International Journal of Research in Marketing 34 (2017) 761–779

Contents lists available at ScienceDirect

IJRM
International Journal of Research in Marketing
journal homepage: www.elsevier.com/locate/ijresmar

Full Length Article

Metrics unreliability and marketing overspending☆

Shrihari Sridhar [a,*], Prasad A. Naik [b], Ajay Kelkar [c]

[a] Center for Executive Development Professor, Mays Business School, Texas A&M University, United States
[b] Graduate School of Management, University of California Davis, United States
[c] Hansa Cequity Pvt. Ltd., Mumbai 400070, India

ARTICLE INFO

Article history:
First received on September 15, 2014 and was under review for 17 months
Available online 6 September 2017

Senior Editor: Koen H. Pauwels

Keywords:
Dynamic models
Measurement noise
Optimal budget and allocations
Kalman filter estimation
Emerging markets

ABSTRACT

The adverse consequences of measurement unreliability on statistical issues (e.g., inconsistency, attenuation bias) are well known. Yet there exists sparse literature, if any, on how unreliable metrics affect strategic marketing decisions: optimal marketing budget, its optimal allocation to advertising and promotions, and overspending. Consequently, researchers and managers do not know: How to estimate dynamic demand models using unreliable data? How to optimally combine multiple noisy and biased metrics? How to optimally set the total marketing budget and optimally allocate it to advertising and promotions activities using unreliable sales metrics?

To answer these open questions, first, based on Kalman filtering theory, we show how to estimate and infer dynamic demand models using unreliable sales metrics. Then, we furnish evidence of significant measurement noise in both retail audit and company's internal data to track brand sales. We replicate these results across six largest political regions in the emerging Indian markets for a major hair care brand. Next, we analytically derive the optimal weights to combine noisy and biased metrics to infer the latent demand. This result uncovers a counter-intuitive insight that two independent noisy metrics are better than one even when the second metric is noisier. In other words, a composite metric serves as noise reduction device as it is more reliable than individual noisy metrics. Subsequently, we derive closed-form expressions for the optimal budget and its optimal allocation to advertising and promotions activities in the presence of unreliable sales metrics. Based on these results, we discover that marketing overspending increase as metrics unreliability increases. Furthermore, overconfidence —the presumption that the metrics are reliable— leads to overspending on advertising and promotions. Managers should reduce advertising and promotional spending when sales metrics are noisy. Finally, we provide a simple correction factor that managers can use to eliminate overspending.

☆ We appreciate the comments and encouragement from Bill Bean, Worldwide Director, Colgate-Palmolive Company; David Ciancio, Managing Director, Customer Strategy and Engagement at Dunnhumby Inc.; Kevin Richardson, Senior Vice President Consulting Services at Nielsen; Harpreet Singh, CEO, Kvantum Inc.; M. G. Parameswaran, CEO, Draft FCB Ulka, India.We also thank the seminar participants at the Darden Business School, Goethe-Universitaet Frankfurt, Hass Business School, HEC Paris, Kellogg Business School, University of Mannheim, and the Wharton Business School for their helpful suggestions. We gratefully acknowledge the support of the participating company and Hansa Cequity for insights into managerial issues.

* Corresponding author.
E-mail addresses: ssridhar@mays.tamu.edu (S. Sridhar), panaik@ucdavis.edu (P.A. Naik), ajay.kelkar@cequitysolutions.com (A. Kelkar).

http://dx.doi.org/10.1016/j.ijresmar.2017.09.001
0167-8116/

1. Introduction

Virtually all metrics unreliably reflect their unobservable constructs, perhaps with the exception of time measured by atomic clocks or calendar weeks. In sciences, for example, metrics such as moisture, texture and pH measure the underlying "soil conditions" (Grace & Bollen, 2008). In economics, metrics like consumer confidence or gross domestic product reflect the state of an economy; or consumption and expenditure surveys help gauge poverty (e.g., Beegle, Weerdt, Friedman, & Gibson, 2010). In marketing, metrics such as sales, market share, cash flow, operating earnings, stock returns indicate a firm's value (e.g., Srinivasan & Hanssens, 2009). In branding, companies strive to win customers' hearts and minds and so they monitor mind-set metrics (e.g., awareness, liking, consideration, intention) to infer how customers think, feel and act (Bruce, Peters, & Naik, 2012; Pauwels, Erguncu, & Yildirim, 2013; Srinivasan, Vanhuele, & Pauwels, 2010). In advertising, eye-tracking data permits inference on viewers' angle of gaze, attention, information acquisition, and memory for brands (e.g., Wedel & Pieters, 2008). In sales, surveys of physicians indicate the information content used during sales call for detailing prescription drugs (Kappe & Stremerch, 2016). In retailing, consumer offtakes and competitors' brand sales are measured by using diary panels, scanner panels, or store audits to estimate marketing effectiveness (e.g., Nielsen, IRI, GfK).

Such metrics of awareness (Millward Brown), consumer confidence (Conference Board), customer satisfaction (ACSI), sales calls on physicians (IMS Health, Cegedim), consumption and expenditures (Bureau of Labor Statistics) are based on surveys, which are likely to be error-prone. Consumer offtakes measured by auditing stores are also contaminated by measurement errors, which we describe in detail in Section 4.1. Even bar code scanning for accurately tracking items sold at the stock-keeping unit (SKU) level when aggregated over dozens of SKU items in each store and hundreds of such stores dispersed geographically to obtain national brand sales yields various "estimates," depending on how SKUs are combined (e.g., weighted by volume, prices, or market shares).

Measurement errors manifest themselves in business-to-business (B2B) contexts as well. Companies report that 25% of B2B databases are inaccurate and 60% of them judged overall data quality as unreliable.[1] Hanssens (1998) states that accurate demand data are typically hard to come by, as most industries lack consolidated scanning services and instant demand feedback that are typical of the packaged goods sectors in advanced economies.

It is well known that the presence of measurement errors leads to adverse *statistical* consequences. For example, measurement errors render parameter estimates inconsistent and introduce attenuation bias (e.g., see Naik & Tsai, 2000). However, *marketing* consequences due to the presence of measurement errors are not known. Specifically, how does measurement noise impact optimal marketing budgeting, its optimal allocation to advertising and promotions, and marketing overspending? To this end, this paper develops a method to reduce measurement noise and discovers how metrics unreliability drives marketing overspending.

We begin by formulating a measurement model that incorporates bias and noise in each of the multiple metrics. Then, we derive the optimal weights to combine multiple metrics to infer the latent demand consistently. Next, we design a Kalman filter that controls for measurement errors, estimates the time-varying effectiveness of advertising and promotions, and quantifies the synergies between advertising and distribution as well as between promotions and distribution. We illustrate the application of the proposed method to a major hair care brand in India. Empirical results furnish evidence that measurement noise and bias in both the metrics and in each of the six regions are statistically significant at the 95% confidence level. Subsequently, we derive closed-form expressions for optimal advertising spending and optimal timing of promotions. We deduce new propositions that elucidate how metrics unreliability impacts the optimal budget and allocation as well as marketing overspending. Specifically, marketing overspending increases as metrics unreliability increases. This finding not only underscores the importance of metrics unreliability, but also incentivizes managers to reduce measurement noise. We also learn that overconfidence —the presumption that the metrics are reliable when they are not— drives overspending on advertising and promotions. This impact is asymmetric, with more overspending on advertising than on promotions. Finally, we derive a "correction factor" which offers a constructive approach for managers to eliminate overspending.

In sum, this paper is the first one to make the following original contributions. First, methodologically, we derive the optimal combination of unreliable metrics and incorporate it in the proposed estimation method. Second, empirically, we establish that metrics are indeed noisy and quantify the magnitude and heterogeneity across six markets in India. Third, theoretically, we discover how low versus high noise levels affect marketing overspending and its asymmetric effect on advertising and promotional overspending.

The rest of the paper is organized as follows. We first review the extant literature to establish gaps. We then formulate the measurement model to derive the optimal metrics combination to reduce noise. We then describe the data, estimation, and results. Subsequently, we derive new propositions on the effects of measurement noise on the optimal marketing budget, optimal allocation, and marketing overspending. We close by discussing the implications for managers and researchers.

[1] http://www.funnelholic.com/2013/09/16/the-problem-of-dirty-data-and-why-every-sales-and-marketing-leader-should-care/.