Valuation and management of money-back guarantee options

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Received 30 March 2001; received in revised form 22 November 2001; accepted 24 December 2001

Abstract

In this article, we model money-back guarantees (MBGs) as put options. This use of option theory provides retailers with a framework to optimize the price and the return option independently and under various market conditions. This separation of product price and option value enables retailers to offer an unbundled MBG policy, that is, to allow the customer to choose whether to purchase an MBG option with the product or to buy the product without the MBG but at a lower price. The option value of having an MBG is negatively correlated with the likelihood of product fit and with the opportunity to test the product before purchase, and positively correlated with price and contract duration. Simulation of our model reveals that when customers are highly heterogeneous in their product valuation and probability of need-fit, and if return costs are low, an unbundled MBG policy is optimal. When customers have high likelihood of fit or return costs are excessive, no MBG is the best policy. When customers have small variance in product valuation, but vary greatly in likelihood of product fit, the retailer may prefer to offer a bundled MBG contract, extracting consumer surplus by charging a price close to the valuation level.

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Keywords: Money-back guarantee; Return policy; Consumer uncertainty; Option value; Product fit

1. Introduction

Money-back guarantees (MBGs) are a return option that protects consumers against the risk of purchasing products with unsatisfactory performance, personal misfit, or negative social feedback. Early work modeled MBGs as a bundled, homogenous risk-reducing mechanism that increased demand (Mann & Wissinik, 1988, 1990; Welling, 1991; Geistfeld & Key, 1991; Phillips, 1993; Davis, Gerstner & Hagerty, 1995) or as a signal for quality of either the product (Heal, 1977) or the retailer (Moorthy & Srinivasan, 1995). These studies treated MBGs as a single, well-defined product, ignoring variations in consumer product evaluation and uncertainty and market evidence showing that companies offer differentiated MBGs.

MBG contracts differ between stores, for example, small shops and boutiques often offer short MBGs or only store credit, while large retail chains usually offer 30 to 90-day MBGs that differ by product category in the same establishment. For example, Office Depot offers a 30-day full refund for all products except computers, monitors, printers, scanners, fax, and multifunction machines. The latter come with only a 14-day full refund. For notebook computers, open software, cellular phones, TV’s VCRs, DVD and digital cameras, the only offer is a 14-day exchange. The Good Guys charges customers a 15% “restocking fee” for all returns of 13 inches and larger TVs, while smaller screen TVs are exempt from return penalties.

Target offers 60-day MBGs on almost all of its products, but does not offer MBGs for opened packages of software, medicines, and cosmetics, and offers shorter-period MBGs on some electrical appliances. Some stores may even offer a variety of return policies for the same product. For example, Umiracle Microsystems offers a full refund if the PC is returned within 7 days, but for returns between 7 and 30 days, customers are charged a 15% restocking fee. Datacom notebooks come with a seven-day full refund. Customers that choose to return the product after 7 to 30 days must pay a 20% restocking fee.

In designing a particular MBG policy that differenti-
ates between and within product categories and customers, retailers can choose between three distinct approaches: a) selling their products without an MBG; b) selling with a bundled MBG, that is, the MBG is integrated with the product and its price and the product’s price are inseparable; and c) selling them with an unbundled MBG, that is, the product and the MBG option are sold separately. In order to choose between these three policies, retailers need to optimize prices for both the product and the return option under each policy. Modeling an MBG as an option provides retailers with the optimization tool needed to design a nonhomogeneous, unbundled policy that permits market segmentation and improves profits.

In this research we model MBGs as a put option similar to the methodology of real option theory (Dixit & Pindyck, 1994). Using the option framework, we derive the demand for the product (and the MBG if relevant) under the three MBG policies. Simulations are run to identify optimize prices under each policy, and to show how changes in parameters affect the retailer’s choice of policy. Finally, we present examples from the U.S. market that reveal where and how these alternative policies are used.

2. Prepurchasing risks and their marketing remedies

The literature distinguishes between a product’s extrinsic and intrinsic characteristics and uncertainties (Olson, 1977). Attributes that represent an associated part of the product, such as price, brand, and sometimes packaging, are defined as extrinsic attributes or quality cues. Those attributes inherently part of the product and thus determine its quality are regarded as intrinsic or quality attributes (Zeithaml, 1988).

Before purchasing a product a consumer may be uncertain about its extrinsic qualities, intrinsic qualities, or both. Extrinsically, the consumer may be uncertain about the price of the product and its availability in different stores. This type of uncertainty is reduced by the advertisement of price and availability guarantees. Price guarantees, which offer a refund to a customer who finds a lower priced product elsewhere, reduce price uncertainty as well as the potential regret from choosing the wrong store (Inman, Dyer & Jia, 1997). These serve as a mechanism to enable price discrimination among customers and may serve as a signal for low price (Jain & Srivastava, 2000). Price guarantees (against subsequent markdowns in the same store or elsewhere) are a limited type of MBGs as they assure only the lowest price while MBG allow consumers to return the product for any reason. This includes, of course, the event that the buyer finds the same product for a lower price at an alternative location.

Uncertainty about a product’s intrinsic quality attributes comes from three sources: 1) uncertainty about product performance; 2) uncertainty about the durability of the performance and of the product itself; and 3) fit uncertainty (Roselius, 1971; Heiman, McWilliams & Zilberman, 2001). Fit uncertainty is the risk that a product will not fit the needs, lifestyle, social feedback or capabilities of the buyer. The intensity of these three uncertainties varies between different consumers, products and selling vehicles.

Uncertainty about the durability and manufacturing quality can be reduced by warranties that provide an insurance that is bundled with the product. With warranties, the manufacturer is obliged to replace, or repair, products that break down during the warranty period, which is generally much longer than the MBG period. Warranties therefore reduce consumer uncertainty about the long-term performance of the product, while MBGs protect the consumer when the product does not fit her personal needs.

Warranties, brand strength, price, advertisement intensity and seller reputation have the potential to serve as signals for product quality. (See Aaker, 1994 for discussion on brands; Olson, 1977 for price; Schmalensee, 1983 for advertisement; Chu and Chu, 1994 for retailers’ reputation; and Tirole, 1989 for warranties; Boulding and Kirmani; 1993 for credibility of warranty signals.) Since the retailer generally sets MBG terms and duration for broad product categories, MBGs may serve more as a positive signal for the retailer’s service than information on product quality.

The important omission in this picture is that this mixture of service and product quality indicates nothing about personal fit. The personal fit of a product varies among individuals and provides an important role for MBGs; that of reducing prepurchase fit uncertainty.

Demonstrations in durables, such as test drives and free samples for consumables, are prepurchase instruments that allow consumers to obtain direct experience with the product without purchasing (see Heiman & Muller, 1996). By contrast, an MBG is a postsale learning tool that enables the consumer to learn about the product after buying it, but with the option to return the product if the customer is not satisfied. MBGs are extremely important for those goods and services where on-site trials and feedback from others are needed to resolve uncertainties, or for products with short or disputed track records, such as weight loss programs.

The literature suggests that an MBG has a greater impact on reducing risk than either brand name or price reduction (Hawes & Lumpkin, 1986; Roselius, 1971; Akaah & Kongonkar, 1988). The importance of an MBG increases in nonpersonalized selling channels such as the Internet and catalog sales since these products cannot be experienced prior to purchase (Van den Poel & Leunis, 1999).

There has been scant research in the modeling of marketing tools as financial options designed to reduce uncertainties. Yet, MBGs, leasing, and some extended warranties programs have the characteristics of financial
options. Leasing can be considered a call option since the buyer gets the option to buy an asset at a predetermined price (see Grenadier, 1995; Miller, 1995), while extended warranties and MBGs are put options that allow the buyer to sell back (return) the asset at a predetermined price.

We model the value of the product to the buyer as a random variable that is discovered during the experiment (guarantee) period. If the product does not fit the buyer’s needs or expectations, it is returned. The net value of return is the returned price minus return penalties and the customer’s cost of returning. Similar to the put option, time has value, and a longer duration MBG increases the likelihood of discovery of the true value or fit and reduces the cost of return by increasing return convenience.

3. The option value of an MBG

Suppose a customer is uncertain whether a product will fit her personal needs on not. She knows initially that if the product turns out to fit her needs, she will realize a value of $X$, which is greater than the price, from its use. However, if the product does not fit her needs, its value to the consumer is assumed to be zero. If the product includes an MBG, the customer can purchase the product and take it home for evaluation during the duration ($T$ days) of the MBG contract. For the purpose of this article, we consider the duration of the MBG contract to be the learning period, although the consumer may have had an opportunity to learn about the product previously to purchase, and, in the case that she does not return the product before the end of the MBG contract, may continue to learn beyond the contract period $T$.

The customer goes through a learning process in which she begins by determining that the product will fit her needs with a probability $q$. She sequentially tests various characteristics of the product and either identifies that the product does not fit her needs or becomes more confident that the product is a fit. We define a discovery function $G(\cdot)$ such that if, after $T$ days of testing, a product does not fit the customer’s needs, she will discover this reality with likelihood $G(T)$. We can also define $g(t)$ as the rate of discovery, such that the total likelihood of discovery within the duration $T$ of an MBG contract is $G(T) = \int_0^T g(t) dt$.

Suppose there is a duration period $T$ such that the customer is certain of identifying product fit/nonfit within the duration of the MBG contract, that is, $G(T) = 1$. The time required for full discovery ($T$) may be relatively short for products such as clothing items where most individuals may be able to make up their minds about fit within a few days, and relatively long for other products such as a musical instrument for a child, where it may take months for the parent to realize whether the child will take to playing the instrument.

Since the likelihood of a nonfit is $(1 - q)$, a customer testing the product for $T$ days will discover a nonfit with probability $[(1 - q) \cdot G(T)]$. The initial expected net benefits $(L)$ of buying a product with an MBG when only the base price of the product is charged can be expressed as:

$$L = qX + (1 - q) \cdot G(T) \cdot RB(T) - P_0 \quad (1)$$

where $RB(T)$ is the expected return benefits and $P_0$ is the base price of the product. The customer’s value of purchasing a product with an MBG is thereby composed of three parts: i) the expected value of a fit, ii) the expected returns from discovering a nonfit, and iii) the payment for the product. By contrast, the expected net benefits of buying without an MBG are only:

$$qX - P_0 \quad (2)$$

The option value of buying with an MBG can be found by subtracting Eq. (2) from Eq. (1), yielding:

$$OV(T) = (1 - q) \cdot G(T) \cdot RB(T) \quad (3)$$

This option value tells us the nonrefundable price premium $M$ the customer is willing to pay to receive an MBG of duration $T$.

3.1. Return benefits

Return benefits are composed of the refund the customer receives from the store for the product minus the customer’s expected costs of returning the product. A customer that returns a product receives a refund for the product, but may have to pay a penalty for this refund. The penalty may be that the seller only refunds part of the price or that the consumer receives only in-store credit. We express this penalty as a linear function of the price:

$$(1 - \eta)P_0 \quad (4)$$

where $\eta = 0$ if there is no penalty and the store offers a full cash refund.

The personal return costs faced by the customer depend on factors such as the travel distance for returning the product, any time spent waiting in line, the value she places on her time, and whether she can find a convenient time to return the product if she discovers it does not fit her needs. The longer the customer has to return the product, the more likely she is to find a convenient time to do so.

If the customer returns a product within the allotted duration of the MBG contract, the time until discovery and the post-discovery return time must sum to less than the contract duration. The consumer knows the distribution of the rate of discovering the nonfit of the product ($g(t)$), but does not know when this discovery will occur. We assume a concave learning function, with $g(t) > 0$, $g'(t) < 0$, $g''(t) > 0$, implying that consumers learn the most about the product early in the MBG duration and marginally less over time.

If discovery of a nonfit occurs late, the consumer may incur inconvenience costs from returning the product be-
cause of the short time remaining before the MBG contract expires. Since the future discovery time of $t$ is initially unknown, the customer calculates an expected return cost that depends on the weighted likelihood of the possible time of discovery. Specifying the unknown time to discovery as $t$ and the contract duration as $T$, the expected return costs can be written as a function of the time remaining $(T - t)$ to return the product before the MBG expires:

$$
\int_{0}^{T} \frac{RC(T - t)g(t)dt}{G(T)}.
$$

The expected return costs are composed of the costs of return $RC(T - t)$ for every possible discovery time multiplied by the probability of discovery in each period, divided by the total likelihood of discovering a nonfit $(G(T))$ within the duration of the MBG contract. We assume $\frac{\partial RC(T - t)}{\partial (T - t)} < 0$, implying that the more time the customer has to return the product, the lower the inconvenience costs of doing so. Summing Eqs. (5) and (4) yields the expected return benefits:

$$
\tilde{RB}(T) = (1 - \eta)P_0 - \int_{0}^{T} \frac{RC(T - t)g(t)dt}{G(T)}.
$$

Introducing Eq. (6) into the option value formula (Eq. (3)) yields:

$$
OV(T) = (1 - q) \cdot G(T) \cdot \tilde{RB}(T)
$$

$$
= (1 - q) \cdot G(T) \cdot \left[ (1 - \eta)P_0 - \int_{0}^{T} \frac{RC(T - t)g(t)dt}{G(T)} \right].
$$

which becomes our formula for the MBG option value. We assume that $RC(0) < (1 - \eta)P_0$, that is, even if the consumer discovers a nonfit at the last moment, she still finds it worthwhile to return the product.

The option value of the MBG in Eq. (7) is similar to the value of a financial put option with zero discount rate (Cox & Rubinstein, 1985). In this case, the strike price is the expected return benefits (6), and the underlying uncertainty is described by the probability of return $(1 - q)$ $G(T)$ and the expected return costs. Because of the zero discount rate, the customer has total freedom of choosing the most convenient time to return the product between the time of discovery $t$ and the expiration date $T$ without loss of refund value.

It is obvious from (7) that the option value of the MBG increases with the price $(P_0)$ and decreases with the likelihood of fit $(q)$. Therefore, customers will value MBGs most in products that are high cost and in which they have great uncertainty about whether it will fit their needs.

Differentiating (7) with respect to $T$ yields the marginal value of extending the duration of the contract:

$$
\frac{\partial OV(T)}{\partial T} = (1 - q) \cdot \left[ (1 - \eta)P_0 - RC(0) \right] \cdot g(T) - \int_{0}^{T} \frac{RC(T - t)g(t)dt}{G(T)} > 0.
$$

The impact of increasing the duration of an MBG can be broken into two effects. The first is the marginal discovery value which is the expected benefit of returning a product that has been found not to fit as the duration of the MBG is extended. If the duration of the MBG is longer than that necessary for gaining full information, that is, $T > \hat{T}$, then $G(T) = 1$ and $(g(T) = 0)$, there is no value from increasing the duration and the first effect is zero. The second effect is the return costs effect in which extending the MBG duration allows the customer more time to return a product that has been discovered to not fit her needs. Since $\frac{\partial RC(T - t)}{\partial T} < 0$ by assumption, this effect is positive, and longer contracts increase the value of the MBG return option.

We find that prepurchase testing of the product has a negative effect on the option value of MBGs. This occurs for two reasons: first because customers that test the product and do not reject it will have a higher initial likelihood of fit (thereby reducing the value of an MBG). Second, through the prepurchase test the customer gains much of the benefits from learning—particularly that which occurs at the early stages when benefits are the greatest (recall that $g'(t) < 0$). For example, if a customer shops for clothing at a store, she can test the item to see how it fits and looks on her before she purchases the product. By contrast, if the customer purchases the item through a non-personal distribution channel such as by catalog, mail order or internet, she does not get to test the product before purchase and, therefore, is likely to place a higher value on post-purchase learning and on the MBG return option.

### 4. Demand, sales, profits, and unbundling MBG contracts

In this section, we look at the demand and net sales of products when MBGs are bundled, that is, integrated in the product and its price is inseparable from products price, and unbundled, that is, when the product is sold without MBG and the option is sold separately. We will consider the basic features of demand and sales with and without MBGs, and then discuss the implications of bundling and unbundling MBGs with the product.

#### 4.1. Demand without an MBG

Suppose there are $H$ customers that are heterogeneous in their initial likelihood of product fit $(q)$ and valuation of the

Assume a constant $T$ that is sufficiently long to enable consumers to know with certainty whether the product fits or not and thus, $G(T) = 1$. Additional assumptions are that return costs are constant and represented by $RC$ and customers receive a full refund if the product is returned. In this case, the expected net benefits of purchasing the product with an MBG can be expressed as:

$$qX + (1 - q) \cdot (P_1 - RC) - P_1$$  \hspace{1cm} (11)

If $X < P_1$, even with $q = 1$ the product will not be purchased. For every $X \geq P_1$ the critical likelihood of fit above which customers will purchase the product with an MBG ($q_1$) can be found by setting Eq. 13 to zero. This critical value is:

$$q_1 = \frac{RC}{X - P_1 + RC}$$  \hspace{1cm} (12)

The segment of buyers of the product with bundled MBG is

$I_1 = \{ P_0 < X < \bar{X}, \; q_0 < q < 1 \}$

The segment $I_1$ is presented by the $q, X$ values that are in the area above the curve labeled $D_M$. The properties of $I_1$ depend on $P_1$, and in drawing Fig. 1 we assume that $P_1 > P_0$ since the customer receives a better product when the MBG is included and the retailer incurs extra return cost. This issue will be elaborated upon later. Return costs, RC, are assumed to be significantly smaller than the base price $P_0$, more specifically, $RC < P_0 (\bar{X} - P_1)(X - P_0)$, so that the bundled MBG is not dominated everywhere in $q, X$ space by purchasing without an MBG. This assumption assures also that $q_1 < q_0$. Under this assumption, the two boundary lines $D_N$ and $D_M$ in Fig. 1 intersect at the point $V$ where

$$q(V) = \frac{P_0 - RC}{P_1 - RC} \hspace{1cm} X(V) = \frac{P_0(P_1 - RC)}{P_0 - RC}$$  \hspace{1cm} (13)

At point $V$, individuals are indifferent between buying with an MBG, buying without MBG, and not buying at all. The two boundary curves generate three segments in the $q, X$ space. Segment $A$ corresponds to consumers with low valuation of the product and high fit that would buy without an MBG but not with a bundled MBG. Segment $B$ represents individuals with sufficient high valuation and probability of fit that they will buy with or without a bundled MBG. Segment $C$ consists of individuals who have a high valuation of the product but low probability of fit who would buy with a bundled MBG but would not buy without the MBG. These segments are defined by:

A: \{ $P_0 \leq X \leq X(V)$, \ $q_0 \leq q \leq MIN[1, q_1]$ \}

B: \{ $P_1 \leq X \leq X(V)$, \ $q_1 \leq q \leq 1$ \}

\cup \{ $X(V) \leq X \leq \bar{X}$, \ $q_0 \leq q \leq q_1$ \}, and

C: \{ $X(V) \leq X \leq \bar{X}$, \ $q_1 \leq q \leq MIN[q_0, 1]$ \}.

These segments are functions of the price and return costs. The demand of consumers in a particular segment $J$, where

$$D_0(P_0) = H \int_{I_0} f(q, x) dq dx$$  \hspace{1cm} (10)

4.2. Demand with a bundled MBG

Now suppose the seller offers a bundled MBG contract of and charges $P_1$ from all customers. For simplicity, we

...
J may assume values A, B, or C, is: $D_J = \int J \int f(q, X)dq dX$. With this notation $D_0 = D_A + D_B$ and $D_1 = D_B + D_C$. If an MBG is introduced with price $P_1$ instead of selling without an MBG at $P_0$, the change in sales is: $\Delta D = D_B - D_0 = D_C - D_A$. The introduction of an MBG replaced consumers with low valuation and high probability of fit with consumers with high valuation but low probability of fit.

With an MBG, because of returns, there is a distinction between demand and expected net demand that represent final sales. The expected probability of fit for the consumers of segment $I_1$ is denoted by $\bar{q}_1$ defined as:

$$\bar{q}_1 = \frac{\int \int qf(q, X)dq dX}{\int \int f(q, X)dq dX}$$

The expected probabilities of fit for the other segments are defined similarly. For example, $\bar{q}_2$ is the average probability of fit of consumers in region B of Fig. 1. Let $D_1^N$ denote the expected net demand (sales minus expected returns) with a bundled MBG. We will use the term net demand for this function, which is the gross sales minus expected returns, and thus is equal to $D_1^N(P_1, RC) = D_1(P_1, RC)\bar{q}_1(P_1, RC)$. Without an MBG, there are no returns and thus $D_0^N(P_0) = D(P_0)$. The introduction of bundled MBGs results in a loss of sales to group A, reduction of sales to group B because of returns, and increase of sales because of purchases by group C. MBGs increase total sales but reduce net sales if $D_C > D_A$ and if there are sufficient returns so that

$$(1 - \bar{q}_0)D_B + (1 - \bar{q}_C)D_C > D_C - D_A.$$  

In the case where $P_1 = P_0 = P$, segment A does not exist and thus, $D_1 - D_0 = D_C > 0$, and demand with unbundled MBG is greater than without it. In this case the condition for net demand without MBG to be greater than the demand without MBG is:

$$D_1^N(P) - D_0(P) > 0 \ \text{if} \ \frac{D_C}{D_B} > \frac{1 - \bar{q}_B}{\bar{q}_C}$$  

Condition (15) is likely to hold in reality since both $\bar{q}_C$ and $\bar{q}_B$ are likely to be closer to 1 than to 0.5 in most cases. For example, suppose $\bar{q}_C = 0.8$ and $\bar{q}_B = 0.9$. In this case the expected net demand with MBG is greater than without MBG if introduction of MBG increases the number of buyers by more than 12.5%. Thus throughout the text it will be assumed that $D_1^N > D_0$.

4.3. Unbundled MBGs

Unlike the bundled MBG, when the product and MBG are unbundled, customers have two alternatives: buying the product as is at some given price $P_2$, without an MBG, or buying the product for $P_2$ and purchasing an MBG option for price $M$. We model the unbundling similarly to insurance, that is, in the case of a return, only the price of the product ($P_2$) is returned. The expected net benefits to the consumer who purchases the product without an MBG are:

$$qX - P_2$$

The expected net benefits to a consumer who buys the MBG option when she purchases the product are:

$$qX + (1 - q)(P_2 - RC) - P_2 - M$$

Consumers with high probability of fit ($q$) will buy the product without an MBG option while consumers with lower $q$ will purchase the option. The critical $q$ that separates between buyers and non buyers of the option, given by equating (16) and (17), is:

$$q_2^* = \frac{P_2 - (M + RC)}{P_2 - RC}$$

The lowest $q$ that will result in a purchase with MBG is:

$$q_2 = \frac{M + RC}{X - P_2 + RC}$$

The segment of buyers of the product without the option is:

$$I_2^0 = \{P_2 \leq X \leq \bar{X}, \ \bar{q}_1^2 \leq q \leq 1\}$$

The segment of buyers of the product with the option is:

$$I_2^1 = \left\{P_2 + M \leq X \leq \bar{X}, \max\left(q_2^2, P_2, X\right)\right\}$$

With this notation, the demand with unbundled MBG can be decomposed into two elements. The demand from consumers in segment $I_2^0$ is denoted by $D_2^0$, and $D_2^1$ is the demand from segment $I_2^1$. Some of the consumers in segment $I_2^1$ may return the product; let $\bar{q}_2^1$ be the average probability of fit for members of segment $I_2^1$. The expected net demand with unbundled MBG is $D_2^N(P_2, RC, M) = D_2^0 + \bar{q}_2^1 D_2^1$. The expected number of returns is $(1 - \bar{q}_2^1)D_2^1$. An increase in $P_2$ will reduce the total number of buyers, but at the margin, some buyers who would have purchased without an MBG will now prefer purchasing with the option (Eq. 18). An increase in $M$ will decrease the total number of buyers (Eq. 17), and some buyers will decline the option.

Compared to an environment in which there is no MBG, the introduction of an unbundled MBG with $P_2 > P_0$ would lead to a loss of buyers with high $q$ and $P_2 \geq X > P_0$, but another group of consumers with low $q$ and high $X$ will be added to the demand. Comparing bundled and unbundled MBGs, if $P_2 + M > P_1 > P_2$, this suggests that the seller has a tradeoff between a group of consumers with high $q$ and relatively low $X$ that will buy only with the unbundled MBG without purchasing the option, and another group with relatively low $q$ that will only buy the product when the MBG is bundled at the lower price.
5. Optimizing a retailer’s choices

In this section we develop a framework to determine the selection of optimal return policies. When retailers make their choices between the different return policies they have both discrete and continuous choices. The discrete choice is between three MBG strategies: no MBG, bundled MBG and, unbundled MBG, while the continuous choices are the selection of the optimal parameters, that is, product price in the case of no MBG or bundled MBG strategies, and product and option prices in the case of the unbundled strategy.

We consider the case of a monopolistic retailer who seeks to identify the optimal return policy and the related pricing decision. We assume that the retailer pays $C$ per unit of product and incurs costs $R$ per unit returned. The decision problem of the retailer is:

$$\max_{i=0,1,2} \{ \pi_0, \pi_1, \pi_2 \}$$

where $\pi_0$ is the profit when selling without an MBG, $\pi_1$ is the profit when selling with a bundled MBG, and $\pi_2$ is the profit from having an unbundled MBG policy. The retailer’s profit-maximizing choice of price with no MBG is determined by solving:

$$\pi_0 = \max \left( P_0 - C \right) D_0 (P_0)$$

By contrast, when a monopolistic retailer determines an optimal price $P_1$ under the bundled MBG policy, it maximizes the gains from expected sales minus the product and return costs. Therefore the retailer’s optimization problem is:

$$\pi_1 = \max \left( P_1 - C \right) D_1 \cdot \tilde{q}_1 - R \cdot D_1 (1 - \tilde{q}_1)$$

where $1 - \tilde{q}_1$ is the average return probability of the buyers. Finally, profit under an unbundled MBG policy consists of profits from selling to consumers who chose to buy the product without the option, plus profits from selling to the segment that buys both the product and the option, minus expected return costs for those in this second group:

$$\pi_2 = \max \left( P_2 - C \right) D_2^0 + (P_2 + M - C) D_2^1 \frac{1}{2} + (M - R) D_2^1 (1 - \tilde{q}_2)$$

The first order condition of (21) determining optimal price without MBG can be presented as the usual optimality condition for a monopolist:

$$C = MR_0 = \frac{D_0}{\partial P} [D_0]$$

where $MR_0$ is the marginal revenue derived from the demand without MBG ($D_0$). The optimality condition for price under a bundled MBG can be derived from (22) as:

$$C + R \frac{\partial}{\partial P} \left[ D_1 (1 - \tilde{q}_1) \right] / \frac{\partial}{\partial P} (D_1 \cdot \tilde{q}_1) = MR_1$$

$$= P_1 + \frac{D_1^N}{\partial D_1^N/\partial P}$$

where $MR_1^N$ is the marginal revenue derived from the net demand function and $D_1^N$ is the net demand function given by total sales minus returns. The second expression in the LHS of (25) is the marginal adjusted returns cost, which is defined as the marginal change in returns with response to price increase divided by the marginal change in expected purchases in response to price increase. This ratio is assumed to be positive because when gross demand declines in response to an increase in $P_1$, both returns and net expected purchases are expected to decline.

A comparison of conditions (24) and (25) suggests that sales without MBG are determined where $MR_0 = C$ while expected sales with bundled MBG are determined where $MR_1^N > C$. We assume that at each price level $D_1^N > D_0$ and in most cases it will lead to $MR_1^N > MR_0$ and this suggests that $P_1$ is greater than $P_0$.

In the case of the unbundled MBG policy there are two optimality conditions determined by product price and option price. The first order condition with respect to the product price suggests that at the optimal solution:

$$C + R \frac{\partial}{\partial P} \left[ D_2^1 (1 - \tilde{q}_2) \right] / \frac{\partial}{\partial P} (D_2^1) - M \frac{\partial D_2^1}{\partial P}$$

$$= MR_2^N$$

The first order condition with respect to the option’s price, $M$, is:

$$D_2^1 + M \frac{\partial D_2^1}{\partial M} + (P_2 - C) \frac{\partial D_2^N}{\partial M} = R \frac{\partial D_2^1}{\partial M}$$

Condition (26) states that at the optimal solution, marginal revenue is equal to the product cost plus marginal adjusted returns cost minus marginal adjusted option earning loss. The last term is the marginal change in the option’s revenue in response to price change divided by the marginal change in product demand with respect to price. An increase in product price will reduce the demand from existing buyers of the product-MBG package but some customers will switch from buying without an MBG to buying with one. Therefore, the net effect on demand for MBG is uncertain.

Eq. 27 states that at the optimal price premium, the marginal revenue from increasing the price of the MBG must equal the marginal savings (negative) from decreased returns when fewer options are purchased.

Eq. (26) holds that the determination of the price of an unbundled MBG has to take into account an additional element, the adjusted option earnings. If this element is positive, it will reduce $P_2$. A comparison of $P_2$ with $P_1$ and
Simulations derive the equilibrium price \( P \), consumers' return costs are \( C \), and retailer return costs are \( R \). The selection of the specific guarantee policy depends on the distribution of \( q \) and \( X \) in the population as well as consumers' and retailers' return costs. To gain insight into the conditions where each policy is optimal, we conducted several simulations. First we simulated a benchmark case with a wide distribution of customer valuation \( (X) \) and fit \( (q) \), then we run simulations in which we vary each of the parameters: production price, retailer return cost, consumers return costs, the distribution of product fit \( (q) \), and the distribution of \( X \).

The benchmark case assumes that \( X \) and \( q \) are distributed uniformly and independently, with 0 ≤ \( X \) ≤ 10 and 0 ≤ \( q \) ≤ 1. The cost parameters assumptions for the benchmark case are: production costs are \( C = 3 \), retailer return costs \( (R) \) are 50% of the production costs, and consumer return costs are \( RC = 0.1 \), and the size of the population is \( N = 1,000 \). The simulations derive the equilibrium price \( (P) \), final demand \( (Q) \), profit \( (\pi) \) and other outputs. The simulations were conducted using the optimization software MAPLE 5.1. The resulting equilibrium price and profits from the simulations are presented in Table 1.

<table>
<thead>
<tr>
<th>Sim. No.</th>
<th>Description</th>
<th>No MBG ( P_0 )</th>
<th>Profit ( \pi_0 )</th>
<th>Bundled MBG ( P_1 )</th>
<th>Profit ( \pi_1 )</th>
<th>Unbundled MBG ( P_2 )</th>
<th>Option price ( M )</th>
<th>Profit ( \pi_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Benchmark: ( C = 3; R = 0.5^*C; RC = 0.1; 0 \leq q \leq 1; 0 \leq X \leq 10 )</td>
<td>5.16</td>
<td>307</td>
<td>7.15</td>
<td>401</td>
<td>5.97</td>
<td>0.63</td>
<td>437</td>
</tr>
<tr>
<td>2</td>
<td>Increase in retailer’s return costs ( (R = 0.8^*C) )</td>
<td>5.16</td>
<td>307</td>
<td>7.56</td>
<td>307</td>
<td>5.95</td>
<td>0.89</td>
<td>378</td>
</tr>
<tr>
<td>3</td>
<td>Increase in consumers’ return cost ( (RC = 2) )</td>
<td>5.16</td>
<td>307</td>
<td>6.21</td>
<td>296</td>
<td>5.13</td>
<td>0.98</td>
<td>302</td>
</tr>
<tr>
<td>4</td>
<td>High probability of fit with small variance ( (0.9 \leq g \leq 1) )</td>
<td>6.5</td>
<td>1225</td>
<td>6.54</td>
<td>1140</td>
<td>Not offered</td>
<td>Not offered</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Homogeneous in ( X (X = 10) )</td>
<td>6.5</td>
<td>1225</td>
<td>9.72</td>
<td>2720</td>
<td>9.72</td>
<td>0</td>
<td>2720</td>
</tr>
</tbody>
</table>

\( P_0 \) is not straightforward analytically because of the simultaneous determination of \( P_2 \) and \( M \). This simultaneity allows the retailer to reach segments that are similar to \( A \), \( B \) and \( C \) in Fig. 1. It is clear that \( P_1 \geq P_2 \) or the retailer would not gain from unbundling and reaching new customers.

### 5.1. Simulations

The selection of the specific guarantee policy depends on the distribution of \( q \) and \( X \) in the population as well as consumers' and retailers' return costs. To gain insight into the conditions where each policy is optimal, we conducted several simulations. First we simulated a benchmark case with a wide distribution of customer valuation \( (X) \) and fit \( (q) \), then we run simulations in which we vary each of the parameters: production price, retailer return cost, consumers return costs, the distribution of product fit \( (q) \), and the distribution of \( X \).

The benchmark case assumes that \( X \) and \( q \) are distributed uniformly and independently, with 0 ≤ \( X \) ≤ 10 and 0 ≤ \( q \) ≤ 1. The cost parameters assumptions for the benchmark case are: production costs are \( C = 3 \), retailer return costs \( (R) \) are 50% of the production costs, and consumer return costs are \( RC = 0.1 \), and the size of the population is \( N = 1,000 \). The simulations derive the equilibrium price \( (P) \), final demand \( (Q) \), profit \( (\pi) \) and other outputs. The simulations were conducted using the optimization software MAPLE 5.1. The resulting equilibrium price and profits from the simulations are presented in Table 1.

The benchmark simulation indicates that the optimum, the retailer increase price by 38.6% when they offer a bundled MBG instead of selling the product without MBG (7.15 vs. 5.16). Profits are increased by 30.1%. Choosing to unbundle the MBG changes the product’s base price (without MBG) to 5.97 units and the retailer now charges 0.63 units for the return option. The price of the base product when the MBG is unbundled is higher by 16%, while the cumulative price of the product and the option is 6.6, which is 8% lower than the bundled price. The pricing of the

unbundled MBG indicates that retailers try to capture the three segments keeping minimal overlap between the segments. Though not given in the table, gross demand for the benchmark case was greatest under bundled MBGs, but because of the high rate of return, net demand was lower than under either of the other policies. The unbundled MBG policy had the highest net demand in this simulation. Additional results show that the average net consumer benefits from purchasing the MBG option (i.e., the MBG option value minus the premium paid to get the option) was lower under the bundled MBG than under the unbundled MBG. The net benefits from the MBG option are greater for the unbundled MBG because it is only the higher risk customers that purchase the MBG option when it is unbundled.

The second simulation further emphasizes the role of seller return costs. When only these costs increase, the price with bundled MBGs increases substantially to reduce purchases by consumers with low \( q \)’s, and the profitability of bundled MBGs declines substantially from the benchmark case (simulation 1). For unbundled MBGs, the retailer simultaneously increases the price of the MBG option by more than 55% and reduces the base price by 14% in order to reduce the demand from consumers with low \( q \)’s and entice those with higher \( q \)’s to switch to buying without an MBG. The unbundled MBG allows a substantial earning from consumers with high \( q \)’s, and the loss of revenues because of higher return cost affects only the segment with low \( q \)’s.

Simulation 3 shows that an increase in the consumer’s return costs reduces the price of bundled MBG to 6.21 and profits to 296. Under an unbundled MBG policy, the retailer sharply decreases the price of the option by almost 50% to 0.98, and somewhat offsets this loss by increasing the base price of the product without MBG from 5.97 to 5.13.

The fourth simulation highlights the role of the distribution of the population. When the probability of fit is very high and with little variance (0.9 ≤ \( q \) ≤ 1), selling without an MBG is the preferred choice, and unbundled MBGs would not be considered.
Simulation 5 shows that when consumers are homogeneous with respect to their evaluation of the product \((X = 10)\) but there is high variance in the likelihood of fit, bundled MBG is the preferred policy. Demanding that customers purchase an MBG with the product allows the seller to charge a price close to the homogeneous valuation \((P_t = 9.72, X = 10)\). Any set of product price and positive option price under an unbundled MBG policy yields lower profits than the bundled MBG, and as a result the unbundled policy collapses to the bundled solution.

Technically, an unbundled MBG policy can at least replicate the profitability of either of the other policies, in the case of the bundled MBG by charging \(M = 0\), and, in the case of the no MBG by charging an \(M\) that is greater than the consumers’ MBG option value. Under the conditions of simulation 4, there are an infinite number of \(M\) under the unbundled MBG policy that can be high enough to replicate the no MBG policy. Under the conditions of simulation 5, the unbundled MBG policy replicates the bundled MBG policy by charging \(M = 0\).

In summary, the simulation results show that:

- If consumers are heterogeneous with respect to both probability of fit and product valuation, and both producer and consumer return costs are low, then retailers realize higher profits from an unbundled MBG policy.
- If the probability of fit is high and its variation is small, the no MBG policy is the preferred seller policy.
- If there is little variation in consumer valuation of the product but consumer heterogeneity of fit is high, then a bundled MBG is the preferred seller policy.
- High retailer or consumer return costs reduce the profits that can be gained from offering MBGs, and, in the case of high retailer return costs, the effect on profits is greater for bundled than for unbundled MBGs. In the extreme case, high return costs may cause retailers to prefer a no MBG policy, and in less extreme cases it will cause retailers to exclude some product categories from their MBG guarantee plan.

5.2. Implications for market opportunity from the simulations

Although an unbundled MBG policy may be more profitable than a bundled policy, consumers may be resistant to such a policy because of expectations based on industry norms and past behavior (Raghubir & Coffman, 1999), where customers are accustomed to not paying a separate premium for MBGs. In this case, the seller may find alternative ways of replicating the unbundled MBG policy. For example, the seller may occasionally offer products for “sale” without the option to return, or offer “bargain basement” prices at a specific location where the consumer does not have the return option. Customers are used to not having return options for items on sale.

Consumer moral hazard must also be considered in the decision to offer MBGs, particularly when there is high depreciation of returned products. Moral hazard arises when the consumer purchases the product for immediate use, knowing that he will return it for a full refund before the expiry of the MBG deadline. If the seller does not provide an MBG, this would drive away consumers with high valuation of the product but low probability of fit.

One solution is to offer MBGs with high return penalties. The unbundled MBG option provides a framework for penalizing returns by refunding only the base price and not the amount paid for the MBG option. The combination of high return costs and a potential moral hazard problem characterizes some electronic products. For example, a consumer may want a laptop computer for a particular trip or a big screen TV for a party. Charging a nonrefundable MBG return option greater than the rental costs of the product can eliminate much of the moral hazard, and honest customers with high likelihood of fit may choose to purchase the product without the MBG.

This conceptual framework suggests that in most cases where producers and consumers return costs are low, unbundling would yield the highest profits. However, in reality, such a policy may be difficult to implement. The second best solution to unbundling is selling without MBGs for products with low valuation, high returns costs, or high probability of fit, and bundling MBGs on those products with high valuation and heterogeneity of fit. Nevertheless, simplicity of operation, and the desire to maintain a high store image may rule out this option for many stores.

6. Market Evidence

If consumers differ in their product valuations and are heterogeneous with respect to fit likelihood, and since stores have different return costs for different product categories, the framework provided in this paper suggests that we should observe sellers offering a great variety of MBG options for different products. On the other hand, market norms and the benefits offered by simple, unified store policies result in a tendency to offering a unique MBG policy for all products.

We collected evidence in person and through the Web to identify where and under what conditions these policies are practiced. The collected information is on the return policies of eleven national retailers, nineteen local computers retailers in the San Francisco Bay area, and three stores that sell musical instruments. In addition, we analyzed print advertisements of major US airlines.

6.1. Option A. Bundled MBG, no MGB—standard policy and deviations

The norm among many national retailers is to provide 30-day MBGs. Among mass merchandisers, it is 90 days.
Higher class, service retailers, such as Nordstrom and The Gap allow unlimited MBGs. Surprisingly, the ease of making returns does not differ greatly between high-end service retailers and others. This may be explained by differences in return costs. Stores that sell bargain items have lower return costs, since their purchasing costs may be lower than those of their competitors.

In electronics, both high return cost and a high potential for moral hazard exist in some product categories, such as software and laptops. These products are often sold at the same establishment that sells toasters, phones, and other products for which there is a low probability of returns. This creates a situation where retailers need to balance between one simple policy, which is far from being optimal, and multiple return contracts. This resembles the market of lemons problem and it is obvious that if a separating policy could be implemented easily it would be chosen.

As a partial relief to this problem, retailers may offer one official MBG policy of 30 days, but exclude from the guarantee products with high moral hazard such as opened software and laptops, which are not returnable. Alternatively, retailers may adopt a less strict exclusion policy, and reduce moral hazard problem by imposing penalties on returns. This clearly decreases return benefits, but is still better than no MBG. For example AY Computer System allows returns with a 15% penalty for Toshiba notebooks while EPS Technologies deducts a $700 return penalty for the software that comes bundled with the computer. Office Depot accepts exchanges only for the same computer while U.S.A. Flex sells notebooks without any MBGs.

In general, Circuit City and the Good Guys charge customers a 15% restocking fee for opened electronics packages while Office Depot and Costco accept returns without penalties. A 15% restocking fee imposed by the Good Guys on TV returns applies only to 13" and larger models. This use of a differentiated MBG policy within the same product category reflects retailer recognition of high differences in uncertainty, moral hazard and return costs between products.

Charging a flat penalty rate on returns does not take into account that customers differ in the amount of time they need to learn about a product. Time-varying options can help address this problem.

6.1. Time-varying MBG options

A time-varying option is an MBG option that changes its terms over the length of the contract. The commonly used technique is to reduce the value of the option as the duration of the return increases. For example, a product may come with a full MBG for the first period, say a week, and then a restocking charge is applied after this period. This represents a time bundled option where the customer tests the product without a charge for the first period. If more time is needed, the customer knows that a fee must be paid. This is not a perfect unbundled MBG option since the customer is not offered the option to buy the product without an MBG. However, de facto, it is a form of an unbundling option on the duration of the return that is frequently observed among retailers and wholesalers.

We collected information on nine computer retailers. Five sell an identical motherboard with graphic cards from different makers, but with similar performance. Four of the five retailers selling the same motherboard offer a 30-day MBG with 15% penalty for return, charging almost identical prices ($147–$149). The fifth retailer charges a higher price ($165) but offers a time varying MBG option. The first 10 days are full MBG, but the following 20 days come with 20% restocking charges. For customers that are fast learners and perceive a high likelihood of returning the product, the time-vary MBG offers a good option.

Offering two different return policies for the same product that is sold in different channels varying in their services is an elegant way to unbundle the return option. Manufacturers may sell their products through traditional retailers that provide MBGs and sell the same product at discounted “factory outlets” at discounted prices that do not include MBGs.

6.2. Option B. Unbundled MBGs and channel price discrimination

6.2.1. Online versus traditional shops

Priceline.com sales are final, that is, nonrefundable and not tradable. This enables the company to sell tickets of eight major airlines at lower prices. Alaskan Airlines offered online shoppers flights to several destinations discounted up to 75% relative its price through a travel agent. However, it required a 7–14 day advance purchase for the online sale and the tickets were not refundable.

6.2.2. Retailer versus manufacturer return policies

HP, Compaq and IBM offer 30 day MBGs on computers including notebooks sold online. Retailers, on the other hand, as discussed previously, sell these products with shorter, more limited MBGs if any at all.

6.2.3. Discounted items

Another way to bypass customers’ resistance to unbundling is to offer discounts on unreturned products and justify this policy with end of season sale, or special sale event. In many cases discounted items or off-season sales are sold without MBG. For example, Footware and so forth, which has five stores on the SF Peninsula, offers a 10% discount for final sale items. This is a practical way to offer both bundled and no MBG items at the same store at the same point of time. Since customers are used to basement pricing, that is, products that are sold in a separate section of the store, they would not feel that the privilege of returns is taken from them.

6.3. Product customization

One way to offer a selection of MBG contracts is to offer to customize the product to the customer’s idiosyncratic needs.
Since customers should have a higher probability of fit for customized products, the practice of eliminating MBGs for customized products is consistent with option theory that suggests a lower need for the return option for products of higher probability of fit. When a product is customized to specific needs the probability of fit may approach 1, and if returned, the product is worth much less to the retailer. For example, Office Depot does not allow returns for customized furniture while noncustomized furniture comes with unconditional, 30-day MBG. Men’s Warehouse has a similar policy that excludes customized clothes from its regular 30-day MBG. PC doctor sells computers with a seven-day MBG, but excludes built-to-order (customized) PCs.

6.4. Rentals with option to buy

Rentals with the option to buy the product deducting rental payments represent another form of uncertainty reduction and are in essence another means for providing an unbundled MBG. It replaces the MBG in those cases where the learning period is much longer than the duration of typical MBG contracts and where the product only moderately loses its value over time. This practice is common in music stores where a prospective pianist may need to first learn how to play an instrument before becoming certain whether she really wants to take ownership of the product. This also facilitates parents in providing their children with the opportunity to learn an instrument. Since children change their minds about what they want, the rental with purchase option reduces parental risk and encourages the learning of musical skills.

Ten musical instrument shops in the Bay Area were surveyed as well as two online (www.musicalinstrumentrental.co.uk and www.long-mcquade.com). All offered potential buyers two options. A potential buyer could rent a piano for up to 6 months, and if he or she decides to purchase, the rental payments are deducted from the purchase price. Alternatively, the buyer can purchase the piano immediately and receive a discount of up to 15% of the price, which represents the price of the uncertainty reduction option. The conditions for offering a differentiated contract arises in this market because of the high cost of the product, and the large consumer variation in confidence of fit—the professional and good amateur will be confident about product fit, while the new amateur will be very uncertain of product fit and may decide to either upgrade or drop the instrument.

6.5. Alternative menus

Unbundled MBGs occur when consumers are offered menu of guarantees with varying coverage and prices. The Advanced Fertility Center of Chicago, for example, offers potential customers three fertility services alternatives prior to the purchasing decision. The Single Cycle is a service that costs $6,800 without any MBG, implying that the customer may have to make several trials before achieving a successful pregnancy as well as bear the risk that all attempts may fail. A shared risk option costs $10,500, with $2,500 refundable to clients younger than 35 years of age. A fully refundable MBG program charges the same couple $18,500. The fertility clinic shows that the unbundled MBG arises in areas predicted by our model, since the costs of the service are high and there is a great deal of variation in both consumer valuation of the product (ability to pay) and consumer risk (likelihood of success).

7. Conclusions and managerial implications

In this research, we model the MBGs as a put option. In essence, any financial instrument that guarantees a predetermined return price to its holder may be regarded as a put option. When a customer exercises an MBG, she is selling the product back to the store at a previously agreed upon price. The option value of having an MBG is negatively correlated with the likelihood of product fit and with other opportunities to test the product before purchase, and positively correlated with the price and duration of the contract. The benefit of thinking of MBGs as options is that it offers a tool for optimizing the product price and MBG option price separately and simultaneously. When the seller separates the product and the return option, he creates a third return policy—the unbundled MBG in which the customer can decide to purchase the product with or without the MBG. Unbundling allows sellers to differentiate their offers and discriminate between consumers and products.

We analyze three return policies: selling without an MBG, selling a bundled MBG and offering an unbundled MBG. When consumers are heterogeneous in their product valuation and likelihood of fit, an unbundled MBG allows the seller to set prices that separately target customers with lower valuations but high likelihood of fit by allowing them to purchase without the MBG, and customers with high valuations and low likelihood of fit by allowing them to purchase with MBGs. Simulation analysis reveals that different MBG policies—no MBG, bundled MBG and unbundled MBG—can be optimal to the seller under different conditions. When customers are heterogeneous in their valuation of the product and probability of fit, and if return costs are relatively low, an unbundled MBG policy may be optimal. When customers have high likelihood of fit or return costs are excessive, no MBG may be the best policy. When customers have a small variance in valuation of the product but vary greatly in the likelihood of fit, the seller may prefer to offer a bundled MBG contract, extracting consumer surplus by charging a price close to the valuation level.

While we do observe unbundled MBGs in the market place, its use to this point in time has been limited. Unbundling MBGs in the current environment may be difficult to undertake since customers may have expectations based on past industry norms in which the MBG has been traditionally bundled. This status may be difficult to change. If one company decides to change its policy and offer unbundled
MBG instead of bundled MBGs, customers could form negative interpretations that could damage image and demand. However, it should be noted that extended warranties, now a common practice in some product categories, once did not exist either.

Our model speaks of a single retailer selling a single product. Where the retailer sells many product categories that vary in value and probability of fit, implementing the theory in reality would require a complex, multicategory optimization. In doing so, retailers must equalize the gain from having an additional category’s specific differentiated MBG policy to the costs of offering this policy. The gain from adding an MBG policy designed for a specific product category is the precision in pricing, while the costs are reflected in greater complexity, both to consumers and to store employees.

While simple and uniform policies are generally the rule with respect to MBGs, differentiated MBG policies are observed in the real world. Office Depot makes a distinction between PCs and laptops. The Good Guys differentiations between small and large screen TVs. This suggests that if the payoff among categories is large enough, as apparently some retailers sense that it is, they will offer differentiated MBG policies. In addition, we provide examples of retailers that provide menus of options with and without MBGs, product rentals with the future option to buy and deduct prices, and products with and without MBGs either at the same store (products on sale) or in different channels (outlet, online). All of these may be considered variations in unbundled MBGs.

Future research needs to assess empirically the conditions consumers and retailers will consider differentiated and unbundled MBG policies for specific product categories. Better understanding of these conditions may be a stepping-stone that provides both consumers and retailers with products and services that better fit their needs and profit opportunities.

The theoretical framework we develop in this research can also be used to study issues we have not explicitly considered. First, the effectiveness of various fit-uncertainty reduction tools: demonstrations, sampling and MBGs, declines with consumer experience. This means that their importance diminishes for repeated purchase of the same product. However, this may not hold for product categories that change frequently, for example, fashion, computers, software and electronics or where the customer’s characteristics change over time (children’s clothing size). Thus, sellers will need to design uncertainty reduction mechanisms that would be less intense over the consumer life cycle, but still allow inexperienced customers the opportunity for full risk reduction. The unbundling of MBGs presented here would enable retailers to change the return option over time and across customers.

Finally, prepurchase learning reduces the need for MBGs. Demonstrations, for example, are efficient in providing prepurchase information and reducing the need to learn at home, but are costly to provide. An investigation of how to balance a combined policy that uses both MBG and demonstrations may offer further insight as to how to make better use of uncertainty reduction tools.

Notes
1. Office Depot extended warranty program, “Replacement protection plan” says that in case of product failure the customer can return the product and get his/her money back.
2. A zero salvage value is used for simplification. Making the salvage value positive but small (relative to the return benefits) would not affect the findings in this paper.
3. The assumption is for convenience, and does not affect our conclusion. For example, if \( RC(s) = (1 - \eta)p_0 \) for some \( s < T \), that is, the consumer needs at least \( s \) periods after her discovery of a nonfit to return the product, we can simply replace the integration range from period 0 to \( T \) by one from 0 to \( T - s \) in Eqs. (5)–(7). The rest of our analysis still holds.
4. Proof is available from the authors.
5. Detailed findings, which include quantities, average probability of fit and option value are available upon request from the authors.
6. Return duration is longer in Ross than in Sears while ease of returns are similar in McFragel and The Gap.
7. AY Computer system, ATACOM, Spectrum Peripherals and Advanced communication.
8. We thank Josh Zivin from Columbia University for providing this example.
9. We would like to thank Yanghong Jin from the Department of Agricultural and Resource Economics, UC Berkeley, for her help with the simulations.
10. The paper had benefited from partial founding of BARD and the ISRAELI Academy of Sciences.

References


