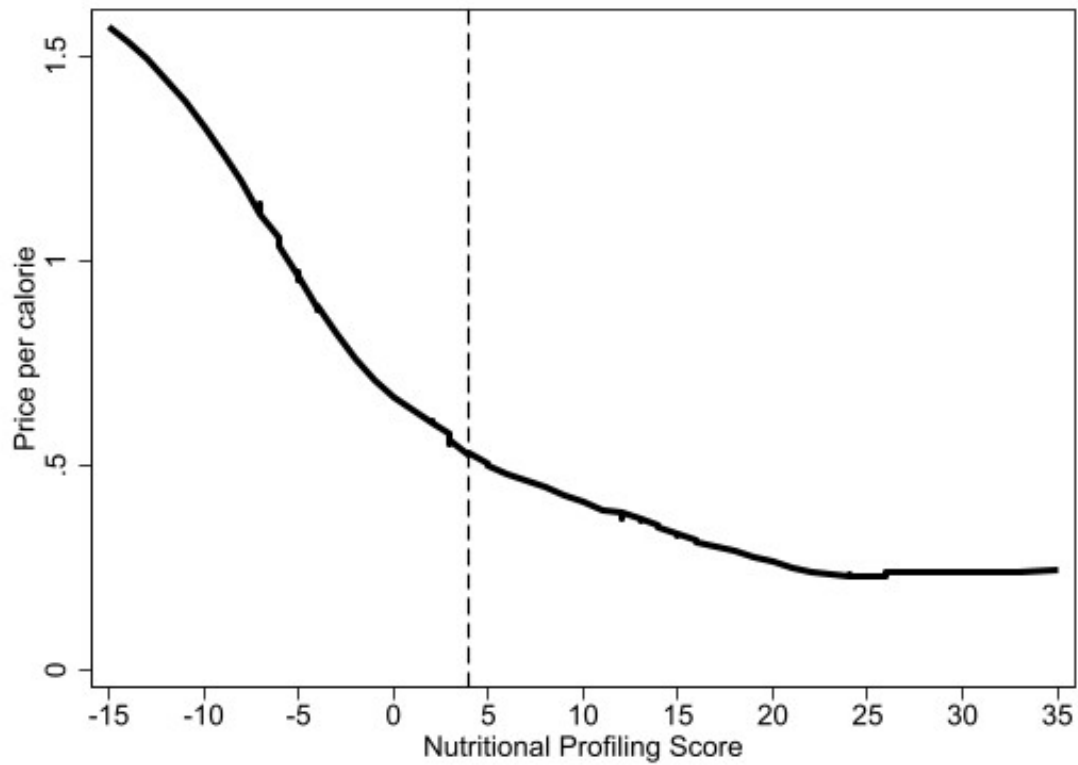
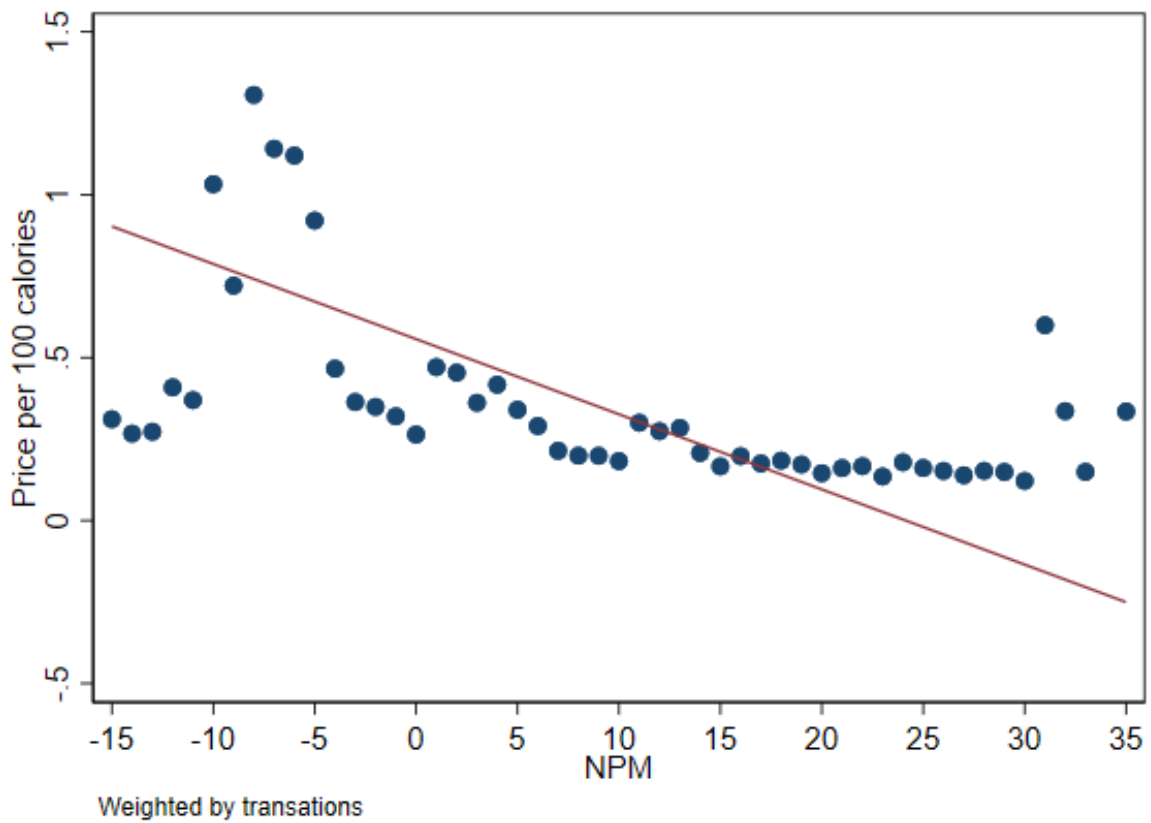


Figure 4 shows a bin scatter plot of the NPM score against price per calorie. This takes all products, ranks them by NPM and put them into 100 equally sized bins - each dot is a bin (so an equal number of products are represented by each dot).

Figure 4: Price per calorie by transaction (bin scatter)



One problem with this approach is that in the vertical axis (price per calorie) calories appear as the denominator and the NPM is increasing in calorie density. This creates a mechanical relationship in the two variables.³

Why do some foods cost more than others? The price of a food product depends on the interaction of supply and demand factors. If something costs more to make or grow, then this will typically be reflected in a higher price. However, if there are social costs to the consumption of unhealthy foods -- that is if the costs of production do not fully reflect the costs to society of that product being consumed -- then the price might be "too low", in the sense that there may be a benefit to government intervening in the market to raise the price. For example, the overconsumption of sugar or salt is associated with increased prevalence of diet-related diseases, the costs of which are often borne by publicly funded healthcare systems. It is the existence of these social costs that provide a rationale for taxes on unhealthy foods, such as sugary drinks. The appropriate level of these taxes depends not on the differences in price between healthy and unhealthy products, but on the magnitude of the social costs that are associated with the consumption of unhealthy foods.

Another reason that the price of two products that cost the same to produce might differ is if firms have market power that enables them to mark prices up above marginal cost; if one product is much more popular than the other, then the more popular item is likely to have a higher price (because consumers like it more they will be willing to pay more for it, and less willing to substitute away to other products).

Notes

We use Kantar Fast Moving Consumer Goods (FMCG) Purchase Panel (Take Home) 2019. The Kantar purchase panel data covers food purchased and brought into the home and has demographic and purchase data for over 30,000 households in the UK and price and nutritional information for over 100,000 products.

We exclude the following products:

- drinks, because the NPM scale is different for them (I can draw a separate figure if you want)
- products with very few calories, such as herbs and water, because price per calorie is not defined (you can't divide by zero)

³ See Carlson and Frazão (2012) "Are healthy foods really more expensive? it depends on how you measure the price" Washington DC: Economic Research Service, Lipsky et al (2011) "Fundamental misunderstanding of the relation between energy density (kcal/g) and energy cost (\$/kcal)" *American Journal of Clinical Nutrition*, 93, 867-868, and Jones and Monsivais (2016) "Comparing prices for food and diet research: the metric matters" *Journal of Hunger and Environmental Nutrition*, 11:3, 370-381 for discussion of this point