A mathematician takes issue with supermarket price promotion gambits

In the spring of 2015, the consumer magazine *Which?* issued a report claiming that discounts by supermarkets are often misleading. As a mathematician and game theorist, I was asked to comment on this in the BBC radio show "PM" (for "afternoon") hosted by Eddie Mair on 21 April. I find that the time to contribute in a live broadcast is usually too short to explain any scientific insight; in this case, it turned out that I could explain the use of some basic mathematics (not game theory) as a grocery shopper.

I had been asked in advance by the host to do some supermarket shopping for this programme, and brought a few of my shopping samples along, which Eddie or I would talk about while I took them out of their bags.

A first example is a mathematical trick that makes discounts appear larger than they actually are: "100 percent extra free!". This, of course, does not mean that the whole product is free (in which case one would have to pay nothing for it), but rather that one gets an extra 100 percent, i.e., twice as much for the same amount of money. That is equivalent to a "two for the price of one" offer. So twice the product for the same dollar amount means in effect half price, or a discount of 50 percent. Not insignificant, but not a 100 percent reduction. Similarly, "50 percent extra free" means essentially getting three while paying for two, so each unit costs two thirds of the original price — a markdown of one third (about 33 percent).

Let us illustrate it with packs of dishwasher tablets. The ones I found were not only sold in the "100 percent extra free" version but also in a very small package with 13 tablets inside. That makes it very hard to compute the cost of a single unit (via division by 13). The whole pack cost £3.79, or a little over £0.29 per tablet — very expensive. The shop is obliged to display this unit price, which perhaps is not by accident just below 30 pence (for those customers who bother to read the fine print), just as £1.99 is meant to look cheaper than £2.00, although it is nearly the same.

Unit pricing is also meant to simplify comparisons. Bulk items like fruit should normally be charged per kilogram. The so-called "local" (convenience-store style) outlet of a national supermarket chain prices apples PER FRUIT, such as for six apples. This way, comparisons are particularly hard, as no weight is given. This practice should be forbidden (and that has nothing to do with the misleading pricing of offers noted by *Which?)*.

Another notable aspect was a package of tomatoes that displayed a big British flag in its corner to suggest, positively, that the consumer was buying locally sourced, rather than imported, food. However, this came with a side effect: there was no tomato behind the flag on an otherwise transparent container. The printed flag hid an empty part of the package, making it seem like it had more tomatoes than it actually had.

One important recommendation is to use basic arithmetic and benchmarks of unit costs to check whether bulk offers are really cheaper than smaller packs. That is often not the case. Which is cheaper? A pack containing 24 rolls of toilet paper for £7.99 or one with nine rolls for £2.59? I will use some arithmetic: £8 for 24 rolls means £1 for three rolls, because 24 = 8 x 3. This means the package with nine rolls is cheaper (it would otherwise cost £3). Now, a four-roll pack for £1.50 would definitely be an even more expensive option.

Remembering the benchmark of £1 for three rolls is useful.

Enjoying a little bit of calculation in your daily shopping keeps your brain in use and helps you save money, as your in-house mathematician recommended on this radio programme. (People seemed to pay attention to the show. Immediately afterwards a friend, long out of touch, sent an email and noted that he only ever pays £0.10 per dishwasher tablet.)

Take a listen to my interview on BBC Radio 4.

Audio Player
http://www.maths.lse.ac.uk/Personal/stengel/bvs-supermarket.mp3
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