

Across time and space: Psychological distance and inventory decision making

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In operations management, there's a well-known model called the newsvendor problem. Based on the classic scenario of a paper carrier deciding how many papers to try to sell each day, the newsvendor

problem illustrates the challenge of determining supply in advance of knowing demand.

"The newsvendor problem serves as a workhorse of [inventory](#) issues because it captures, in its simplest form, the challenge of balancing the cost of excess inventory with the cost of a shortage," said Brent Moritz, associate professor of supply chain management in the Penn State Smeal College of Business. "There's a cost of having too much—because the value of a day-old newspaper is zero—and a cost of not having enough—because you don't want to run out when you could have sold more."

Complicating inventory issues are [psychological factors](#) that can affect how inventory managers perceive their suppliers. Moritz, along with co-author Samuel Kirshner, associate professor in the School of Information Systems and Technology Management at the University of New South Wales, Australia, recently published a paper in *Production and Operations Management* that examines how psychological distance factors affect order quantity decisions.

"Many businesses have to place orders for inventory ahead of knowing demand," explained Moritz, whose area of research is behavioral [operations management](#). "If a business knows the costs of either too much inventory or too little inventory and can estimate expected demand, it's possible to select an optimal order quantity. In our study, however, we found that individual decision makers are not especially good at doing this, even if they have all the information they need."

The researchers looked at two common measures of psychological distance—spatial distance (suppliers that are geographically near or far) and temporal distance (short or long lead time from order to receipt). Across four experiments with 663 participants acting as inventory managers, they found that a far psychological distance, both spatial and

temporal, increases order quantities.

In general, this increase in order quantities leads to better outcomes for high-profit-margin settings and poorer outcomes for low-profit-margin settings. In the case of high-margin items—those with a high price markup—Moritz said, "You don't want to run out because every sale is profitable. In the electronics world, for example, it's not TVs where retailers make their money—rather, they make their money on TV accessories like cables and mounting brackets. If you're Best Buy, you don't want to run out of mounting brackets because they might sell for close to \$100 but probably cost the retailer about \$10. So you might over-order to make sure you have enough."

For low-margin items, those that sell for minimal profit, over-ordering is less profitable. Moritz posed another example: "Let's say you're going to sell Penn State T-shirts featuring Homecoming 2022," he said. "If you buy shirts at \$10 each and then sell them for \$12 each, you don't want to have too much left over because what happens when Homecoming weekend of 2022 is over? You're stuck with extra inventory."

The researchers found it especially interesting that psychological distance in both space and time influenced order quantity, even though those factors shouldn't matter. "It shouldn't influence the order quantity at all," Moritz said. "While an inventory manager might place an order earlier from a [supplier](#) with a longer lead time, there's no reason to order more from that same supplier."

Adding another layer to the psychological distance phenomenon, the researchers applied construal level theory, which speaks to how someone construes or perceives distance. In one phase of the study, the researchers asked two groups to focus on a supplier that is 100 miles away. For the first group, suppliers ranged from 10 to 100 miles away, and the participants were asked to focus on the supplier that was 100

miles away. For the second group, suppliers ranged from 100 to 1,000 miles away, and subjects were again asked to focus on the supplier 100 miles away.

"So in each case, participants made ordering decisions from a supplier located 100 miles away, but with respect to the firm's other suppliers, 100 miles away was framed as being relatively close or relatively far," Moritz explained. The researchers found that when ordering low-profit-margin items, framing the supplier as spatially close led to a significant decrease in orders, and for high-margin conditions, framing the supplier as far away led to an increase in orders.

"Given that spatial and temporal distances occur naturally in supply chains, these results show us that psychological distance is one driver of decisions, and distance framing could be used to decrease biased inventory ordering," he said. "Applying theory from [cognitive psychology](#) to show the intersection of human nature and supply chain and operations decisions, as we did in this study, can lead to improved performance in inventory ordering."

More information: Samuel N. Kirshner et al, For the future and from afar: Psychological distance and inventory decision-making, *Production and Operations Management* (2022). [DOI: 10.1111/poms.13829](https://doi.org/10.1111/poms.13829)

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