

## **The introduction of online operations to brick-and-mortar grocery stores and its impact on spoilage**

Omnichannel grocery retailers often use stores to fulfill online orders for a variety of reasons (e.g., faster deliveries, labor availability). This strategy influences inventory management, particularly the spoilage ratio (defined as the ratio of loss to sales) in two opposing ways. Fulfilling online orders has the potential to increase the sales-to-stock ratio thereby improving turnover and, consequently, the spoilage ratio. However, the last-expired-first-out picking policies used by store employees to serve online customers may generate higher levels of spoilage in the store. Using granular data from a grocery retailer, we study the impact that introducing online fulfillment to existing stores has on spoilage. Our empirical methods include a staggered difference-in-difference approach to account for the way in which online fulfillment was adopted throughout the chain. We find the spoilage ratio to increase, on average, with the introduction of online fulfillment at brick-and-mortar stores. However, substantial heterogeneity in this increase exists across product categories and stores. We exploit this heterogeneity to understand more about the dynamics of online order fulfillment and to caution retailers about several unforeseen performance impacts of online operations.

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