7. Choosing to choose: the dynamics of store, product, and consumption choices

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7.1 INTRODUCTION

A growing body of psychological research suggests that people in developed countries face too many choices, choices they would be better off avoiding. When they shop, people can visit more stores of increasingly diverse retail formats, each store offering more extensive product assortments than before. Choosing products from these assortments imposes cognitive costs (Shugan, 1980; Chernev, 2003), which can lead to information overload and suboptimal choices (Jacoby et al., 1974a, 1974b; see Chernev et al., 2015 for a review). Yet people continue to find choice inherently attractive. As shoppers, they are drawn to stores that offer more product alternatives from which to choose (Baumol and Ide, 1956; Brown, 1989; Iyengar and Lepper, 2000; Briesch et al., 2009). As consumers, they often choose a variety of product alternatives to hedge against future preference uncertainty (Walsh, 1995; Salisbury and Feinberg, 2008; Fox et al., 2017).

In this chapter, we will review evidence that people seek, construct, and preserve choices when shopping for and consuming products. Uncertainty about their future preferences (Pessemier, 1978; March, 1978; Kreps, 1979; Kahneman and Snell, 1990) leads people to prefer flexibility as a rational hedge. As a result, consumers do not simply choose their favorite products. We will explore the dynamics of three different choice levels. First, we will show that store choice requires anticipation of subsequent product choices – this is well understood and non-controversial. We will also show that product choices made in-store require anticipation of how those products will be consumed at home – this is less well understood as the literature evolves. Finally, we will present evidence that consumption choices themselves require anticipation of future consumption choices, which will be made from the products that remain in inventory.

Most of the literature in this area has studied hedonic products, perhaps because future preference uncertainty is particularly relevant for such products. The common premise underlying these studies is that shoppers choose products at the store to consume later at home. Our review will

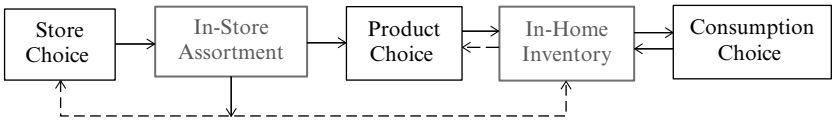

Figure 7.1 Choosing to choose – a conceptual framework

therefore focus on published studies of hedonic products commonly purchased in supermarkets and other grocery stores for future consumption. However, the frameworks and findings we will present may generalize beyond this context.

We begin with a simple conceptual framework, shown in Figure 7.1. A rational shopper first chooses a grocery store from which to purchase products.[1] The store choice decision depends, at least in part, on product assortments in those stores (e.g., Baumol and Ide, 1956; Arnold et al., 1978; Arnold et al., 1983; Arnold et al., 1981; Arnold and Tigert, 1982; Briesch et al., 2009).[2] Which assortments affect store choice? That depends on which category inventories in the shopper's home have been depleted (in the figure, feedback about in-home inventories is represented by dashed lines). When a store is chosen, assortments at that store become choice sets for the shopper's product choice decisions. When choosing hedonic products, a rational shopper anticipates future consumption, typically multiple consumption occasions. Standard choice models assume that the shopper chooses a single product of a common package size (or none at all), but more recent models accommodate the purchase of multiple products in categories such as carbonated soft drinks (Dube, 2004), yogurt (Lee and Allenby, 2014) and apples (Richards et al., 2012). Which products are chosen in-store depends on inventory levels of the shopper's preferred products at home (Blattberg et al., 1981). Product choices augment the shopper's in-home inventory, which in turn represents the choice set for subsequent consumption choices. When choosing a product (or outside option) on each consumption occasion, a rational consumer anticipates future consumption choices that will be made from the inventory that remains.

Although this conceptual framework bears some similarity to that of Tellis and Zufryden (1995), there are two key differences. First, we have broadened the product choice decision to include category incidence and purchase quantity. These decisions are simultaneous and thoroughly comingled – category incidence is defined by the choice of a product; purchase quantity is effectively conflated with a product's package size. Second, Tellis and Zufryden's framework was developed to study price and promotion response. Our framework is intended to address the effects

of choice sets (both selected in store and constructed at home) on the sequence of choice decisions.

Perhaps the defining characteristic of the sequence of choices in Figure 7.1 is their inherent dynamics. A rational decision maker makes forward-looking choices, anticipating their effects on subsequent choices. This chapter will review the literature related to the dynamics of shopping and consumption choices in the same way that one develops a dynamic model. The final decision, on which previous decisions directly or indirectly depend, is the choice of a product for consumption. This is where we begin.

7.2 CONSUMPTION CHOICE – PRESERVING FLEXIBILITY FOR FUTURE CONSUMPTION

Consumption choices are made from the set of products in a category that the consumer has in inventory at home. The consumer may have an inventory of zero, one, or multiple product alternatives (i.e., different SKUs). The inventory quantity of each product alternative may be considered in terms of servings, where a single serving is consumed on each consumption occasion. This allows one to accommodate different package sizes.

If no products are in inventory, there is no consumption choice (this case would also represent feedback for store and product choices; see Figure 7.1). If a single product alternative is in inventory, the consumer can choose only that alternative. If multiple product alternatives are in inventory, however, the consumer chooses between those alternatives. It is commonly assumed that the consumer chooses her/his most preferred product; in other words, that the consumer's preference is revealed (e.g., Guo, 2010). In economic terms, this implies that the chosen product offers the highest consumption utility. However, while consumption utility is known at the time of consumption, *it is not known with certainty for future consumption occasions*.

Uncertainty about future consumption utility (hence future consumption preferences) has been attributed to any number of different factors, from unknown future moods to unknown future consumption sequences (March, 1978; Kreps, 1979; Pessemier, 1978; Kahneman and Snell, 1990; Hauser and Wernerfelt, 1990). More importantly for our purposes, uncertainty about the future leads to a preference for flexibility. March (1978) argued that "we have a tendency to want to take actions now that maintain future options for acting when future preferences are clearer" (p. 597). Pessemier (1978) observed that this uncertainty causes people to diversify their choices over time. Assuming uncertain future preferences, Kreps (1979) proved that there are conditions under which flexible sets

are preferred to sets containing the consumer's favorite product. Salisbury and Feinberg (2008) varied the time to future consumption and the relative preference for different product alternatives. Their simulation studies showed that both factors affect consumers' desire for flexibility when choosing sets of products for future consumption.

To reflect uncertainty about future preferences, consumption utility is generally modeled as the sum of two components: (1) a *deterministic component*, which is known in advance and can be anticipated, and (2) a *random component*, which is unknown until it is revealed immediately before consumption.[3] In this *random utility* model, differences in the deterministic component across product alternatives reflect differences in *expected utility*. However, if the consumer is able to choose between product alternatives, the likelihood of choosing any particular alternative increases with that alternative's random component of utility. This is because the consumption utility of an alternative (deterministic component plus random component) is linearly increasing in the random component. The chosen alternative is therefore more likely to have a positive random component. The extra utility from this positive random component provides a rational basis for preferring to choose.

Assume that, in a given product category, the consumer has one serving each of two different product alternatives. The two alternatives will be consumed on successive consumption occasions, one now and one later. Let us further assume that the consumer usually prefers one product to the other; in other words, one has a higher deterministic component of utility. Because the first consumption occasion is immediate, the consumer knows the random components of utility for both product alternatives and is therefore certain which has a higher consumption utility. However, choosing which alternative to consume *now* requires that the expected utility of consuming the remaining alternative *later* also be considered. For example, if the random component of utility for the less preferred alternative is positive while the random component for the more preferred alternative is not, the consumer is demonstrably better off choosing the less preferred alternative now – even if it has lower consumption utility. This is because the expected random component for whichever alternative remains for the final consumption occasion is zero, so the consumer is better off waiting for another "draw" of the random component for the more preferred product.

Walsh (1995) developed a model of choice between two such product alternatives. Analysis of that model showed the optimality of making strategic consumption choices. More specifically, Walsh found that consumption choices depend on the consumer's in-home inventories of the two products. Fox et al. (2017) generalized Walsh's model to any number

of product alternatives.[4] Analysis of their more general model yielded a closed-form consumption policy, adding precision to Walsh's insight. They determined that a rational consumer would choose a product alternative for consumption in proportion to the in-home inventory of that alternative. Fox et al. (2017) also analyzed a second model, which included an outside option, thereby allowing for differences in consumption rate. Analysis of this model also yielded a strategic consumption policy in closed-form, albeit without additional insight.[5]

Taken together, these studies offer a compelling basis for rational consumers to make consumption choices that preserve flexibility (i.e., that retain product alternatives) for the future. A rational consumer will therefore not necessarily consume the product alternative that maximizes current consumption utility; instead, s/he is more likely to choose a product alternative with greater inventory. This strategic approach to consumption serves to balance inventory across product alternatives as they are consumed, thereby preserving choices for future consumption.

7.3 PRODUCT CHOICE – CONSTRUCTING FLEXIBLE CHOICE SETS FOR FUTURE CONSUMPTION

Recall that consumption choices are made from the set of product alternatives in inventory at the consumer's home. This set depends not only on recent consumption choices, but also on product purchases. Shoppers construct the set of product alternatives (and the inventory of each alternative) by choosing products in-store. In this section, we will examine the research addressing variation in product choices, particularly hedonic product choices. This research is extensive, owing to ubiquitous point-of-sale scanners, loyalty card programs, and the wide availability of syndicated panel data.

One possible explanation for variation in product choices is that shoppers purchase for multiple consumers in their households, each preferring a different product alternative. Though within-household preference heterogeneity could certainly cause variation in product purchases over time, this explanation has been largely ignored. Perhaps this is because in-home consumption, particularly for multiple users, is seldom observed and recorded.

Several other explanations for variation in purchase choices have attracted far more interest in the literature. Figure 7.2 presents a matrix to organize that literature. The vertical dimension of the matrix relates to purchase occasion – either across purchase occasions (i.e., over time) or

When Variation Is Observed	*Sources of Variation*	
	Deterministic Component of Utility	Random Component of Utility
Across Purchase Occasions	Variety Seeking • Jeuland, 1978 • McAlister, 1982 • Givon, 1984 • Lattin and McAlister, 1985 • Khan, Kalwani, and Morrison, 1986 • Bawa, 1990	Household Inventory • Blattberg, Eppen, and Lieberman, 1981
Within Purchase Occasion	Diversification Bias • Simonson, 1990 • Simonson and Winer, 1992 • Read and Loewenstein, 1995 • Khan and Ratner, 2005 Multiple Discreteness • Dube, 2004 • Richards, Gomez, and Pofahl, 2012 • Lee and Allenby, 2014	Flexibility for Uncertain Future Tastes • Walsh, 1995 • Salisbury and Feinberg, 2008 • Fox, Norman, and Semple, 2017

Figure 7.2 Variation in product choices

within a single purchase occasion. The horizontal dimension of the matrix relates the variation in product choice to the random utility paradigm – affecting either the deterministic component or the random component of utility.

7.3.1 Variety Seeking

The most common explanation for variation in product choices over time is variety seeking. The earliest rationale proposed for variety seeking was an innate psychological need to explore, or to seek novelty (Venkatesan, 1979; Raju, 1980, 1981; Raju and Venkatesan, 1980; also see Raju, 1981 for a review). The related theory of satiation/stimulation – that consumers experience diminishing stimulation as more is consumed until reaching (then exceeding) the point of satiation – soon became the primary rationale for variety seeking (see McAlister and Pessemier, 1982; Kahn, 1995 for detailed discussions). Jeuland (1978) proposed a choice model based on satiation/stimulation theory in which the utility of specific products decreases in recent consumption. McAlister (1982) proposed a model of satiation/stimulation for attributes of products, rather than the products themselves. McAlister applied this model to soft drink consumption data, with each consumption choice changing time-varying stocks of product

attributes such as sweetness, flavor, and caffeine. McAlister's application was unusual in that variety-seeking models have been applied far more often to purchase data than to consumption data, even though variety seeking affects consumption preferences. As Richards et al. noted, ". . . while demand theory rests on consumption, data reflect purchases" (2012, p. 207).

Returning to the random utility paradigm, variety seeking based on satiation/stimulation would affect the deterministic component of utility. Consuming a product reduces the deterministic component for that product (or a product with similar attributes) on the next consumption occasion, reducing the probability that it will be chosen again. Most choice models incorporating variety seeking assumed that consumption utility is affected by which product was consumed on the most recent purchase occasion (Givon, 1984; Lattin and McAlister, 1985) or two (Kahn et al., 1986). Several empirical applications of these models actually found "negative" variety seeking, often called inertia; i.e., the probability of choosing a product increases if it was chosen recently. A hybrid model, allowing for both variety seeking and inertia, was found to fit data better than inertia or variety seeking alone (Bawa, 1990). But these findings, like the majority of variety-seeking studies (with the notable exception of McAlister, 1982), used purchase data rather than consumption data. As Bawa explained

> While the model relates to individual-level behavior, we illustrate its application using household-level panel data. This is because it is desirable to have a large number of observations available for parameter estimation, and a sufficient number of observations on individual-level consumption is not easily obtainable. (1990, p. 272)

This limits the generalizability of their results.

7.3.2 Multiple Discreteness

More recently, econometricians have addressed the purchase of multiple products for future consumption, with products varying by brand, flavor, variety, and/or package size. This research has focused primarily on the effects of multiple purchases on price and promotion response. The general approach has been to extend discrete choice models to accommodate the choice of multiple products – multiple discreteness, as it came to be known. Dube (2004) assumed that shoppers' purchases would be consumed over an unknown number of future consumption occasions. Consumption utility for each product was assumed to be concave and monotonically increasing in quantity, which leads to diverse multi-product

purchases. The resulting model was demonstrated using carbonated soft drink purchase data. Richards et al. (2012) focused on multiple discreteness among perishable products, in particular apples. This study used a satiation parameter to accommodate multi-product purchases, implicitly assuming that consumers prefer variety when buying for future consumption. Lee and Allenby (2014) derived a model that incorporates package size differences, in addition to brand and flavor variety. Concerned with the estimation problems posed by discreteness, this model was applied to simulated data and then to yogurt purchase data. The study found that ignoring discreteness results in biased parameter estimates and improper attribution of many zero purchase quantities.

These econometric models of demand assumed decreasing marginal utility for products (or attributes) in order to accommodate consumers' preference for variety. This causes the deterministic component of utility to change over time, depending on consumption.

7.3.3 Diversification Bias

Experimental psychologists have also studied the choice of multiple hedonic products for future consumption. This choice was termed "simultaneous choice," contrasting with the "sequential choice" of individual products at the time of their consumption. The predominant finding from this research is that simultaneous choice sets include a greater variety of product alternatives than sequential choices do (e.g., Simonson, 1990; Simonson and Winer, 1992; Read and Loewenstein, 1995). The primary explanation for this "diversification bias" (cf. Read and Loewenstein, 1995) is a combination of variety seeking and poor forecasting. More specifically, the literature suggests that people overestimate their propensity to satiate on their favorite products during future consumption occasions, causing their simultaneous choices to include too much variety (Simonson, 1990; Read and Loewenstein, 1995; Kahn and Ratner, 2005). This was seen as "a mistake, which they could perhaps avoid by a serious attempt to predict their tastes on each of these weeks [consumption occasions] separately" (Kahneman and Snell, 1990, p. 304).

Simonson's (1990) pioneering study included three experiments that collectively showed consumers systematically choosing more varied product alternatives when making simultaneous choices for future consumption than when choosing sequentially at the time of consumption. Interestingly, one of the experiments manipulated satiation, the antecedent of variety seeking, and found no effect on diversification. The diversification bias implies that buying for more future consumption occasions should increase the variety of product alternatives selected. Simonson and Winer

(1992) tested this implication using scanner panel data for the yogurt category, finding the expected positive relationship between the total number of units purchased and the variety of flavors selected. Read and Loewenstein (1995) investigated whether diversification is actually a bias or is consistent with rational utility maximization. This study found bias in two forms – "time contraction" and "choice bracketing." Time contraction is the tendency to overestimate the time between consumption occasions, which causes people to overestimate satiation and therefore select too much variety. Choice bracketing contrasts the broader decision scope of simultaneous choice (selecting all products at once) with the narrow scope of sequential choice (a single product at a time). Note that choice bracketing differs from variety seeking in that it focuses on the breadth, rather than the timing, of choices.

7.3.4 Inventory-theoretic

We now turn to normative explanations for variation in product choices. One such explanation uses inventory theory to model how shoppers may take advantage of time-varying retail prices to lower their average purchase costs. Lowering average purchase costs requires stockpiling when prices are low, which increases inventory-holding costs. Rational shoppers must therefore balance purchase costs (i.e., retail prices) and holding costs.

Blattberg et al. (1981) proposed the first such inventory-theoretic model of product purchases. This model made the simplifying assumption of a constant consumption rate, but noted that consumption would actually (1) depend on prices and (2) include a random, or stochastic, component.[6] This model was used to predict the frequency and depth of retail price discounts; these predictions were then tested using panel data. Assuncao and Meyer (1993) proposed a dynamic inventory model that investigated the effects of randomly distributed retail prices on consumption and purchase quantity. The optimal consumption rate was found to be (1) a non-decreasing function of the amount of product in inventory at home and (2) a non-increasing function of the holding cost per unit of inventory. The first of these findings (the effect of inventory on consumption) was termed "stock pressure." The inventory-theoretic models discussed above applied to the purchase and consumption of a single product, but they laid the groundwork for normative models of multi-product choice and consumption.

7.3.5 Flexibility for Uncertain Future Tastes

Discovery of the diversification bias raised the possibility that "excessive" product diversity in simultaneous choice (when compared to sequential choices) might be normative. Simultaneous choice was likened to selecting a portfolio of stocks as a hedge against future uncertainty (Simonson, 1990; Read and Loewenstein, 1995; Kahn and Ratner, 2005). Though Read and Loewenstein (1995) did not find diversification to be normative, Salisbury and Feinberg (2008) did.[7] Characterizing future preference uncertainty as "temporal stochastic inflation," Salisbury and Feinberg used simulation studies to show that the degree of diversification *should* depend on the amount of temporal stochastic inflation, as well as the relative attractiveness of product alternatives and uncertainty about their attractiveness.

Walsh (1995) proposed a dynamic model in which the consumer chooses quantities of two product alternatives for a fixed number of future consumption occasions – a two-product version of simultaneous choice. Analysis of this model showed that it may not be optimal for consumers to select only their favorite product alternative for future consumption. They might be better off choosing a smaller quantity of the less preferred alternative, *independent of variety seeking*. Walsh observed, "If the consumer is not a variety-seeker (i.e., X = 1) but does take flexibility into account, one may erroneously attribute the observed variety in purchases to indicate variety-seeking behavior" (p. 155). Walsh also showed that simultaneous choices should include more product variety than the same number of sequential choices. The reason for choosing a diversified set (i.e., a set including both product alternatives) is to offer consumers a choice at the time of consumption. Preference uncertainty implies that consumers will not prefer their favorite product on every consumption occasion, so they might be better off having the option to choose between their favorite and the less-preferred alternative.

Fox et al. (2017) extended Walsh's model to any number of product alternatives. Analysis of their primary model yielded a closed-form expression for the value of any set of *n* products chosen for future consumption. That value has two components. The first is the sum of deterministic components of utility for all products chosen. This component reflects the consumer's valuation of the set *if consumption decisions ignore preferences revealed at the time of consumption*. In other words, this component does not account for the consumer's knowledge of the random component of utility for product alternatives at the time of consumption. The second component captures the value of this knowledge – knowledge that enables the consumer to take advantage of choice flexibility. Fox et al. called this

second component the "choice premium." The minimum choice premium is zero, which occurs if the consumer chooses all n units of a single (presumably the favorite) product alternative. The maximum choice premium is ln (n!), which occurs when the consumer chooses one unit each of n different product alternatives. More generally, the choice premium increases (1) as more product alternatives are included in the choice set and (2) as units are distributed more evenly across those product alternatives. Optimal diversification of a set chosen for future consumption balances the choice premium with the expected utilities of products chosen. This balance is the normative basis for hedging in the construction of choice sets for future consumption.

Fox et al. (2017) introduced a second model that included an outside option; that is, a "no consumption" option for future consumption occasions. The outside option effectively allowed consumption rates to vary. Analysis of the model showed that, as the consumption rate slows, the optimal choice set may become only more diversified. Thus, the rate of consumption affects the choice set that should be constructed for future consumption.

7.4 STORE CHOICE – SELECTING ASSORTMENTS FROM WHICH TO CHOOSE PRODUCTS

Conceptually, choosing a store implies choosing the option to purchase a subset of products offered by that store. Baumol and Ide (1956) developed a probabilistic model consistent with this point-of-view. Using the store's area (i.e., floorspace) as a proxy for the number of products offered, the model assumed that the probability of the shopper successfully finding the products s/he needs is an increasing function of the store's area, with that probability increasing at a decreasing rate. On the other hand, the model also assumed that the cost of shopping increases linearly with walking distances inside the store. Analysis of this model showed that "increased variety is an advantage to the consumer only up to a point" (p. 96); in other words, a larger choice set is not always preferred to a smaller one. Baumol and Ide (1956) also found that a store's optimal product variety does not depend on how far shoppers must travel to the store.

Partitioning a store's product offering into (1) the breadth of product categories offered and (2) the depth of product assortments within each category, subsequent research has generally focused on the latter. Because shoppers' needs are typically defined at the category level (Spiggle, 1987), product assortments can be viewed as choice sets from which product choices are made.

A key objective of the research on product assortments has been to understand their impact on store choice decisions. In a series of studies, Arnold, Tigert and colleagues surveyed shoppers about the factors affecting store choice. Shoppers consistently reported that product assortments are an important consideration in their store choice decisions (Arnold et al., 1978; Arnold et al., 1981; Arnold and Tigert, 1982; Arnold et al., 1983).

Kreps (1979) developed a general economic framework to investigate shoppers' choice between assortments, from which a single product will be chosen. In this framework, future preference uncertainty was shown to lead to a "desire for flexibility" in the assortment; that is, preferring assortments that include more product alternatives. The random utility paradigm, in which each product alternative has a deterministic and a random component of utility, can also be applied to a shopper's choice of assortment. Assuming that the shopper's deterministic component of utility for each product is known in advance but the random component is revealed immediately before s/he chooses a product in store, the expected value of the *best choice* from that assortment can be modeled with the inclusive value of the multinomial logit (Ben-Akiva and Lerman, 1985, p. 284–5). Kahn and Lehmann (1991) used this type of random utility model to develop hypotheses about how shoppers choose assortments. Two experiments provided support for the random utility approach; specifically, that: (1) preference for an assortment increases with the number of acceptable items; (2) for assortments of the same size, those with higher-value product alternatives are preferred; (3) for product alternatives that are equally preferred, more unique alternatives add more value to the assortment.[8]

More recent research has used observational data to investigate the effects of assortments on store choice. This research has faced two complicating issues: (1) assortments cannot be characterized sufficiently just by counting the number of product alternatives, and (2) assortments vary little over time. The first of these issues recognizes that preference for an assortment depends on its composition (including the shopper's valuation of individual product alternatives and their uniqueness in the assortment). The challenge is to identify the dimensions of product assortments that affect store choice decisions and that parsimoniously capture differences in assortments across categories and stores. The second issue is more technical, making the estimation of empirical models more difficult. Fox et al. (2004) addressed the second issue, though not the first, in their study of shopping and spending across the retail formats. Taking advantage of changing category purchase probabilities to capture effective changes in assortment over time, this study found that product assortments have a significant, positive effect on a

household's probability of shopping at a store during a given month. The study also found that assortments have a significant positive effect on spending at a store during the same period, which indicates more frequent patronage. In the first study of store choice that focused primarily on category assortments, Briesch et al. (2009) addressed both the first issue (how to characterize an assortment) and the second (lack of temporal variation in assortments).[9] They proposed and estimated a model in which category assortments were characterized by (1) the number of brands, (2) the number of product alternatives per brand, (3) the number of sizes per brand, (4) the proportion of unique product alternatives (i.e., alternatives not available at other retailers) in the assortment, and (5) whether or not the shopper's favorite brands were available. This study found that the number of brands and the availability of the household's favorite brands significantly increased the probability of choosing a store. The other characteristics of assortment did not.

The decomposition of product assortments used by Briesch et al. (2009) drew on prior studies of assortment reduction, also known as SKU (stock keeping unit) rationalization. Broniarczyk et al. (1998) developed a conceptual foundation for assortment reduction, proposing that store choice depends on a shopper's *assortment perceptions*, which are based on actual product assortments. In two experiments, this study found that the perception of an assortment is determined by the amount of shelf space devoted to the category as well as the presence (or absence) of the shopper's favorite products. The study also found that assortment perceptions mediated the effect of assortment size on store choice. Based on those findings, the study concluded that the number of alternatives in an assortment could be reduced without adversely affecting assortment perceptions or the probability of choosing the store. It is worth noting that assortment perceptions were measured with a question about the relative amount of variety in the assortment ("very little" vs. "excellent"). In fact, the dimensions of assortment perceptions remain unclear (e.g., "good assortment" vs. "bad assortment"; "similar products" vs. "unique products"; "little variety" vs. "much variety"; see Hoch et al. 1999, for a more general analysis of assortment perceptions). Boatwright and Nunes (2001) published an empirical study that analyzed assortment reductions across 42 categories at an online grocery store. The study investigated the impact of those assortment reductions on sales, which increased by an average of 11 percent across categories. Reducing the number of brands and flavors in small amounts was found to increase sales, but reducing the number of brands and flavors by larger amounts decreased sales. Reducing the number of brand-sizes was found to have less of an effect on category sales. While this study focused on category sales, a subsequent analysis of

the same online retailer data found substantial negative effects of assortment reductions on store patronage and spending (Borle et al., 2005).[10]

A related study by Chernev and Hamilton (2009) investigated how the attractiveness of products in an assortment affects a shopper's choice of assortment. In a series of experiments, they found that shoppers' preference for larger assortments was reduced or reversed for assortments composed of either (1) higher quality products, or (2) products that better match shopper preferences. In other words, the attractiveness of products in an assortment moderated shopper preference for larger assortments. The study also found evidence that greater *differences* in assortment size increase the moderating effect of product attractiveness.

Taken together, the research linking store choice with product assortments – effectively choosing a choice set for product selection decisions – leads to two primary conclusions. First, a shopper's store choices depend on stores' product assortments in the categories s/he needs. Second, preference for an assortment depends on its composition as well as its size. Generally, that preference is increasing in the brand variety of an assortment and the presence of the shopper's favorite brands; the number of products and sizes per brand are less important.

Finally, shoppers typically have needs in multiple categories when they choose a store. Briesch et al. (2013) found that store choice depends disproportionately on just a few categories. Those categories are usually, but not always, the store's best-selling categories.

7.5 FUTURE RESEARCH

The research reviewed in this chapter points to a number of potentially fruitful avenues for future research. (1) Models of in-store product choices seldom incorporate the shopper's inventory at home, in large part because the data are difficult to procure. Yet the evidence in this chapter shows the importance of in-home inventory levels on both product choice and consumption decisions. Learning more about the effects of in-home inventories on these decisions represents a potentially important topic for additional research. Perhaps emerging technologies will facilitate the capture of in-home inventory data, for consumer panels if not more generally. (2) Rational hedging in response to future preference uncertainty explains variety in multi-product choices. As such, it represents an alternative to other explanations such as variety seeking and diversification bias. While these models explain similar phenomena, future research may be able to identify conditions under which one model or another better explains

observed choices. As a minimum, hedging against future preference uncertainty provides a rational baseline against which to evaluate other models. (3) If hedging against future preference uncertainty is optimal, then shoppers should be willing to pay to preserve their options. For example, shoppers should be willing to pay more for sets of products that they can customize to their preferences as compared to a bulk pack that includes only their most preferred product. Exploring people's willingness to pay for flexibility represents another research opportunity. (4) Finally, there has been surprisingly little research about in-home consumption behaviors. The absence of such research has led to naïve assumptions, such as constant consumption rate, that ignore temporal variation and heterogeneity. Improving our understanding of consumption patterns (rates, choice probabilities, periodicity, etc.) holds great potential, and could be addressed in the future with both descriptive and normative research.

NOTES

1. The shopper might visit multiple stores, rather than a single store, to purchase needed products (Fox and Hoch 2005; Gauri et al., 2008; Talukdar et al., 2010). However, because multi-store shopping is the exception rather the rule, it is not considered in our conceptual framework.
2. Other factors, including convenience, price, and customer service are also known to affect a shopper's store choice.
3. Note that many different choice models also conceptualize utility as having deterministic and random components. Future preference uncertainty is just one possible interpretation of the random component of utility.
4. The models analyzed by Fox et al. (2017) assumed the random component of utility to be Gumbel-distributed, while Walsh (1995) made a more general distributional assumption. However, Fox et al. found their results to be robust to the Gumbel distributional assumption.
5. Assuncao and Meyer (1993) also showed the optimality of consuming more of a product alternative of which the consumer has more inventory. Their consumption policy, termed "stock pressure," was found to minimize purchase costs.
6. Blattberg et al. (1980) explained "This assumption avoids integrating TC(q)[*Total Cost as a function of quantity*] with respect to *c* [consumption] which would greatly complicate the mathematics. The results would change, but the direction of the model's predictions should not because each household will still forward buy. Only the quantity bought per household will vary" (p. 120).
7. Read and Loewenstein (1995) did not find evidence of rational explanations for diversification in their data.
8. The first experiment used six snack food categories as stimuli, the second experiment used television shows as stimuli.
9. Briesch et al. (2009) weighted each category's assortment by the probability that the shopper needed the category on that store visit.
10. Borle et al. (2005) analyzed more categories and more consumers for the online retailer than Boatwright and Nunes (2001) had.

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