

Relating Heavy Snacking to Variation in Consumption Across Snack Brands and Categories

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ABSTRACT

The authors use a rich diary panel data on snacks consumed, to address the following questions: (1) To what extent do heavy snackers exhibit greater variation in consumption? Is variation in consumption across product categories or brands or both? (2) Are consumers high in varied consumption at the category level also high in varied consumption at the brand level and *vice-versa*? (3) What factors influence variation in consumption across categories and brands? The study accounts for direct varied behavior due to satiation and satiety, derived varied behavior due to consumption context and aspects of planned consumption. This is another departure from prior work that focused on only one aspect but not on all three. Results show that heavy snackers exhibit greater variation in consumption across brands, but not across categories. Further, there is a significant positive correlation between varied consumption across brands in a category and varied consumption across categories.

Keywords: Variety-seeking, Variation in consumption, Varied behavior, Brand, Category, Snack consumption.

Some of the “switching” among brands in a product category observed in household purchases can be attributed to consumers’ desire for variety that the brands offer (Kahn 1995; Kahn and Ratner 2005; McAlister and Pessemier 1982; Trivedi, Bass and Rao 1994). This has been referred to as *variety-seeking* behavior to distinguish it from switching caused by other reasons such as lower prices, promotions, or non-availability of “favorite” brands. Thus, variety-seeking refers to the intrinsic need of consumers to seek variety and is motivated by a preference for change (McAlister and Pessemier 1982). Variety-seeking could also be due to boredom, satiation, novelty seeking, or need for uniqueness and has been explained using the theory of optimal stimulation level (Raju 1980; Venkatesan 1973).

In addition to variety-seeking, other factors could also influence switching behavior which is known as *variation in consumption* (Van Trijp and Steenkamp 1992). Variation in consumption is a broader concept and is thought to be driven by multiple or different needs, changes in the marketing mix, and by intrinsic variety-seeking tendency. In the case of food products such varied consumption can also occur due to a physiological need for different nutrients such as fat, carbohydrates, protein and minerals. In this paper, we investigate variation in *consumption* of snacks at the individual level. This is in contrast to the majority of work that uses scanner panel data to look at variation in brands *purchased* by a household.

The ideal way to study varied consumption is by observing individual consumption behavior. The data we use comes from monitoring all the snacks that an individual consumes over a two-week period. It is a unique dataset that was specifically collected to understand the many dimensions of individual varied snack consumption and to provide a detailed map not only of consumers’ choices of snacks for consumption but also of the motivating factors that guided their

choices. The data encompasses several product categories and over 700 brands sold in the US packaged snack market. The rich dataset allows us to discover the extent of varied consumption that prevails among consumers and how individual and situational factors are related to the degree of varied consumption. Thus, our study of varied consumption by individuals adds to the existing literature on variety-seeking reflected in purchase behavior by households. Prior studies that used scanner data to study variation in brands purchased were unable to isolate intra household heterogeneity. As a result, variation in individual consumption is confounded by heterogeneity within the household. In contrast, our data is collected at the individual level and it tracks consumption of snacks, not purchases. So we are able to isolate variation in consumption using consumption data rather than purchase data.

We address four main research questions. First, we examine if heavy snackers also engage in greater varied consumption. This question is relevant from a managerial point of view since the bulk of sales is likely to be generated by heavy consumers and firms would like to attract and/or retain them. Should a seller offer many varieties to meet the needs of heavy consumers of snacks? Clearly, if heavy consumers do not exhibit markedly higher levels of varied consumption, we could conclude that increasing sales to them is better accomplished through marketing mix activities. On the other hand, if the opposite holds true, the firm could increase sales of a product to heavy snack consumers by offering more varieties. A theoretical reason for observing a difference in need for variety between heavy and light snackers is that light snackers may not reach the satiation levels that trigger greater varied consumption.

Second, we wish to examine whether heavy snackers seek variety at the product category level or at the brand level or both, since consumers may satisfy their desire for variety by switching to

other product categories or to other brands. This question has not been examined before and is pertinent to managers as it will help them decide whether it is important to offer greater variety across product categories or to offer a larger set of brands within a product category in order to attract heavy snackers. For example, in 2008, Frito-Lay, the largest producer of snacks, introduced a nut-based snack branded *TrueNorth*. One managerial question is whether they would be better off introducing a new brand of potato chips (thus increasing brand variety) instead of *TrueNorth* (which increases category variety), if their objective were to attract heavy snack users. Similar issues may be raised in other contexts such as the consumption of news, entertainment, and investment opportunities.

Our third research question asks whether variation in consumption across categories and that across brands are positively related. There is empirical evidence to suggest that variety-seeking in one product category is positively related with greater variety-seeking in another product category (Seetharaman, Ainslie and Chintagunta 1999). They suggest that variety-seeking tendencies may be a household trait that is exhibited across a number of product categories. In a similar vein, we ask whether consumers who exhibit high variation in consumption across categories also exhibit high variation in consumption across brands. An interesting issue would be to see if there are a large number of consumers that exhibit high variation in consumption in categories but not in brands and *vice versa*. It is conceivable that high variation in consumption across categories (or brands) mitigates the need for high variation in consumption across brands (or categories) since both mechanisms can reduce boredom due to attribute specific satiation.

We also examine if the relationship between variation in consumption and heavy snacking is bi-directional. Studies have shown that increased variety across meals increases the amount of food

consumed (Rolls, Duijvenvoorde and Rolls 1984; Rolls, Rowe and Sweeney 1981). Wansink (2010) has conducted numerous experiments to show that people eat more when they face a situation in which a greater variety of food is offered such as at a buffet or at a party. In other words, heavy snacking and variation in consumption may be mutually dependent.

Finally, we investigate a comprehensive set of factors that could influence variation in consumption. In particular, we assess the influence of situational and motivating factors on varied consumption behavior both at the category level and at the brand level. Based on prior research, we isolate a detailed list of covariates that have been associated with variation in consumption and test their effects. We also test new covariates that we believe could be important. Our rich data permits such an investigation and our results will add to our understanding and the literature.

We develop a comprehensive model of variation in consumption (hereafter termed VC), which builds on the earlier frameworks of McAlister and Pessemier (1982), Kahn (1995), Van Trijp, Hoyer and Inman (1996), and Inman (2001). Our model, using a simultaneous system of equations, is unique because it assesses the inter-relationships among category VC, brand VC and total snack consumption. We estimate the model using data from a large nationally representative sample of US consumers who reported every snack they consumed over a two-week period. In addition, consumers also recorded the specific need that drove them to eat the snack and the activity that they were engaged in when consuming the snack. Using this model we are able to test our hypotheses and obtain several new insights into varied consumption behavior that have managerial implications.

The rest of the paper is organized as follows. In the next section, we briefly review prior research and discuss the theoretical framework. We then develop our hypotheses. We follow with

Model and Estimation, where we present our empirical model, discuss the explanatory variables and give a detailed overview of our data. In the Empirical Results section we present the empirical results and in Insights and Managerial Implications we follow with an overview of the main insights and managerial implications. Finally, we conclude our study, discuss caveats and propose directions for future work.

Determinants of Variation in Consumption

Research in economics and marketing describes a consumer's varied consumption behavior as the tendency to seek diversity in her choices of services and goods. Variation in consumption can arise from three sources: an intrinsic variety-seeking tendency termed *direct varied behavior*, from different choice situations termed *derived varied behavior*, or from the need to plan for future consumption (Kahn 1995). Figure 1A is a conceptual depiction of these forces and closely follows McAlister and Pessemier (1982) and Kahn (1995). In Figure 1B, we present our conceptual model to highlight the similarities and differences from past research.

<Insert Figure 1 here>

The underlying behavioral theories used to explain direct varied behavior recognize that consumers may vary their choices to overcome satiation with their current selections, to reach an optimal stimulation level, to avoid boredom or to try something new and different (Berlyne 1960; Kahn 1998; McAlister 1979; McAlister 1982; Raju 1980; Van Trijp 1995; Zuckerman 1979). These researchers and others (Seetharaman and Chintagunta 1998; Van Trijp and Hoyer 1991) have examined empirically direct varied behavior using household purchase data or through laboratory experiments. One study that examines individual level consumption data is by Inman (2001). He

finds that direct varied behavior leads to variation in consumption primarily across flavors and less across brands. We also use individual level consumption data but we examine variation in consumption both across brands and across categories. Further, we study differences across consumers in direct varied behavior based on their consumption level.

It has been proposed that derived varied behavior depends on the consumption context, social setting, income and other demographic variables (Yang, Allenby and Fennell 2002; Pessemier and Handelsman 1984; Kahn 1995; Menon and Kahn 1995; Fennell 1997, Ratner and Kahn 2002). Most of the above studies report results from laboratory experiments. An exception is the study by Yang, Allenby and Fennell (2002) that used data on individual level consumption of beer to demonstrate that consumers drink beer based on the activity in which they are engaged. Our data contains not only the activity that consumers are engaged in while eating a snack but several other relevant variables including social setting, time of day, location, income and other demographic variables. We also introduce variety of needs, activities, and dayparts as potential influencers. Including a richer set of covariates will allow us to identify factors that may influence derived varied behavior at the category level in addition to that at the brand level.

Finally, variation in consumption can also result from the need to plan for future consumption (Kahn 1998; Huang, Khwaja and Sudhir 2012). In their paper, Huang and his co-authors examined individual level consumption data and show that anticipating future activities influences current consumption of soft drinks. Our study focuses on variation across consumers, rather than on inter-temporal variation in consumption. However, we are able to study how behavior is affected by the extent to which consumption takes place immediately after purchase as opposed to consumption from the pantry.

It is useful to note that past studies have focused on one of the three determinants of variation in consumption behavior: direct varied behavior, derived varied behavior or planning for future consumption. We will explore the effect of all three factors on variation in consumption behavior.

Hypotheses on Varied Consumption Behavior

Some consumers exhibit greater variation than others in their consumption behavior. As we already observed, Figure 1 shows the factors that might account for consumer heterogeneity. In our proposed model the focus is on understanding this heterogeneity by relating all the factors to variation in consumption behavior at the individual level. We know from past research that an important determinant of direct varied behavior is satiation (McAlister 1982). Since our study is across consumers, we can expect satiation is more likely to occur for heavy snackers than for light snackers. We therefore investigate cross sectional heterogeneity in consumption variation by formally linking it to consumption level (Figure 1B). Further, variation in consumption of snacks can occur either at the brand level (for example Lays or Doritos) or at the category level (for example salty snacks or sweet snacks) or both. We denote BrandVC and CatVC as measured variation in consumption across brands and across categories respectively.² Such variation in consumption may be affected by intrinsic needs, contextual variables, and other factors.

We propose five major hypotheses that capture consumer's varied behavior in consumption at the brand and the category levels, as shown below.

H1	Heavy snackers exhibit higher BrandVC and CatVC.
H1a	Consumers with higher BrandVC and CatVC exhibit heavy snacking.

² Later, we will provide an exact mathematical definition of these measures.

H2	BrandVC is positively related with CatVC.
H3	BrandVC in a category is negatively related with BrandVC in another category.
H4	When snacking is motivated by health, quality or relaxation needs, consumers will seek lower variation in consumption. When consumers are motivated by social needs, they will engage in greater variation in consumption.
H5	Consumers with more varied activities and more diverse needs exhibit greater variation in consumption.

The first hypothesis (H1) stems from the idea of satiation in the literature and our interest in consumer heterogeneity. Frequent consumption causes the inventories of product attributes to build up quickly. As the inventory of attributes builds up, the consumer feels satiated with those attributes and seeks other attributes in order to reach the optimal stimulation level. For example, in the case of food products, consumers get satiated with the different macronutrient components such as fat, carbohydrates and protein. This would encourage heavy snack consumers to seek more varied consumption than light snackers. Thus, satiation can lead to variety-seeking both at the brand and at the category level. The above relationship may also be a consequence of sensory-specific satiety, a concept analyzed in detail in the nutrition literature (see Raynor and Epstein 2001 for a review). According to these studies, consumers seek variety in their consumption because they experience satiation when they repeatedly consume foods that are similar in sensory properties, such as taste, flavor, texture, aromas or food type. For example, people who were forced to eat the same foods repeatedly over long periods of time experienced significantly reduced liking for those foods and a decreased willingness to eat those foods again (Rolls and de Waal 1985). If consumers switch among different types of foods, e.g. moving from salty to sweet foods, the pleasantness of each of the items of foods consumed increases (Rolls et al. 1981b). Thus, in the snacking context, sensory-

specific satiety suggests that consumers vary their snacks because they get satiated with the hedonics of the food consumed.

It is important to understand the full implication of H1. We measure BrandVC and CatVC for each individual consumer by aggregating in-home snack consumption over a two-week period. Naturally, this consumption is subject to random shocks depending on purchases and pantry stock, neither of which is observed by us. Studies have shown that increased variety across meals increases the amount of food consumed (Rolls, Duijvenvoorde and Rolls 1984; Rolls, Rowe and Sweeney 1981). This suggests that consumers with a high variation in consumption may consume more snacks than those with a low VC. Other research has shown that the availability of greater variety at a point in time increases the amount of food consumed (Raynor 2012; Raynor and Wing 2006; Raynor, Niemeier and Wing 2006, Meiselman and Schutz 2003; Rolls et al. 1981a,1981b; Zandstra, deGraaf and van Trijp 2000). Similarly, Kahn and Wansink (2004) also show that even perceived variety which is manipulated by varying how choices are presented while keeping actual variety the same, can also increase consumption quantities. Therefore, in our cross sectional model, both BrandVC and CatVC are treated as endogenous variables. For the sake of completeness, we formally offer an additional hypothesis, H1a which suggests that consumers who exhibit greater variation in consumption are likely to consume more snacks.

The second hypothesis (H2) is based on consumers' desire to relieve satiation and sensory specific satiety. Research in nutrition has established that consumers gradually become satiated not only with the food's macronutrients but also experience increased sensory-specific satiety (Benelam 2009). For example, a consumer with high BrandVC in the salty snack category is likely to want to switch to the sweet category because of satiation with the macronutrient salt as well as satiety with

the hedonics of the salty snacks. Keep in mind that high BrandVC in salty is related with heavy snacking in the salty category, making the switch to the sweet category more attractive. This suggests that high BrandVC may be associated with high CatVC. Another argument can be made based on treating variety seeking as an individual trait. Using purchase data, Seetharaman, Ainslie and Chintagunta (1999) show that households that seek variety across brands in one category also seek variety across brands in another category. They attribute this to a household characteristic or trait. The drive for stimulation through seeking variety has been shown to differ by individuals (Steenkamp and Baumgartner 1992). Were this an individual characteristic, then we might expect BrandVC and category VC to be positively correlated as in hypothesis 2.

The third hypothesis (H3) needs to be understood in light of Menon and Kahn's work (1995). In experimental studies they found that a consumer who seeks variety in soft drinks (snacks) is found to seek less variety in snacks (soft drinks). Clearly, soft drinks and snacks are different categories and they are complements. They posit that consumers are driven to maintain an optimal stimulation level and, if one obtains stimulation by consuming a variety of brands in one category, then they may prefer to reduce variety in another category. It would be interesting to see to what extent their finding holds in consumption data when the categories are either complements or substitutes.

In addition to testing these hypotheses, we assess the effects of the various factors that determine variation in consumption. These factors capture direct varied behavior, derived varied behavior and the effect of immediate versus planned pantry consumption. Our interest is in determining which of these factors influence consumers' overall consumption levels and their variation in consumption across brands and categories. For example, do health-conscious consumers or quality-driven consumers snack more? And do they seek more variety of snacks in

their consumption? Is the variety of activities people are involved in correlated with the level of snacking and/or the variety of snacks chosen? Can we identify special activities that make consumers seek more variety across brands or across categories of snacks? Do people who snack mostly from their pantry seek more variety than individuals who eat the snack as soon as they bought it? Lastly, are there particular demographics that explain the overall snacking level or variation in consumption? For example, are men and women similar or different in the variety of snacks they choose in their consumption? In this way, we are able to expand our understanding of variation in consumption from an analysis of individual level consumption data. The findings will also provide valuable managerial insights into a variety of marketing mix strategies such as product positioning, managing portfolio variety and pricing. We group these effects into two additional hypotheses, H4 for direct varied behavior and H5 for derived varied behavior.

Hypothesis H4 is grounded in the psychology and marketing literature. An individual's direct varied behavior is affected by an intrinsic desire to change due to satiation or need for stimulation and is captured through a set of interpersonal and intrapersonal motives such as desire for variety, the unfamiliar, information, group affiliation, and personal identity (McAlister and Pessemier 1982). In our study, given the specifics of food consumption, we identify these motives as the desire to be healthy, desire for quality products, desire for relaxation, desire for social affiliation, desire to tide consumption over until the next meal, and desire to avoid boredom.³ When a consumer is driven by health considerations or quality, she is more likely to limit her choices to brands and categories that are perceived as healthy and of high quality, respectively. Over time,

³ These motivations have also been suggested in numerous qualitative studies in the nutrition literature (Roininen et al. 1999, Connors et al. 2001, Meulenberg 2003) and are consistent with the motives presented in the standard varied behavior model of McAlister and Pessemier (1982).

these brands are more likely to be chosen more consistently, and therefore, reflect a lower variation in consumption (Bass, Pessemier and Lehman 1972). When the snack selections are guided by a need to relax or reduce stimulation, the theory of optimal stimulation level (Raju 1980) suggests that consumers are likely to prefer a narrow selection of choices, thus leading to lower VC. The behavior is akin to a consumer seeking her ‘security blanket’ and reverting to her favorite options under stressful environments. On the other hand, when consumers are meeting a social need, they are likely to exhibit greater VC due to the fact that a larger selection of snacks is available at such occasions. They are more likely to either offer or sample snacks that are different than the ‘usual’ ones.

The last hypothesis, H5, builds on previous research that individuals’ varied behavior also varies in response to the external environment, to changes in usage situations (McAlister and Pessemier 1982), e.g. public versus private settings of consumption (Ratner and Kahn 2002) or due to various activities in which the consumer is engaged (Yang, Allenby and Fennell 2002). We add to this previous research to show that varied behavior increases for consumers who participate in more varied activities, who snack throughout the whole day, and who seek to satisfy a bigger variety of needs. This is consistent with the idea that variety seeking could be an intrinsic trait that manifests itself in not only food choices, but also in activities and motivating needs.

Model and Estimation

We develop a model using a simultaneous system of equations to understand the relationships among brand VC, category VC, and frequency of snacking. We specify each equation keeping in mind past literature on variety-seeking and variation in consumption. In our data all

snacks can be grouped into four categories – salty, sweet, fuel, and grain snacks. While salty and sweet snacks are self-explanatory, fuel snacks refer to nut-based bars, popcorn, and flavored nuts; and grain snacks include grain bars, pita chips, rice cakes, bagel chips and other grain-based snacks. Thus, variation of consumption across categories, denoted by $CatVC$, is calculated by monitoring consumption across these four categories. In each of these categories we monitor variation in consumption across brands, denoted by $BrandVC$. Since the grain category is very small, we will consolidate reporting of brand variation in consumption in the fuel and grain snack categories. Thus, we have three measures of brand VC - one for each category ($BrVC_{Salty}$, $BrVC_{Sweet}$, $BrVC_{FuelGrain}$). Our fourth equation in the system models variation in consumption at the category level ($CatVC$). The fifth equation models frequency of snacking ($TotSnacks_i$), which is measured by the total number of snacks consumed by a person over a two week period.

Several measures have been used in the literature to quantify variation in consumption (Steenkamp and Van Trijp 1991) - the number of different items consumed (Lancaster 1966; Lee 1987; Shonkwiler et al. 1987), entropy (Theil and Finke 1983), index of temporal variety (Pessemier and Handelsman 1984), varied behavior measure (Pessemier and Handelsman 1984; Handelsman 1987), and the Herfindahl index (Theil and Finke 1983). The advantages and shortcomings of these alternate measures have been discussed in Van Trijp and Steenkamp (1990), and Gijsbrechts, Campo and Niso (2000). Van Trijp and Steenkamp (1992) compared the validity of the alternate measures for variation in consumption used in economics and marketing and found that the Herfindahl index was the preferred measure, while ‘the number of different items consumed’ was the least reliable. Accordingly, we use the Herfindahl index measure of variation in consumption.

We define variation in consumption across brands in a given snack category ($BrVC_{c,i}$) based on the Herfindahl Index and calculate it as follows:

$$BrVC_{c,i} = -\log\left(\sum_{j=1}^{N_c} s_{j,i}^2\right)$$

where i denotes the respondent, N_c is the total number of brands within category c , and $s_{j,i}$ is the share of consumption of each snack brand, j , in that category. We further note that $BrVC_c$ must be computed for each snack category - salty, sweet, and fuel and grain snacks. If a consumer i snacks only one brand (i.e., exhibits low variation in consumption), the sum in the above expression will become 1, and if the consumer has an equal share of consumption across all brands, this sum will be $1/N_c$. We take the negative log transformation so that a lower value of $BrVC_{c,i}$ indicates a lower variation in consumption. In the estimation model, we use the notation $BrVC_Salty_i$, $BrVC_Sweet_i$, $BrVC_FuelGrain_i$ to measure consumer i 's brand variation in consumption in the Salty, Sweet, and Fuel and Grain categories, respectively.

Similarly, we define variation in consumption across categories (CatVC), for each respondent i in our data as a function of the sum of squares of the share of snack consumption in each category.

$$CatVC_i = -\log\left(\sum_{c=1}^4 s_{c,i}^2\right)$$

where i denotes the respondent, c stands for the snack category, and $s_{c,i}$ is the share of consumption in each snack category. As above, we take the negative log transformation so that a lower value of $CatVC_i$ indicates a lower variation in consumption and makes it easier to interpret.

To model consumers' snacking level and their variation in consumption across brands and categories, we build a system of equations as follows. Due to the bi-directional effects of quantity

of snacking and variation in consumption, the five equations need to be estimated as a simultaneous system of equations. Further, we expect the error terms in each of the equations to be also correlated due to unobserved factors such as product unavailability or perceived palatability. The nutrition literature shows that increased palatability increases appetite and eating rate and that the most palatable foods, such as fatty salty foods, tend to be the least satiating (Drewnowski 1998; Berthoud 2007). Other unobserved factors include the type of meals consumed, sleep deprivation, or dietary restrictions, each of which could affect the quantity of snacking as well as the desire for variety. For example, the energy density⁴ and portion size of meals consumed by an individual affect not only the level of subsequent consumption but also preferences across brands and categories. Stubbs et al (1996) show that a big breakfast high in protein suppresses hunger throughout the day. Spiegel et al. (2004) show that sleep-deprived consumers feel hungrier, therefore, eat more and make more unhealthy food choices (Knutson 2007). The foregoing reasoning suggests the need to use three stage least squares (3SLS) to estimate the model taking into account correlations across equations. We specify our model in equation (1).

$$\begin{bmatrix} \text{BrVC_Salty}_i \\ \text{BrVC_Sweet}_i \\ \text{BrVC_Fuelgrain}_i \\ \text{CatVC}_i \\ \text{TotSnacks}_i \end{bmatrix} = B_0 + B_1 \begin{bmatrix} \text{BrVC_Salty}_i \\ \text{BrVC_Sweet}_i \\ \text{BrVC_Fuelgrain}_i \\ \text{CatVC}_i \\ \text{TotSnacks}_i \end{bmatrix} + B_2 \mathbf{Direct}_i + B_3 \mathbf{Derived}_i + B_4 \mathbf{Pantry}_i + \\ B_5 \mathbf{Demographics}_i + B_6 \mathbf{Seasonality}_i + \mathbf{U}_i, \tag{1}$$

⁴ It is the amount of energy that a particular food contains per unit weight (Kcal/gram). Fatty foods tend to have higher energy density than proteins or carbohydrates.

where $BrVC_Salty_i$, $BrVC_Sweet_i$, $BrVC_FuelGrain_i$, $CatVC_i$, $TotSnacks_i$ are the endogenous variables measuring variation in consumption across Salty snack brands, Sweet snack brands, Fuel and Grain brands, as well as variation in consumption across categories of snacks and total level of snacking for each consumer i , respectively. The intercept vector is $B_0 = (\beta_{10} \beta_{20} \beta_{30} \beta_{40} \beta_{50})'$. B_1 is a 5x5 matrix of coefficients for the RHS endogenous variables; all diagonal elements are set to 0. **Direct** $_i$, **Derived** $_i$, and **Pantry** $_i$ are the vectors of exogenous variables measuring direct varied behavior, derived varied behavior and the pantry effect. **Demographics** $_i$ and **Seasonality** $_i$ are the vectors identifying demographic characteristics and seasonality in consumption. All variables are summarized in Table 1 and are listed in the next section. Matrices $B_2 - B_6$ contain the coefficients for the exogenous variables; some elements are 0 to reflect the identifying restrictions imposed on the structural parameters. Finally, $\mathbf{U}_i = (u_{1i} u_{2i} u_{3i} u_{4i} u_{5i})'$ is the vector of random error terms.

We confirm that our system is identified by testing the order and rank conditions. We exclude at least four of the exogenous variables to satisfy the order condition in each of the five equations. The number of excluded variables in equation 1 is 14 while that in equation 5 is 7 leading to an over-identified system. We identify the included and excluded variables in each equation based on previous theories of consumer behavior, empirical studies in marketing research, and by analyzing the correlations among the exogenous and endogenous variables in our data.

Explanatory Variables

One of our study's goals is to understand what factors influence brand and category VC and whether the same or different factors affect both types of VC. To facilitate a clearer understanding of the model, we summarize and define all our covariates in Table 1.

<Insert Table 1 here>

Using data on twenty five consumer needs that motivated their snack choice, we identified six main factors that describe consumers' direct varied behavior in consumption:

$$\mathbf{Direct}_i = (Quality_i Health_i Relax_i Social_i TideMeOver_i Boredom_i)$$

The need for quality snacks (*Quality*), desire for healthy food (*Health*), desire for relaxation (*Relax*), desire for social snacking (*Social*), desire for energy until the next meal (*TideMeOver*) and desire to escape boredom and try something new and different (*Boredom*) are the intrinsic motives that influence consumers to vary their choices. They are consistent with intrinsic needs used in prior research in marketing and nutrition as shown in Table 2. These intrinsic needs are captured through a factor analysis of 25 motivational needs⁵ used by consumers to indicate why they chose the snack they consumed in each occasion.

<Insert Table 2 here>

The vector of derived varied behavior we consider in our model estimation is:

$$\mathbf{Derived}_i = (Activity_i ByItself_i AM_i Weekend_i Num_Act_i Num_Needs_i Num_DayParts_i)$$

Consistent with previous research, we test for the effects of different activities at the time of consumption. We also examine if variation in consumption changes when the snack was consumed by itself, versus when enjoyed with other snacks or drinks. As detailed in Table 3, some of these factors have been used in past research of derived behavior. We further add to the literature by including three new factors of derived varied behavior. First, we wish to know if consumers who are involved in more varied activities, rather than fewer, would exhibit greater VC (*Num_Act_i*).

⁵ In their 2002 study on beer consumption, Yang, Allenby and Fennell (2002) used a similar list of motivational statements to gauge what makes consumers choose one brand versus another.

Second, we check whether consumers who snack throughout the day are different from consumers who snack only at limited times during the day ($Num_DayParts_i$). Third, we study whether consumers who experience a greater variety of needs (Num_Needs_i) also exhibit greater VC. These new factors measure changes in the external environment and extend prior research by allowing us to test whether the trait (i.e., need for variety in snacks) is also reflected in needs, activities, and timing of snacking.

<Insert Table 3 here>

In our data, prior to each snack occasion consumers indicated whether the snack they consumed was taken from the pantry or whether it was purchased for immediate snacking. We test whether consumers' immediate snacking influences the level of variety in snack consumption ($Pantry_i$). We expect that consumers who snack from the pantry may have a limited assortment of snacks and might exhibit a lower VC. This pantry effect accounts for the influence of the need to plan for future consumption as the third major driver of variation in consumption.

In addition to the three sets of factors, we test whether demographics explain variation in consumption across brands or categories. Our vector of demographic variables is consistent with previous research in marketing, as detailed in Table 4:

$$\mathbf{Demographics}_i = (Age_i \ Female_i \ HHSize_i \ Region_i \ Educ_i \ Race_i \ Exercise_i)$$

Lastly, we test for seasonal effects on variation in consumption across brands and categories. We include the annual seasons and ten of the most important US holidays.

<Insert Table 4 here>

Consumption Data

The data consists of self-reported snack consumption of a representative sample of US consumers over a two week period between 2008 and 2010. Of the 18,000 respondents, we considered 1893 consumers who consumed all their snacks at-home, since we wanted to minimize the effect of prices and promotions on variation in consumption. Respondents record their snack choice from among 700 brands of snacks sold in the US. For each snacking occasion, they report over 50 covariates that describe the individual and situational characteristics of the consumption. For example, the covariates describe the time when the snacking occurs, whether it is consumed in private or with someone else, whether it is accompanied by other food or drink, and the specific need that motivates the snack consumption. The data also contains demographics and other personal information such as weight, height, body mass index (BMI) and level of weekly physical exercise. Panelists remain in the panel for two weeks before being replaced. Each bi-weekly sample contains approximately 200 consumers, and is selected to be representative of the U.S. population.

Using the industry's market structure, all 700 snack brands are categorized into several categories: salty, sweet, fuel, grain, accompaniments and non-macro snacks. Salty snacks include chips, puffs, pork rinds, snack mixes, and pretzels (200 brands). Sweet snacks include cookies, coffee cakes and pastries, candy, gum, mints, and ice cream (200 brands). Fuel snacks are nuts and seeds, trail mixes, meat snacks, popcorn, pre-packaged fruit snacks, granola and energy bars (200 brands). The grain snack category includes crackers, rice cakes, breadsticks and bagel chips (60 brands). Accompaniments refer to salsas, dips, and hummus (40 brands) and non-macro snacks include fruits, vegetables and other homemade snacks. We drop accompaniments and non-macro snacks from further analysis. Only 5% of respondents consume accompaniments and, when they do,

the accompaniment is always consumed together with another snack, mostly salty. In our analysis, we also drop ‘non-macro snacks’ since they are home-made and one does not observe variation in brand consumption in this category. We also combined the fuel and grain categories into one group.

We define and report the descriptive statistics for all covariates in our model in Table 5. We see that consumers had between 5 and 86 snack occasions in a two week period, with a mean of about 16.65 snacks. They varied their consumption across the three snack categories and the variation in consumption at the category level (CatVC) ranged between 0 and 1.37, with an average of 0.78. The average BrandVC values range between 0.55 and 0.80. The fuel and grain category has the highest brand variation while the salty category has the lowest.

<Insert Table 5 here>

In our data, with each snacking occasion respondents specify the need that motivated their snack choice. They select from a list of 25 statements such as “I felt stressed and wanted to relax,” “I wanted to feel part of the crowd,” “I was thinking about myself,” “I wanted to have fun,” “I was bored,” etc. We performed a factor analysis on the 25 needs and obtained six orthogonal factors that account for 61% of variance. We named the six factors as: *Quality* (It is a quality product), *Health* (It helps me control what I eat), *Relax* (I want to relax), *Social* (It is great to eat with others), *TideMeOver* (It is just to tide me over), and *Boredom* (I wanted something new and different, I was feeling bored).

In addition to the motivating needs, consumers also report the situational factors at the moment of consumption as in Yang, Allenby and Fennell (2002). In particular, we test whether snacking behavior is different under the following situations: (1) when a snack is consumed on its own versus when it is accompanied by a drink or other food, (2) when snacks are consumed in the afternoon as

opposed to morning, (3) when snacks are eaten during the week day rather than the weekend, and (4) when snacking is accompanied by different activities (such as watching TV or doing chores).

ByItself is the share of total snacks consumed on their own, as opposed to consumption with some other food. On average, 53% of snacks are consumed on their own. *AM* is the share of snacks consumed in the morning (about 70%). *Weekend* is defined as the average share of snacks consumed during weekend (mean=84%). *Act1 – Act11* are the shares of snacks that occur during each of the 11 activities. The activities are listed in Table 1.

We model behavioral characteristics such as the fraction of the number of parts of day that a consumer snacks (*Num_Dayparts*), fraction of the number of needs that an individual satisfies in a two week period (*Num_Needs*), and fraction of the number of activities that a consumer reports as snacking occasions in a two week period (*Num_Acts*). For example, *Num_Dayparts* is calculated by dividing the number of different times of day when a consumer snacks by 8, which is the maximum number of day parts during the day, from before breakfast, at breakfast, all the way to at dinner and after dinner. The average value of *Num_Dayparts* is 0.55, *Num_Needs* is 0.45 (11/25) and *Num_Acts* is 0.27 (or 3/11).

In the set of covariates called *Demographics_i*, we consider the following socio-demographic variables describing each individual consumer: age (2-75 years old), gender (=1 for female), household size (1-10 members), income level (=1 if income > \$100k), education level (=1 if bachelor degree or more), and marital status (=1 if single). We also add a dummy variable that describes consumers' level of physical exercise (*Exercise*) and set it to 1 for high level, and 0 otherwise. In our dataset, the average consumer is 43.7 years old and lives in a household size of 2.79 members; 52% of consumers are women; 49% of consumers are single; 65% have a college

education and 86% reported income of \$100k/year or less; only 14% of consumers have a high exercise level.

Consumers' need to plan for future consumption is captured through *Pantry_i*. This variable is defined as the share of total snacks consumed from the pantry as opposed to immediately after purchasing. The snacks in the pantry were purchased before and stocked to address future preference uncertainty. The average value of *Pantry_i* is 0.95 which suggests that most consumers snacked from items available in the pantry.

Seasonal factors and holidays affect consumption of food and could potentially affect the need for variety. We created dummy variables for annual seasons: Spring, Summer and Fall, while keeping Winter as the reference for analysis. We also created ten dummy variables to account for the effect of special US holidays on snacking behavior. For instance, chocolate tends to be consumed more during Valentine's Day and potato chips during Memorial Day or Independence Day. We kept 'No Holiday' as the reference category.

Empirical Results

We present our results of the model fit in Table 6. The system weighted R-square is 30.57% and the 2SLS R-squared values range from 12.15% (for CatVC) to 31.24% (for Total Snacks). This is a good model fit for cross sectional data in real consumption settings. The cross model correlations ranged between 0.1 and 0.6 and were statistically significant and thus confirmed the need to estimate the model with a 3SLS.

<Insert Table 6 here>

We find empirical support for H1, as shown in Table 7 (row 5). Consumers' overall snacking level is a significant and positive predictor of BrandVC in all the categories, but not of CatVC. Every additional snack increases BrandVC of salty snacks by 0.02, BrandVC of sweet snacks by 0.026 and BrandVC of fuel and grain snacks by 0.012. Therefore, we find empirical support for H1 and we find that heavy snackers do engage in greater varied consumption at least at the brand level. This is an important finding for snack manufacturers. It suggests that in order to attract heavy snackers firms are better off increasing their brand variety within a product category, rather than offering many categories. Specifically, if Frito-Lay's objective was to attract heavy snack consumers, our model suggests that a new brand of potato chips might be better than offering a new category of snacks.

<Insert Table 7 here>

We also find support for the related hypothesis H1A, stating that greater variation in consumption is positively related to total snack consumption. As shown in column 9 of Table 7, the coefficients for the three BrandVC measures are all positive and statistically significant (10.2, 10.7, and 3.99). Thus, consistent with Rolls et al (1981a) which suggests that desire for variety or even availability of variety increases consumption of food, we find that BrandVC increases consumers' total snacking level. Interestingly, we do not find a significant association between CatVC and total snack consumption. This may be due to the fact that the CatVC has a lower coefficient of variation (0.38) than that of BrandVC (0.75 - 0.96) and so may not explain the total snacking behavior as well.

H2 posits that CatVC is positively related with BrandVC. We find that CatVC positively affects BrandVC in all three snack categories ($\beta = 0.778, 1.857, \text{ and } 0.579$) even though the effect in the

fuel/grain category is not significant ($t = 1.53$). Conversely, only the effect of BrVC_Sweet is significant and positive on CatVC ($\beta = 0.214$, $t = 4.16$). In the salty and fuel/grain categories, the effect of BrandVC on CatVC is non-significant. The results suggest that CatVC drives BrandVC but the reverse may not be true to a large extent. We find partial empirical support for this hypothesis.

The test for the third hypothesis finds that there is a statistically significant negative bidirectional relationship between BrVC_Salty and BrVC_Sweet. Similarly, BrVC_Sweet and BrVC_FuelGrain are negatively associated with each other. This means that if consumers seek more variety in salty snack brands, they seek less variety in the sweet category and *vice-versa*. We did not find a significant relationship between BrVC_Salty and BrVC_FuelGrain. Overall, our results provide partial support for H3 and are consistent with the optimal stimulation level theory which suggests that more stimulation in one category is compensated by lowering stimulation in another category (Menon and Kahn 1995). It is also possible that consumers like one category or the other (i.e., salty or sweet) and so are likely to seek brand variety within their preferred category. In some consumer segments, the preference for a category could also be influenced by their health and dietary restrictions.

Hypothesis H4 is also empirically supported. As shown in Table 8, health conscious consumers tend to be heavy snackers but are not variety seekers. Similarly, when consumers choose snacks motivated by a desire to seek a quality product or to relax, they appear to seek less variety. On the contrary, when consumers are driven by social needs or wish to alleviate boredom, they snack less but seek more variety. We can understand these findings as follows. Health oriented consumers may follow dietary recommendations of frequent eating and of restricting snack choices to healthy

brands in healthy snack categories. If consumers find a quality snack they stick with it and do not necessarily snack a lot. The results also show that when relaxing, consumers have a set of preferred snacks for consumption, and thus do not seek variety.

<Insert Table 8 here>

We find empirical support for H5 with brand VC but not with category VC. First, we find that active individuals who engage in more varied activities while snacking seek greater BrandVC in all categories. This suggests that seeking variety may be more of an individual trait that encompasses not only food but also manifests as a need for variation in activities. Second, consumers snacking throughout the whole day (as opposed to snacking only in the morning or afternoon) also snack more and exhibit greater BrandVC in the fuel/grain category. This is consistent with satiation theory. And, third, consumers who aim to satisfy a bigger variety of needs also vary their brand consumption more. Again, this is consistent with previous research showing that multiple needs give rise to more varied behavior (McAlister 1982).

Our rich set of covariates allows us to obtain several important insights into the factors that affect variation in consumption. We briefly summarize these insights and offer managerial implications.

Insights and Managerial Implications

Insight 1: Consumers snack more when they snack from the pantry, but exhibit lower variation in consumption.

At home, people can either consume snacks that they just brought home or they can snack from whatever they have in their pantry. We see in Table 9 that when consumers restrict their consumption to snacks in the pantry they exhibit lower BrandVC in both salty and sweet snacks.

Interestingly, the total snacks consumed for such consumers is higher. One managerial implication is that by stocking up a consumer's pantry, firms can increase consumption. However, if brand managers can trigger impulse snacking, consumers are more likely to try brands they do not normally have in their pantry.

<Insert Table 9 here>

Insight 2 (demographic): Women snack less than men overall but seek greater variety in sweets and in fuel and grain snacks. Individuals in larger households snack less often but enjoy more varied salty snacks. Educated consumers exhibit less variation in sweet and fuel and grain categories.

From Table 10, we see that women snack less than men but have a higher VC in sweet and fuel and grain categories. The finding is consistent with the popular notion that women have a greater preference for sweets and pay greater attention to their weight than men (Christensen and Brooks 2006). At first glance, the greater amount of snacking in smaller households may appear to be counterintuitive but it may be due to the fact that singles are more likely to substitute snacks for prepared meals. Individuals in larger households may seek greater brand variety because of the availability of a larger selection of snacks in the pantry.

<Insert Table 10 here>

Insight 3: Consumers snack more when watching TV and on a greater variety of salty snacks. A greater variety of salty snacks are also preferred with a meal. They do not seek variety in the Fuel and Grain category regardless of the context of snacking.

We obtain this from examining Table 9 (rows 4-9). Among the various contexts of snacking, consumers tend to snack more only when watching TV. This can be explained through mindless

eating, as documented in the nutrition literature and industry articles. The next result follows the intuition, since in the US, traditionally consumers have salty snacks with their meals, particularly sandwiches. The last finding is interesting and suggests that consumers have very strong preferences for the fuel and grains snacks they choose in various situations. For managers this implies that when introducing a new fuel or grain product, the market will not readily sample it or accept it. So, they have to position it clearly and strongly promote it.

Conclusions, Caveats and Future Research

This paper explores variation in consumption using rich individual level consumption data. Specifically, we use consumption data to investigate variation in consumption across brands within a category (BrandVC), and variation across categories (CatVC). We seek to understand how both types of variation in consumption are related to the total number of snacks consumed. Such an understanding would help managers to better target the heavy snackers segment. We believe that our study represents the first comprehensive investigation of variation in consumption across brands and categories that used consumption data.

We develop our hypotheses based on an extensive literature review of variety seeking and variation in consumption from three areas - marketing, economics, and nutrition. We then empirically test the hypotheses relating variation in consumption to total level of snacking in addition to testing the effect of factors that have been suggested in prior work. Our first result is that heavy snackers exhibit higher variation in consumption across brands. However, heavy snacking does not appear to be related to variation in consumption across categories. The result is consistent with satiation theory that suggests that consumers who snack frequently are more likely to be

satiated and hence would exhibit greater variation in consumption. The surprise is that variation across categories is not a substitute for variation across brands. This may be partly explained by the finding that consumers switch more intensively across flavors than across brands in 14 out of the 15 categories examined as shown by Inman (2001). By a similar logic, consumers may switch more between brands rather than between categories. The resulting low variation in CatVC across consumers may lead to non-significant effects.

Second, we find that BrandVC and CatVC are indeed positively related. If, as stated in the literature, individuals differ in their intrinsic propensity to seek variety then consumers who seek greater variety are likely to exhibit greater BrandVC as well as greater CatVC. In fact, we find that such consumers also exhibit a greater number of needs, participate in a greater variety of activities, and snack at more times during the day. This also suggests that there are some segments that seek greater variety across categories but not across brands and vice-versa. Based on a median split of BrandVC and CatVC, we obtain the following distribution of customers in the four segments which suggest that about a third of the customers seek variety in one (category or brand) but not the other. We leave the investigation of the characteristics of such customers as a fruitful area of future research.

	High Brand VC	Low Brand VC
High Category VC	31.7%	17.9%
Low Category VC	17.7%	32.7%

Third, we find that BrandVC in one category is negatively related to BrandVC in another, thus confirming prior laboratory experimental results (Kahn and Ratner 2005). In this way our

findings with respect to consumption behavior both extend and confirm prior results from studies that use brand choice data or laboratory data.

Taking advantage of the richness of our data we also obtained several insights into consumer behavior that have potentially important managerial implications. Although the specific managerial implications are most relevant for the snack category the general thrust of our findings offers guidance on how variety-seeking behavior can be incorporated into development of marketing strategy. For example, we are able to show how a manager can distinguish between affecting primary demand or stealing from competitors; how to think of variety-seeking in the context of new product introduction strategies; and how to develop better targeting and segmentation strategies.

It is useful to note some caveats to our findings. One reason why heavy snacking is not positively related to variation in across categories could be because we used only four categories to measure CatVC. With more product categories, we think the relationship may be stronger. Our measure of heavy snacking is the number of times a consumer ate a snack. A more complete measure would also account for quantity consumed. We did not have the quantity data that we needed since consumers ate from large packs of snacks available in the pantry. Since we did not have purchase data we restricted our study to only in-home consumption. So while our results remain valid we were unable to use all the data. Our hypothesis H1A could be stronger if we had the actual inventory available at home for all snacking occasions. Since we do not have that data we are unable to fully resolve the relationship of availability of variety to level of snacking. Another interesting direction for future research is to study categories other than food, for example, music, movie rentals and video games. We hope our study will encourage further research to understand how category variety influences brand variety and total consumption under various conditions.

Table 1. SUMMARY OF MODEL VARIABLES

Variable	Definition
TotSnacks	Quantity of Snacking: the total number of snacks consumed by a person over a two-week period.
BrVC Salty	Variation in Consumption across Salty Brands
BrVC Sweet	Variation in Consumption across Sweet Brands.
BrVC FuelGrain	Variation in Consumption across Fuel and Grain Brands.
CatVC	Variation in Consumption across Snack Categories.
<i>Direct Varied Behavior</i>	
Quality	The desire for Quality: calculated latent factor score.
Health	The need for Health: calculated latent factor score.
Relax	The desire to Relax: calculated latent factor score.
Social	The desire for Social snacking: calculated latent factor score.
TideMeOver	The need to Tide Over until the next meal: calculated factor score.
Boredom	The need to escape boredom and try something new: calculated factor score.
<i>Derived Varied Behavior</i>	
Act. 1: Watching TV	Percentage of snacks consumed while watching TV.
Act. 2: Doing nothing special	Percentage of snacks consumed while doing nothing special.
Act. 3: Working on the computer	Percentage of snacks consumed while working on the computer.
Act. 4: Eating a Meal	Percentage of snacks consumed while eating a meal.
Act. 5: Doing household or personal chores	Percentage of snacks consumed while doing household chores.
Act. 6: Watching Football	Percentage of snacks consumed while watching football.
Act. 7: Working	Percentage of snacks consumed while working.
Act. 8: Studying	Percentage of snacks consumed while studying.
Act. 9: Socializing/Partying	Percentage of snacks consumed while socializing.
Act. 10: Doing sports or other physical activity.	Percentage of snacks consumed while doing sports.
Act. 11: Other activities.	Percentage of snacks consumed while involved in other types of activities.
ByItself	Percentage of snacks consumed by themselves (as opposed to combining with other snacks or drinks).
AM	Percentage of snacks consumed in the morning.
Weekend	Average daily share of snacks consumed during weekends.
Num_Dayparts	Fraction of the number of different parts of day that a consumer snacks, e.g. a consumer snacks in 6 of the 8 parts of the day recorded in the consumption diary.
Num_Acts	Fraction of the number of different activities a consumer engages in when it decided to snack, e.g. a consumer snacks in 8 of the 11 activities recorded in the diary.
Num_Needs	Fraction of the number of needs that an individual seeks to satisfy when snacking, e.g. 20 out of 25 needs recorded in the diary.
<i>Planned Effect</i> Pantry	Proportion of snacks consumed from the pantry (as opposed to those consumed as soon as they were purchased and brought home).

Table 2. DIRECT FACTORS OF VARIATION IN CONSUMPTION

Concepts	Used in Prior Studies	Measures Used in Our Study
<i>Intrapersonal motives</i>		
Desire for change/novelty	McAlister and Pessemier (1982), Raju (1980), vanTrijp et al. (1996), Baumgartner and Steenkamp (1996), Seetharaman and Chintagunta (1998), Seetharaman et al. (1999), Yang et al. (2002)	Boredom (Try Something New)
Need for stimulation	Berlyne (1970), Kahn (1998), Ratner and Kahn (2002)	Relax
Desire for information	Roininen et al. (1999), Connors et al. (2001), Meulenberg (2003)	Quality, Health
Attribute satiation	McAlister (1979, 1982)	
Sensory specific satiety	Inman (2001)	TideMeOver
<i>Interpersonal motives</i>		
Affiliation	Menon and Kahn (1995), Yang et al. (2002)	Social
Distinction		

Table 3. DERIVED FACTORS OF VARIATION IN CONSUMPTION

Concepts	Used in Prior Studies	Measures Used in Our Study
Public versus private consumption	Ratner and Kahn (2002)	InPrivate
Activities at the moment of consumption	Yang et al. (2002)	Act. 1 - 11
Combination of foods/drinks consumed together	Fennell (1997), Menon and Kahn (1995)	ByItself
Assortment Variety	Wansink (1999)	
Time of Day	Roehm and Roehm (2004)	AM
Time of Week		Weekend
Environment influence on variety of needs to satisfy, focused or broad consumption occasions throughout the day or variety of activities involved in.		Num_Dayparts Num_Needs Num_Act

Table 4. DEMOGRAPHIC AND SEASONALITY FACTORS OF VARIATION IN CONSUMPTION

	Used in prior studies	Our Study
<i>Demographics</i>		
Age	Yang et al. (2002), Fennell et al. (2003)	Age (2-75 year olds)
Gender	Inman (2001), Yang et al. (2002), Fennel et al. (2003)	Female
Race	Fennell et al. (2003)	White, African-American, Hispanic, Asian, Other Race
Region	Yang et al. (2002)	
Household Size	Seetharaman et al. (1999), Fennell et al. (2003)	Household Size
Education Level	Fennell et al. (2003)	College Level
Marital Status	Fennell et al. (2003)	Married
Income Level	Fennell et al. (2003), Seetharaman et al. (1999)	\$100K and over
Exercise Level		High Exercise Level
<i>Seasonality</i>		
		Seasons: Spring, Summer, Fall US Holidays: SuperBowl, ValentineDay, Easter, Memorial Day, Independence Day, Labor Day, Halloween, Thanksgiving, Christmas, New Year

Table 5. DESCRIPTIVE STATISTICS

Variable	Mean	Std. Dev.	Min	Max
BrVC_Salty	0.55	0.54	0.00	2.33
BrVC_Sweet	0.75	0.61	0.00	2.28
BrVC_FuelGrain	0.80	0.60	0.00	2.62
CatVC	0.78	0.30	0.00	1.37
TotSnacks	16.65	10.28	5.00	86.00
<i>Direct Varied Behavior Factors</i>				
Quality	0.00	0.99	-2.19	5.86
Health	0.01	0.99	-2.63	7.49
Relax	0.01	0.99	-2.60	5.68
Social	0.00	1.00	-2.19	7.92
Tide Me Over	-0.01	0.96	-3.03	5.19
Boredom	-0.02	0.96	-2.52	8.16
<i>Derived Varied Behavior Factors</i>				
ByItself (base: snack on its own)	0.53	0.31	0.00	1.00
AM (base: p.m.)	0.70	0.22	0.00	1.00
Weekend	0.84	0.18	0.00	1.00
Act. 1: Watching TV	0.50	0.30	0.00	1.00
Act. 2: Doing nothing special	0.17	0.20	0.00	1.00
Act. 3: Working on the computer	0.16	0.22	0.00	1.00
Act. 4: Eating a Meal	0.12	0.18	0.00	1.00
Act. 5: Doing household/personal chores	0.03	0.07	0.00	0.73
Act. 6: Watching Football	0.02	0.07	0.00	0.88
Act. 7: Working	0.02	0.07	0.00	1.00
Act. 8: Studying	0.01	0.07	0.00	0.91
Act. 9: Socialize/Party	0.01	0.05	0.00	0.63
Act. 10: Doing sports/physical activity	0.00	0.01	0.00	0.14
Act. 11: Other activity	0.06	0.12	0.00	1.00
Num_Dayparts	0.55	0.18	0.13	1.00
Num_Acts	0.29	0.12	0.09	0.63
Num_Needs	0.45	0.18	0.04	1.00
<i>Pantry Effect</i>	0.95	0.11	0.00	1.00
<i>Demographic Variables</i>				
Age	43.70	19.17	2	75
Household Size	2.79	1.46	1	10
Marital Status (Single)	0.49		0	1
Education Level (College Education)	0.65		0	1
Income (\$100k/yr and less)	0.86		0	1
Exercise Level (High)	0.14		0	1
Gender (Female)	0.52		0	1

Table 6. MODEL FIT

	Endogenous Variables				
	BrVC_Salty	BrVC_Sweet	BrVC_FuelGrain	CatVC	Total Snacks
1 st stage Regression	17.89%	26.16%	23.89%	12.71%	37.42%
2SLS R-Square	17.12%	24.60%	24.99%	12.15%	31.24%
System Weighted R-Square	30.57%				

Table 7. EMPIRICAL RESULTS OF TESTING THE PROPOSED HYPOTHESES

	BrVC_Salty		BrVC_Sweet		BrVC_FuelGrain		CatVC		Total Snacks	
	Est.	Est.	Est.	Est.	Est.	t-val	Est.	t-val	Est.	t-val
BrVC_Salty			-0.514	-4.15	-0.083	-0.7	0.064	1.1	10.214	4.33
BrVC_Sweet	-0.469	-4.61			-0.315	-2.31	0.214	4.16	10.744	5.56
BrVC_FuelGrain	0.08	0.62	-0.345	-3.02			0.053	0.82	3.996	1.84
CatVC	0.778	2.34	1.857	6.14	0.579	1.53			-5.642	-0.93
Total Snacks	0.02	3.64	0.026	5.24	0.012	2.33	-0.001	-0.23		
Intercept	-0.468	-2.49	-1.002	-6.22	-0.171	-0.86	0.497	14.83	2.37	0.71

Table 8. EFFECTS OF DIRECT VARIED BEHAVIOR FACTORS

	BrVC_Salty		BrVC_Sweet		BrVC_FuelGrain		CatVC		Total Snacks	
	Est.	t-val	Est.	t-val	Est.	t-val	Est.	t-val	Est.	t-val
<i>Direct Varied Behavior Factors</i>										
Quality Needs	-0.01	-0.47			-0.10	-4.8	-0.03	-2.29	0.06	0.18
Health Needs	-0.13	-5.98	-0.093	-3.85	0.04	1.62	-0.01	-0.19	1.99	4.48
Relax Needs	-0.02	-1.36	-0.01	-0.64	-0.04	-2.08	-0.02	-1.96		
Social Needs	0.02	1.47			0.04	2.91	0.01	1.79	-0.79	-3.17
Tide Me Over Needs	-0.02	-1.38	-0.03	-2.71	-0.04	-2.4				
Boredom Needs	0.03	1.60	-0.004	-0.25	-0.03	-0.081	0.01	0.73	-1.18	-5.06

Table 9. EFFECTS OF DERIVED VARIED BEHAVIOR FACTORS

	BrVC_Salty		BrVC_Sweet		BrVC_FuelGrain		CatVC		Total Snacks	
	Est.	t-val	Est.	t-val	Est.	t-val	Est.	t-val	Est.	t-val
<i>Derived Varied Behavior Factors</i>										
ByItself	-0.06	-1.65					-0.01	-0.33		
AM			0.04	0.63	-0.11	-1.53			-0.2	-0.17
Weekend			-0.06	-1.12						
Act. 1: Watching TV	0.08	1.6							1.57	1.93
Act. 2: Doing Nothing Special			0.05	0.74			-0.01	-0.11		
Act. 3: Working on the computer					-0.1	-1.63	-0.01	-0.25		
Act. 4: Eating a Meal	0.17	2.09	-0.1	-1.44	-0.20	-2.32				
Act. 5: Doing household/ personal chores							-0.09	-1.21		
Act. 9: Socialize/ Party					-0.67	-2.42	-0.09	-0.74		
Act. 10: Doing Sports/ Physical Exercise							-0.48	-0.73		
Act. 11: Other Activities			-0.14	-1.18	-0.32	-2.55	-0.03	-0.53	1.44	0.73
Num_Dayparts	0.07	0.48	0.06	0.41	0.58	3.39	0.10	1.09	6.84	2.83
Num_Acts	0.32	2.18	0.44	3.4	0.46	2.95			-1.94	-0.69
Num_Needs	0.3	1.95	0.52	4.5	0.69	3.7	0.04	0.45	1.01	0.41
Pantry Effect	-0.723	-5.86	-0.459	-3.66					13.7	5.74

Table 10. EFFECTS OF DEMOGRAPHICS AND SEASONALITY ON VARIATION IN
CONSUMPTION

	BrVC_Salty		BrVC_Sweet		BrVC_FuelGrain		CatVC		Total Snacks	
	Est.	t-val	Est.	t-val	Est.	t-val	Est.	t-val	Est.	t-val
<i>Demographic Variables</i>										
Age	-0.001	-1.3	0.001	0.47						
Female			0.09	3.94	0.07	2.18			-1.3	-2.69
Household Size	0.03	2.75							-0.52	-3.41
Other Race	0.07	1.18								
College Education			-0.04	-1.96	-0.09	-3.28				
High Exercise Level					0.11	2.95	0.03	1.55		
<i>Seasonality Variables</i>										
Spring							-0.01	-0.55		
Summer							0	0.03		
Fall			0.06	2.21			-0.03	-1.54		
Superbowl	0.1	1.68			0.12	2.05				
Easter	0.14	1.72			-0.18	-2.02			1.27	0.93
Memorial Day									1.74	1.39
Labor Day			-0.15	-2.24	-0.19	-2.26			3.56	2.77
Christmas									1.59	1.14
New Year									-0.56	-0.55

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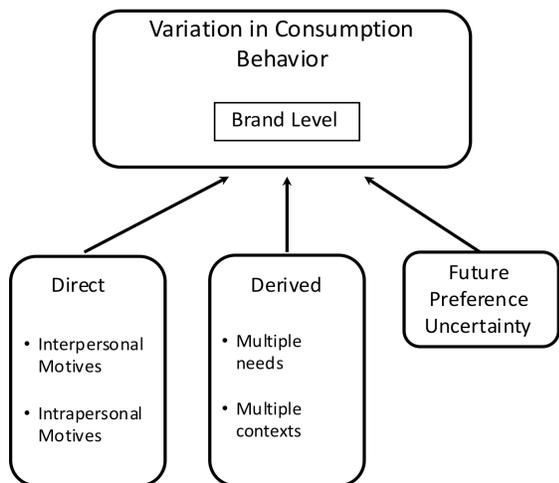
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Figure 1. MODEL OF VARIATION IN CONSUMPTION

(A) Model adapted from proposed model
McAlister and Pessemer (1982) and Kahn (1995)



(B) Our

