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# The Impact of Heterogeneity in Purchase Timing and Price Responsiveness on Estimates of Sticker Shock Effects

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## Abstract

The notion that individuals have an internal reference price against which they compare observed prices is well supported by several psychological theories. Empirically, several papers in the marketing literature, employing scanner panel data, have modeled the impact of reference prices on brand choice via the sticker shock formulation, in which consumers evaluate choice alternatives using differences between shelf prices and reference prices. Most of the studies reported thus far have not accounted for heterogeneity in price response among consumers and have typically imputed reference prices from the shelf prices of brands that a consumer is supposed to have “observed” on previous purchases in the category. Since category marketing activity can differentially affect the purchase timing of households, we argue that this measure of reference price may follow certain systematic patterns across consumers and, when combined with unaccounted for price response heterogeneity, may result in a spurious sticker shock effect. Specifically, we show that estimates of sticker shock are biased upward if households that are price-sensitive in the brand choice decision are also more responsive to category promotion activity in their purchase timing decision.

We discuss some general conditions under which the bias occurs and conduct a simulation experiment to confirm our specific hypotheses. Our simulation results show that changes in purchase timing are a critical determinant of the bias in the sticker shock effect. We also show that unaccounted for price response heterogeneity can in itself result

in a biased sticker shock parameter; however, this requires very large differences in price sensitivities across consumers, far greater than what is normally observed.

We develop a hierarchical Bayes version of the nested logit model, which models heterogeneity via individual-level parameters in a continuous random effects framework. We estimate the model on scanner panel data from the yogurt and ketchup categories. We find, in both categories, that the 95% probability interval of the posterior distribution of the mean sticker shock coefficient contains the value zero. Therefore, at least for the data used in this study, there is no evidence for the sticker shock effect at the aggregate level. In contrast, the corresponding coefficient from a standard model (which ignores this heterogeneity) is highly significant and supports the existence of a (possibly spurious) sticker shock effect. Consistent with our explanation of the underlying cause of the bias, households that are more price-sensitive in the choice decision are also found to be more responsive to category promotion activity in their decision to purchase in the category.

The results highlight the measurement problems associated with imputing reference prices from past prices. Since the frequency, duration, and price level of a retailer’s promotional program depend on its size and prevalence, accurate estimates of the sticker shock effect are essential for formulating optimal promotion strategies. An adequate accounting of consumer heterogeneity is critical to this effort. (*Hierarchical Bayes Approach; Choice Models; Buyer Behavior; Reference Price*)