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Chinese perspective on newsvendor bias: An exploratory note

Yin Cui [a], Lucy Gongtao Chen [b], Jian Chen [a], Srinagesh Gavirneni [c,*], Qi Wang [d]

[a] School of Economics and Management, Tsinghua University, Beijing 100084, China
[b] NUS Business School, National University of Singapore, Singapore 119245, Singapore
[c] Samuel Curtis Johnson Graduate School of Management, Cornell University, Ithaca, NY 14853, United States
[d] Department of Human Development, Cornell University, Ithaca, NY 14853, United States

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Dedicated to the memory of Alice M. Isen – devoted friend, caring colleague, inspiring co-author.

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ABSTRACT

Chinese and American decision makers demonstrated significantly different biases while making newsvendor decisions in a laboratory experiment that utilizes the open-ended verbal protocol analysis approach. Chinese subjects (i) asked more questions before reaching their decision, which suggests that they are more cautious when making a decision; (ii) were more frequently able to come up with a new number as their decision whereas the American decision makers tended to use one of the given numbers as their decision; (iii) were more cognizant of salvage values and as a result ordered more than the American decision makers. Due to the open-ended, time-consuming nature of our experiment, our subject pool was small and thus we present these results as exploratory in nature and discuss directions that are worth further study in future experiments.

1. Introduction

Increasing prominence of the Chinese economy on the global stage means that now many supply chains contain Chinese decision makers whose actions significantly affect supply chain profitability. To achieve operational excellence, it is necessary to understand how Chinese decision makers approach, analyze, and solve operational problems. Existing research on behavioral decision making in operational contexts has mostly been limited to U.S. and other western decision makers (Schweitzer and Cachon, 2000; Bolton and Katok, 2008; Bostian et al., 2008; Benzion et al., 2008; Bolton et al., 2010; Drake and Rudi, 2010); and little is known about Chinese decision makers. The only exception, to the best of our knowledge, is Feng et al. (2011) who repeated the Bolton and Katok (2008) experiment in China and observed that the "pull-to-center" effect is more prominent among Chinese subjects than among those subjects used in the Bolton and Katok (2008) study. The scarcity of pertinent literature has prompted a strong need to tabulate the similarities and differences between Chinese and Western approaches toward operational decision making; and this paper aims to get the research moving in that direction.

The Feng et al. (2011) experiment was computer-based with emphasis on the final decision. In contrast, to understand the actual decision-making process, we focus on verbalizing the thought process and conduct an open-ended verbal protocol analysis based newsvendor experiment from Gavirneni and Isen (2010) using Chinese subjects. It is often conceived that Chinese are mathematically more competitive due to their better quantitative training and performance (Stevenson and Stigler, 1992; Stigler and Perry, 1990), which prompts us to conjecture that Chinese subjects will seek information on the demand distribution more actively during newsvendor decision making. Stereotypical belief also has it that Chinese are brought up in a culture of thrift (Tung and Baumann, 2009) and so we postulate that Chinese subjects are more aware of the salvage value and hence will order more. Further, Chinese are often perceived to be quiet and passive (Lee, 1996; Yeh, 2001). This tendency may manifest as asking fewer questions in the experiment, resulting in obtaining less information for decision making. Whether these conjectures for Chinese subjects are valid, and how their decision process affects the performance, though, is unclear a priori. Are Chinese subjects indeed superior in quantitative analysis in newsvendor decision making? Will they perform better in terms of profitability? Are they really passive in information seeking and will this be detrimental to their profitability? To answer questions like these, we compare Chinese subjects' behavior with that of their American counterparts. Analysis of the resulting verbal protocols revealed that:

1. Chinese decision makers do not have as much trouble with the problem abstractness and are indeed better able to perform the analysis needed to solve these problems.

* Corresponding author.
E-mail addresses: cuiy2.05@sem.tsinghua.edu.cn (Y. Cui), bizcg@nus.edu.sg (L.G. Chen), chenj@sem.tsinghua.edu.cn (J. Chen), nagesh@cornell.edu (S. Gavirneni), qiwang@cornell.edu (Q. Wang).

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2. Chinese subjects use the anchor and adjustment heuristic to a smaller extent. The decisions they arrive at are, less often, one of the numbers given to them in the experiment. They demonstrate an ability to come up with new numbers as their order quantities.
3. Chinese decision makers, surprisingly, ask many more questions, which can be due to (i) their focus on failure prevention (as opposed to promotion; Elliot et al., 2001); (ii) having an intent to avoid uncertainties (Chinta and Capar, 2007).
4. Chinese decision makers indeed better understand salvage values and use them, more often, in newsvendor decision making.

Due to the time-consuming nature of the experiment, we had to keep the sample size relatively small. Thus, we present our results as exploratory in nature with the intention that some of our observations may be worth pursuing in the future using more focused experiments. The rest of this paper is organized as follows. In the next section, we describe the experiment and the subject pools. Section 3 describes the results we observed along with statements of their statistical significance. We conclude in Section 4 by discussing the broader implications of our findings for global supply chain decision making, pointing out the limitations of our study, and formulating hypotheses worth testing in the future using focused larger scale experiments.

2. Experimental design

We provide only the most pertinent information here as further details on the experiment can be found in Gavirneni and Isen (2010). In order to conduct verbal protocol analysis, we present the newsvendor task with only the most basic information (namely, the mean demand), and subjects are expected to seek additional pieces of information that could help them make their decision.

Task instructions

Task: Your task is to determine the purchasing quantity of a product for the upcoming selling season. The forecasting process placed the expected demand at a value of 10,000 but the actual demand is uncertain. You need to determine an order quantity that maximizes the profit for your company. If you order too much, you will incur costs associated with items left over and if you order too little, you will be foregoing profits that you could have otherwise collected. So you must choose the order quantity carefully.

Anticipating that the subjects would likely ask for it, we identified ten pieces of information with respect to (i) demand range (0–20,000); (ii) demand distribution (uniform), (iii) selling price ($900); (iv) purchasing cost ($300); (v) salvage value ($100); (vi) loss of goodwill (zero); (vii) quality problem (10% defective); (viii) quantity discounts ($50 per-unit discount if order quantity is at least 20,000); (ix) demand management (spend $250,000 to ensure demand is at least 5000); and (x) rain checks ($100 coupon guarantees that an unsatisfied customer will come back to buy). If a subject asks for information other than these pieces, he/she will be informed that it is not available, but his/her request will be recorded in the transcript.

We recruited 21 Chinese subjects and 21 American subjects (those in Gavirneni and Isen, 2010) to participate in this experiment. They were Master of Business Administration (MBA) students at top universities in their respective countries. Table 1 shows the detailed sample demographics.

3. Observations

Here we detail the data and describe the observations we made in the areas of (i) information gathering; (ii) decision making; (iii) order quantities; and (iv) effectiveness of decisions.

Fig. 1 illustrates the frequency with which the Chinese and the American subjects asked for and received the ten pieces of information available in our experiment. Notice that more Chinese subjects asked for the information on demand range (18 vs. 14) and demand distribution (18 vs. 13) and this may be related to better mathematical training and comfort with probability distributions. Salvage value was sought by 20 of the 21 Chinese subjects whereas only 14 of the 21 American subjects sought that information. This could be due to the fact that Chinese decision makers have grown up in a culture of thrift and conservation and that trains them to utilize every resource to the fullest extent possible. There is a famous Chinese saying "Wu Jin Qi Yong (or Waste Not, 物尽其用),"which means "make the best use of everything and let all things serve their proper purpose". Influenced by this philosophy of life, the Chinese people have formed a habit of not wasting anything, from food preparation (see Kuan, 2007) to domestic goods collection (see Cotter, 2009). As a result, recycling and reusing is the standard practice in China (Beehive, 2007) and in fact, it is ingrained into the Chinese psyche. This leads them to ask, more often, for information on the salvage value. A Mann–Whitney–Wilcoxon (MWW) test[1] shows that these differences were statistically significant with a p-value smaller than 0.10. We can also observe that fewer Chinese subjects asked for the advanced pieces (items (vi) to (x) as enumerated in Section 2) of information. However, this difference was not statistically significant.

Observe from Fig. 2 that the Chinese subjects asked many more (6.6 vs. 3.9 on average) questions seeking information that was not available in the experiment. This difference was significant at

Table 1
Sample demographics of the two subject groups.

	Chinese subjects	American subjects
Total number	21	21
Female	3	7
Age range	25–41	27–34
Technical undergraduate degree	18	15
Ethnicity	All citizens or permanent residents of the U.S. (with 3 having Asian heritage – 2 Indians and 1 Korean)	All born and brought up in China

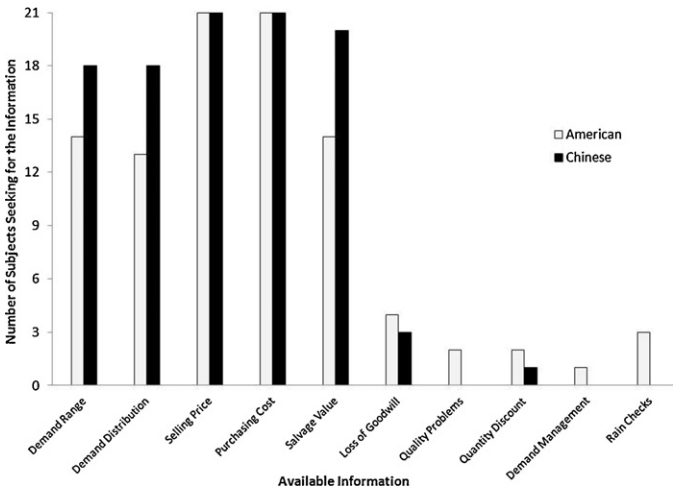

Fig. 1. The frequency with which Chinese and American subjects asked for the information available in the experiment.

[1] The small sample sizes necessitate us to use the Mann–Whitney–Wilcoxon (MWW) test, a test used to assesswhether one of two samples of independent observations tends to have larger values than the other.