## OPINION

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## What's in Your Backpack? The Weird Way We Make Spending Decisions

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Consumer spending in the second quarter of 2023 was nearly \$14.5 trillion, the largest component of the gross domestic product.

Consumers have many reasons to make purchase decisions. A particular product purchased may be based on factors including fashion, price, ergonomics, quality, reputation, availability or practicality. That's why you may find one product that's affordable and available far more attractive to you than the next person would.

Data scientists have studied this decision problem and have come up with ways of narrowing the whole consumer decision-making process into one centered on how you and others define value and how much value costs. They call it the knapsack problem (although backpack is the term more commonly used today), and it applies as equally to households as it does to professional sports teams.

To explain this problem, suppose you have a backpack that can hold a limited amount of weight. You can fill the backpack with a collection of weighted items, each providing you with a defined benefit. Your goal is to fill the backpack with items whose total weight can fit into the backpack such that their total benefit is as large as possible.

If you think of the weights as costs and the benefits as values, you want to pick items that offer the most total value without exceeding your budget.

In the worst case, an individual can try every combination of items that can fit into the backpack and determine which offers the most total value. To be more efficient, algorithms have been designed to solve the problem under a variety of circumstances.

Suppose you are in the market for a pair of athletic shoes. The price is determined by many factors, including the materials used, the labor costs, the quality of the workmanship and the brand, among others. Each of these components contributes to the price. So, when confronted with choosing between two brands of shoes that, on the surface, may look remarkably similar, choices must be made. Indeed, compromises in material, design or brand can make the prices wildly different.

Given all of these factors, how can consumers make wise choices when making purchases?

The solution is focusing on value, which measures the benefits gained minus the costs.



Closeup shot of a person swiping a credit card for payment.IMAGINESTOCK/ Getty Images

Buying the most expensive item may not be affordable, especially if the costs do not justify the value provided. However, simply choosing only the lowest-cost item may not work, especially if its value is low.

Solving a backpack problem is harder than it looks. Yet, it is a problem that everyone is faced with any time they make purchases. We always have a limited budget, yet we want to get the most value out of our purchases.

Situations like this are ubiquitous.

Do you buy the latest smartphone model, or save a little money and buy last year's model? The latest model almost certainly has some technological upgrades that the older model does not offer. Is the added cost worth the extra benefits? What makes this decision unique for each person is that the value of the upgrades is not the same for everyone. For smartphones, this means that the best choice for some people is the newest model, while for others, it is last year's model.

At the extreme, the desire or need for the most up-to-date smartphone places such a high value on the new product that the price becomes irrelevant.

Although each of us solves a backpack problem every time we make a purchase, we are rarely conscious of it. At its core, we are evaluating the tradeoff between price and value, which drives our choices.

This problem is also routinely faced by general managers of professional sports teams who must assemble a team of players with a limited amount of money to pay them, typically determined by the league's salary cap. This is why teams that rely on high-priced free agents to build a winning team rarely succeed over the long haul, while those drafting athletes are more likely to come out on top.

Why is this the case? Big-name free agents are high-performing players. The problem is that the benefit they bring to a team is being paid for at full price. So, general managers must pay the market rate when signing them, which is almost always a bad choice. Conversely, high-draft-pick athletes are paid modestly early in their careers, with some providing exceptional value given their contracts.

Filling backpacks is a near-daily problem for everyone. Those who make wise choices end up with high value for their money. Those who make poor choices end up with little to show for their spending. Some choose randomly, sometimes coming out ahead, other times behind.

Weighing costs and value are personal. That is why two people can make purchases that are diametrically opposite, yet both come out with great value for their money. This explains why filling backpacks is an adventure for us all, even if we are unaware that we are filling them.

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