Team decision-making and individual learning in the newsvendor problem

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Short abstract
Past experimental studies of decision-making in the context of the Newsvendor problem unanimously find that the decision-makers tend to make suboptimal decisions and, unless special measures are taken to induce “in-task” learning, fail to improve quality of their decisions over time. However, most of these past studies dealt with individual decision-makers. In the present study we conduct a laboratory experiment to investigate the impact of the team structure on the team performance and the potential of teams as a learning medium. Consistently with some of the earlier studies we find that simply bringing people to work in teams need to improve the quality of decisions. However, we observe significantly differences performances of flat and hierarchical teams. With regard to learning, team decision-making proves effective in helping decision-makers “unlearn” their biased decision-making patterns but only when some other team member has a superior knowledge.

Keywords: behavioural operations, group decision-making, learning

Topics: competitiveness, knowledge management, learning

Methodology: laboratory experiment

Introduction
The “newsvendor problem” was first introduced and analysed by Edgeworth (1888) as a problem of finding the optimal amount of cash that a bank should have available for cash withdrawals. The key element of the problem is uncertainty with regard to the amount of cash customers will come to withdraw. Holding money as cash is costly because the bank is not earning any interest on that money but not having cash when a customer wants to withdraw money is costly as well because the bank may simply lose future business with the customer. The model serves as a means to analyse a trade-off between having “too much” and “too little” thus capturing a variety of business problems. Typical examples include deciding on the overbooking limits for hotels and airlines, on the number of temporary workers to hire in advance of the harvest season in agriculture, as well as making strategic decisions such as choosing the capacity of a new plant.

However, despite the problem is familiar to most people from their everyday experience (by observing operations of ice-cream vendors and those selling newspapers) there is substantial evidence that most people are unable to make optimal decisions in this environment. Thus, Schweitzer and Cachon (2000) in their seminal study observed that the average earnings across all participants were only about 85% of the earnings they could make by making optimal decisions. Another key finding of the study is that the observed decision-making was significantly different from that of observed in other
problems involving uncertainty, for example, it could not be explained by such well-known biases as risk- or loss-aversion.

These results motivated further studies aiming to gain better understanding of the biases driving decisions and explore ways to improve quality of decisions. One common observation is that although performance improves over time the rate of improvement is very low. Supposedly, a large number of options and very noisy feedback inhibit learning to the extent that many participants fail to learn at all. Some order the same quantity (either below or above the optimum) in every period and some change decisions from period to period but follow the same pattern. Interventions such as in-task training and standing orders (e.g. participants were not allowed to change their decisions more often than once in every five periods) proved helpful. However, in the contemporary fast-changing business environments these interventions may be problematic as the specific task conditions may be different almost every time a decision needs to be made. In such situations a different approach would be desirable.

The focus of our study is team decision-making. First, consistently with what has been argued above about decision-making in dynamic environments, the existing trends in business suggest that team-decision-making is the solution preferred by the companies more and more often. Thus, Lawler et al. (1995) report a significant increase of team utilisation in Fortune 1000 companies from 1987 to 1993 and Gordon (1992) reports that 82% of organisations with 100+ employees use teams to manage their activities. Second, the empirical evidence suggests that decision-making in teams is not as strongly affected by different biases as that of individuals. Teams act more consistently with the reasoning underlying backwards induction (Bornstein, Kugler, and Ziegelmeyer 2004), better learn and play more strategically in signalling games (Cooper & Kagel 2005), are less prone towards myopic loss aversion (Sutter 2007) and are better in information processing (Tindale 1989). A recent review of the literature on team decision-making concludes that teams are (i) superior to individuals due to superior (ii) cognitive abilities, better self-control and productivity, and, overall, acting more rationally (Charness & Sutter 2012). At the same time, there is also evidence that the team performance can be worse than that of individuals (Janis 1972).

To the date, little is known about team performance in the Newsvendor problem. Gavirneni & Xia (2009), the only study of team decision-making in the context of Newsvendor problem that we are aware of, find that teams are subject to anchoring and insufficient adjustment similarly to individuals so that the overall performance does not improve. However, the study did not address the impact of the factors peculiar for team decision-making such as team hierarchy whereas a vast body of research of decision-making in hierarchies provides ample evidence of the team structure on the performance.

In our experiment we manipulate the team structure (flat VS hierarchical) and heterogeneity of knowledge (teams with an expert VS regular teams). With regard to the former, not only we find that the team structure affects team performance but also that it affects quality of decisions at the post-team stage, when participants make decisions individually. With regard to the heterogeneity, we find that the experience of working on a team without an expert does not significantly affect biases of the team members (despite the exposure to different biases). However, the experience of working on a team with an expert dramatically changes biases of non-experts while the transfer of knowledge from the expert may be modest.

References


