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The Effect of Probabilistic Selling on the Optimal Product Mix[☆]

Scott Fay[a,*], Jinhong Xie[b,1], Cong Feng[a,2]

[a] Department of Marketing, Martin J. Whitman School of Management, Syracuse University, 721 University Avenue, Syracuse, NY 13244, United States
[b] Department of Marketing, University of Florida, P.O. Box 117155, Gainesville, FL 32611-7155, United States

Abstract

Determination of the merchandize assortment is an important decision for retailers since the composition and depth of the product mix greatly impact both unit sales and costs. This paper considers how *Probabilistic Selling* (PS), an emerging marketing strategy, impacts the type and number of products a retailer should carry. We find that adopting PS can alter the optimal number of products (i.e., encourage the retailer to offer more or fewer products), depending on demand- and supply-side factors. Furthermore, introducing probabilistic goods sometimes increases the optimal degree of product differentiation and sometimes reduces it. Specifically, less differentiated products are warranted if there are either few or many consumers with extreme tastes, but more differentiation is needed otherwise. Our analysis reveals that PS can serve either as a substitute to new product introduction (because it enables a retailer to serve a diverse market at a lower cost) or as a complement to new product introduction (since, under PS, a new product enables a retailer to offer additional probabilistic goods that utilize this new product as one of its components). In sum, our results indicate that a retailer must adjust its merchandize assortment appropriately in order to fully benefit from probabilistic selling.
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Keywords: Probabilistic selling; Opaque goods; Product differentiation; Product line; Price discrimination; New product development

Introduction

Product is a critical component of the marketing mix of all firms. Manufacturers must decide which products to produce, service providers must choose which services to offer, and retailers must select their merchandize assortments. Significant fixed costs are usually associated with each product offering. For example, manufacturers exert much time and effort on new product development. Service providers must develop the expertise and staffing to enable them to supply the services they offer. Retailers must carry backup stock and devote ordering, managerial, and shelving resources to each component of their merchandize assortment. Customer preferences are a key factor in determining the right product mix and firms must find the right balance in terms of the number of products to offer in order to satisfy customer demand at an acceptable cost. In this paper, we explore how the optimal product mix varies when a seller introduces "probabilistic goods." As defined by Fay and Xie (2008), a probabilistic good is an offer involving the probability of obtaining any one of a set of multiple distinct items. *Probabilistic Selling* (PS) is a selling strategy under which the seller creates probabilistic goods using the seller's distinct products or services (referred to as *component goods*) and offers such probabilistic goods to potential buyers as additional purchase choices. Fig. 1 is an example from ToyWiz.com showing that the retailer is offering one probabilistic good (left) and two component goods.

PS is becoming a widespread selling strategy. Probabilistic goods first appeared in the travel industry (e.g., through *Hotwire* and *Priceline*), but they are now also being offered by a number of online retailers, such as lane4swim.com, 1worldsarongs.com, swimoutlet.com, kidsurplus.com, noisebot.com, buloso.com, bustedtees.com, agonswim.com, and store.americanapparel.net, who offer "grab bag" (or "mystery bag," "random color," "surprise print," or "let us choose the style") apparel and shoes, where patterns, colors and styles are not known to the consumer

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[*] Corresponding author. Tel.: +1 315 443 3456.
E-mail addresses: scfay@syr.edu (S. Fay), jinhong.xie@warrington.ufl.edu (J. Xie), feng@congfeng.net (C. Feng).
[1] Tel.: +1 352 392 0161x1233; fax: +1 352 846 0457.
[2] Tel.: +1 315 385 9902.

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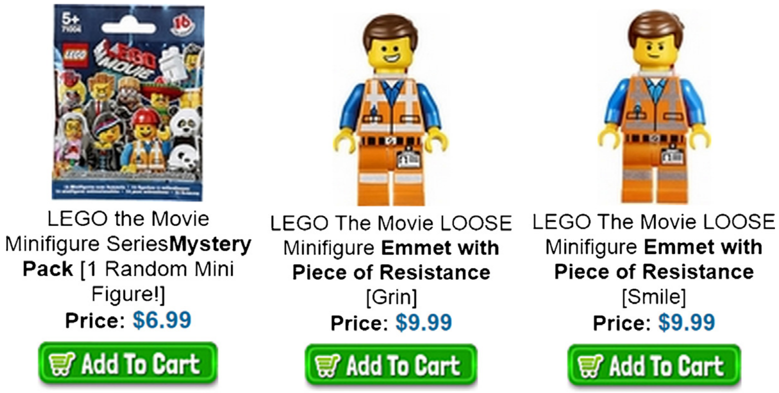

LEGO the Movie Minifigure Series**Mystery Pack** [1 Random Mini Figure!]
Price: $6.99

LEGO The Movie LOOSE Minifigure **Emmet with Piece of Resistance** [Grin]
Price: $9.99

LEGO The Movie LOOSE Minifigure **Emmet with Piece of Resistance** [Smile]
Price: $9.99

Fig. 1. Real-world example of Probabilistic Selling. Screenshots from ToyWiz.com showing Probabilistic Selling. The probabilistic good is the one on the left and the specific, component goods are on the middle and right.

prior to purchase.[3] Many major online retailers, such as Amazon, Nextag, Bizrate, and Toys "R" Us, have also started to offer various probabilistic goods. For example, Toys "R" Us is carrying multiple "mystery bags" manufactured by LEGO on its product line. On China's largest e-commerce platform Taobao.com, there are around 10,000 ongoing listings of probabilistic goods (under the name of "lucky bag") from at least nine hundred different sellers. In Japan, fukubukuro[4] (i.e., mystery bags) sales have become a New Year's Day tradition in which brick-and-mortar retailers (such as Apple Japan and Starbucks Coffee Japan) offer sealed bags filled with randomly selected items.

The examples above appear to be primarily motivated by retailers' desire to generate revenue from distressed inventory (without significantly cannibalizing full-priced sales). Indeed, Rice, Fay, and Xie (2014) identify situations in which PS can be more profitable than temporal-based markdowns. However, recent research (Fay 2008; Fay and Xie 2008, 2010; Jiang 2007) suggests that PS does not require demand uncertainty or limited capacity to be profitable. Instead, the literature shows that the fundamental benefit of PS is that it enables a firm to price discriminate on the basis of the differing strengths of consumers' preferences. Thus, PS need not be restricted to markets characterized by limited capacity and extensive demand uncertainty (such as fashion goods and travel services). Indeed, we now observe probabilistic goods in markets for durable goods (e.g., Apple Japan just hosted an event early this year to sell "lucky bags" that were filled with randomly selected electronic products[5]), staple goods (e.g., local farms regularly promote their "We'll choose for you" baskets[6]), and nontravel services (e.g., chefs decide what customers get for "Chef's Selections"[7]).

The current paper seeks to provide further insight into the PS strategy in order to help retailers, service providers, and manufacturers better understand how to capitalize on their opportunities to introduce probabilistic goods. Specifically, we extend the research on PS by incorporating product mix into probabilistic selling decisions (i.e., allowing the firm to endogenously choose the location and number of products to offer when adopting the PS strategy). We explain *why* implementing PS without altering the underlying product mix (which is likely the easiest approach for sellers) will not achieve full benefit from the PS strategy for current PS adopters. We also provide insights as to *how* a retailer should adjust its product mix when introducing probabilistic goods.

For comparison purposes, the term *Traditional Selling* (TS) refers to the conventional selling strategy whereby the seller's product mix includes only component goods. Presumably, most firms optimize their product mix for TS. Thus, if a firm were to consider switching to PS, the natural inclination would be to simply introduce probabilistic goods using the originally planned mix of component products. Indeed, the extant research on PS assumes that firms who adopt PS will make the same product mix decisions as those under TS. In this paper, we show that such an approach fails to capitalize on the full potential of PS. In particular, we find that PS alters the optimal number and types of products that a seller should offer. Thus, for a firm seeking to introduce probabilistic goods, that is, move from TS to PS, the firm should also change its product mix in light of this shift in selling strategies.

Under TS, revenue for a component product comes from direct sales of that product alone. However, offering probabilistic goods alters the optimal product mix because, under PS, the revenue for a component product comes *both* from direct sales of the component product *and* from sales of probabilistic goods, which the component good is used to create. We find that, when facing several consumer segments of similar size with diverse preferences, a seller should produce more differentiated products when it moves to PS from TS. Such a shift allows the seller to better match the preferences of customers with "extreme" tastes (and thus charge higher prices), while still reaching the consumers with moderate tastes (by selling them a discounted probabilistic good). If there are few consumers with moderate tastes, however, a seller should produce less differentiated products when

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[3] For example, swimoutlet.com offers 63% savings for a Nike women's swimsuit if consumers are willing to give up their demand for a specific print. As stated on the website (http://www.swimoutlet.com/product_p/33164.htm), "The Nike® Swim Cut Out Tank Grab Bag is an affordable and fun way to get a high-quality suit at a very affordable price. You pick the suit, and we pick the print." Note that buyers can choose size but not color, style, or fabric.

[4] http://en.wikipedia.org/wiki/Fukubukuro, retrieved on October 30, 2014.

[5] http://www.engadget.com/2015/01/02/apple-japan-lucky-bag-2015-fukubukuro, retrieved on March 2, 2015.

[6] For example, http://goorganicnyc.com/box/, retrieved on October 30, 2014.

[7] For example, http://shiros.com/sushi-sashimi-menu/, retrieved on October 30, 2014.

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