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Why Analyst Overconfidence About the Functional Form of Demand Models Can Lead to Overpricing

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Abstract

Generally, profit predictions are made conditional upon a particular functional form. The typical caveat offered is that this is not the "true" demand model, but is instead some reasonable approximation. We show how the notion of an approximation can be explicitly represented using a random coefficient model. Our model nests the usual situation of complete model certainty as a special case. We go on to show how ignoring the uncertainty in functional form induced by approximation will lead to erroneous pricing decisions that may frequently lead to overpricing.

For example, an inelastic, double-log demand model implies infinite optimal prices. This is clearly a nonsensical, analyst recommendation. We propose a more general form of the double-log model that allows for high confidence in the observed price range, but incorporates increased uncertainty about the adequacy of the double-log approximation as prices move beyond the observed range. The optimal pricing solutions for this new model are lower than those for the usual case with complete certainty. In fact, we find well-defined optimal pricing solutions even for inelastic double-log demand models. This is a finding of great practical importance, given that aggregate demand models tend to be inelastic for grocery categories, and that log demand models are frequently used (Hoch et al. 1995). We argue that the lack of recognizing uncertainty in the modeling process may partially account for why there is a seeming disparity between observed retail prices and the optimal prices implied by maximizing total category profits using estimated demand models (Little and Shapiro 1980).

The problems of making optimal pricing decisions using double-log demand models calibrated with store-level scanner data have been recognized. Previous solutions are to constrain the results to achieve reasonable solutions (Reibstein and Gatignon 1984, Montgomery 1997) or to avoid these models altogether in favor of household choice models aggregated to the store-level (Vilcassim and Chintagunta 1995). Our assessment of the problem is that it is not necessarily an issue of model specification, but one of inference. In other words, double-log models fit well, but optimization leads to out-of-range predictions. Our suggestion is that inferences from an estimated demand model need to be approached with some caution. Specifically, uncertainty about predictions will always exist. If this uncertainty is incorporated into models such as the double-log form, then much better inferences can be made. It is our hope that this research will encourage others to think not only about model specification and estimation, but also inference.

(*Approximations*; *Demand Estimation*; *Pricing Research*; *Random Coefficient Models*; *Retailing*)

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