
Institute for Research in Marketing

Press Release

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**U of M Researchers Find that Two Plus Two May Not Always Equal Four:
When it Comes to Percentages, Consumer Calculating Errors Can Be Costly**

MINNEAPOLIS / ST. PAUL (5/15/2007) -- People deal with percentages every day: the performance of a stock portfolio, a sale at the department store, or the performance of a new hybrid car are all often expressed as percent changes. As an everyday occurrence, calculating percentages should be second nature to the average person. "Not so," says Akshay Rao, professor of marketing at the University of Minnesota's Carlson School of Management.

In the paper "When Two and Two is Not Equal to Four: Errors in Processing Multiple Percentage Changes," Rao and Haipeng Chen, a Carlson School doctoral alum and assistant professor at the University of Miami, show that consumers treat percentages like whole numbers, and this results in systematic errors in calculation. People simply aren't coming up with four when they add two plus two. The paper will appear in a forthcoming issue of the *Journal of Consumer Research*.

"Numerical quantities such as price or product performance are often expressed in percentage form," said Rao. "But when consumers have to deal with more than one percentage at a time, they make errors that can be costly. For instance, if a store offers a 25 percent off sale with an additional 25 percent off for a certain product, people assume they are getting a 50 percent reduction. In reality, they are getting about a 43 percent discount. On a \$100 product, they pay \$56.25, not \$50. This phenomenon becomes even more interesting when a value goes up and then down. Imagine your stock portfolio went up 40 percent last period, and down 30 percent this period. You are not better off by 10 percent. Your portfolio is down 2 percent."

Marketing and public policy implications for this phenomenon are significant. The effects of consumer miscalculation when confronted by multiple percentage changes can benefit firms at the expense of numerically challenged consumers. In their paper, Rao and Chen tested the impact of offering a 20 percent discount and an additional 25 percent discount versus an economically equivalent 40 percent discount in a retail store. The number of purchasers, sales volume, revenue, and profit were all higher when the double discounts were offered.

Consumers have a hard time processing these numbers, especially on the fly. But it isn't just consumers. Even experts make errors when confronted with multiple percentage changes. Journalists and lawmakers can miscalculate when processing multiple percentages such as describing improvements in achieving regulatory standards or federal agencies seeking budget appropriations.

Given the increasing importance of numerical information in this information age, a key implication is the need to educate consumers of numerical information in basic arithmetic. "At some point, even if you and I don't make this error, if somebody else - such as Congress - does make the error, it affects all of us," Rao said.

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