Shoppers' Spending Habits Follow Well-Known Economic Law

October 26 2007, By Lisa Zyga

An am/pm store in Osaka City, Japan.

By analyzing 100 million receipts from 1,000 Japanese am/pm convenience stores, researchers have discovered a strong economic inequality among shoppers. Among their findings is that the top 25% and 2% of the customers in a given group account for 80% and 25% of the store's sales, respectively.

The researchers, Takayuki Mizuno from Hitotsubashi University, and Masahiro Toriyama, Takao Terano, and Misako Takayasu from the Tokyo Institute of Technology, performed the "econophysics" study, the first to use a large, recently published point-of-sale (POS) database to analyze individual shopping habits. They presented their results at the

APFA6 international conference, and have submitted their study to the *Proceedings of the APFA6*.

“The data we analyzed from 100 million receipts is much larger than the data in previous similar studies in the marketing field,” Mizuno told *PhysOrg.com*. “We scientifically studied the inequality of wealth distribution by using results with high statistical precision.”

One question the researchers investigated was how much a store’s sales depend on a few loyal customers. They analyzed data from customers who paid with an Edy card (a pre-paid card with a unique ID), used on about 5% of the receipts.

The researchers observed the 80/20 rule: about 80% of the store’s sales come from about 20% of its customers. The observation is not too surprising, as the so-called “Pareto principle” has been observed in a wide variety of economic phenomena, such as wealth distribution (20% of a nation’s citizens own 80% of its wealth). The principle has also become a rule of thumb for business owners trying to maximize profits by focusing on that high-spending 20% of the customers.

Using this data, the researchers were also able to determine the inequality of wealth distribution, which stems from the “Gini coefficient.” An equal wealth distribution would relate to a coefficient of zero, and if one person were to purchase everything, the coefficient would be one. In a market economy, the coefficient is usually less than 0.4; in the convenience store data, the estimated coefficient was 0.7, implying significant inequality in the store’s sales.

“We think that the inequality of wealth distribution is representative of the larger society,” Mizuno explained. “When Sega Corporation introduced the Edy into game arcades, similar wealth distribution was observed in the game arcades. Also, when we conducted hearing investigations with employees of convenience stores, many thought that most customers have similar buying behaviors and that the wealth distribution doesn't have a fat-tail. Therefore, they were surprised at this research result."

The researchers also analyzed an individual's spending amount in a single shopping trip, and found that this expenditure follows a power law. Specifically, for receipt totals above about 100 yen (about US $0.86), the probability of an individual spending more yen decreases following a power function. This probability is independent of the store location, shopper's age, and time of day.

The researchers hope that the results may assist convenience store chains in developing marketing strategies aimed at the high-spending shoppers who contribute significantly to a store's sales.

"When a product that a customer needs is out of stock in a store, the customer often stops going to the store in the future," Mizuno explained. "Conversely, when there are products that a new visitor needs, the store can get new regular customers. It is important that sellers always display products that the high-spending shoppers always buy. They can execute this strategy by using the purchase history that can be observed from Edy-IDs."

More information: Mizuno, Takayuki, Toriyama, Masahiro, Terano, Takao, and Takayasu, Misako. "Pareto law of the expenditure of a person in convenience stores." arXiv:0710.1432v1, 7 Oct 2007.