

ANTECEDENTS OF THE ADOPTION
OF NEW CONSUMER PACKAGED GOODS

by

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ABSTRACT

An ongoing stream of successful new product launches is typically considered to be the best way of surviving in the constantly changing, competitive environment of business. A great deal of attention has thus been placed on investigating what factors drive new product success, much of which has focused on what factors influence consumers to try or to adopt new products. Although these previous research efforts have yielded several insights, a deep understanding of the factors that influence consumers' new product adoption is still very limited. In this dissertation, I seek to provide additional insights into this topic by examining antecedents of new product adoption in the context of consumer packaged goods (CPGs). Compared to most research which has operationalized adoption as only a single first-time purchase, I investigate a sequence of purchases as the adoption process. I propose that consumers' past behaviors and marketing-mix variables play roles as antecedents of new product trial purchase timing, repeat purchase timing, and dollar amount of monthly repeat purchases over the twelve months after the trial purchase. Specific hypotheses predict how each behavioral and marketing antecedent will impact each phase of the adoption process. Panel data for sixteen new products from six food categories obtained from Information Resources Inc. are utilized in this study. To test the relationships among the behavioral and marketing antecedents and the three outcome variables, two types of econometric models are utilized: a discrete-time hazard model is used for trial and repeat purchase timing and a Type I Tobit model is used for repeat purchase amount in dollars. The empirical results are discussed.

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By completing one journey to getting a Ph.D. degree, I am now standing at the starting line of another journey to build up an academic career. Throughout this journey, I genuinely hope I can be a teacher who can help many students as much as possible by being their mentor and friend, just like my mentors at UA did for me. I also want to be a researcher who can contribute to the body of the academia in Marketing just as do my co-authors and other faculty at

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CHAPTER 1

INTRODUCTION

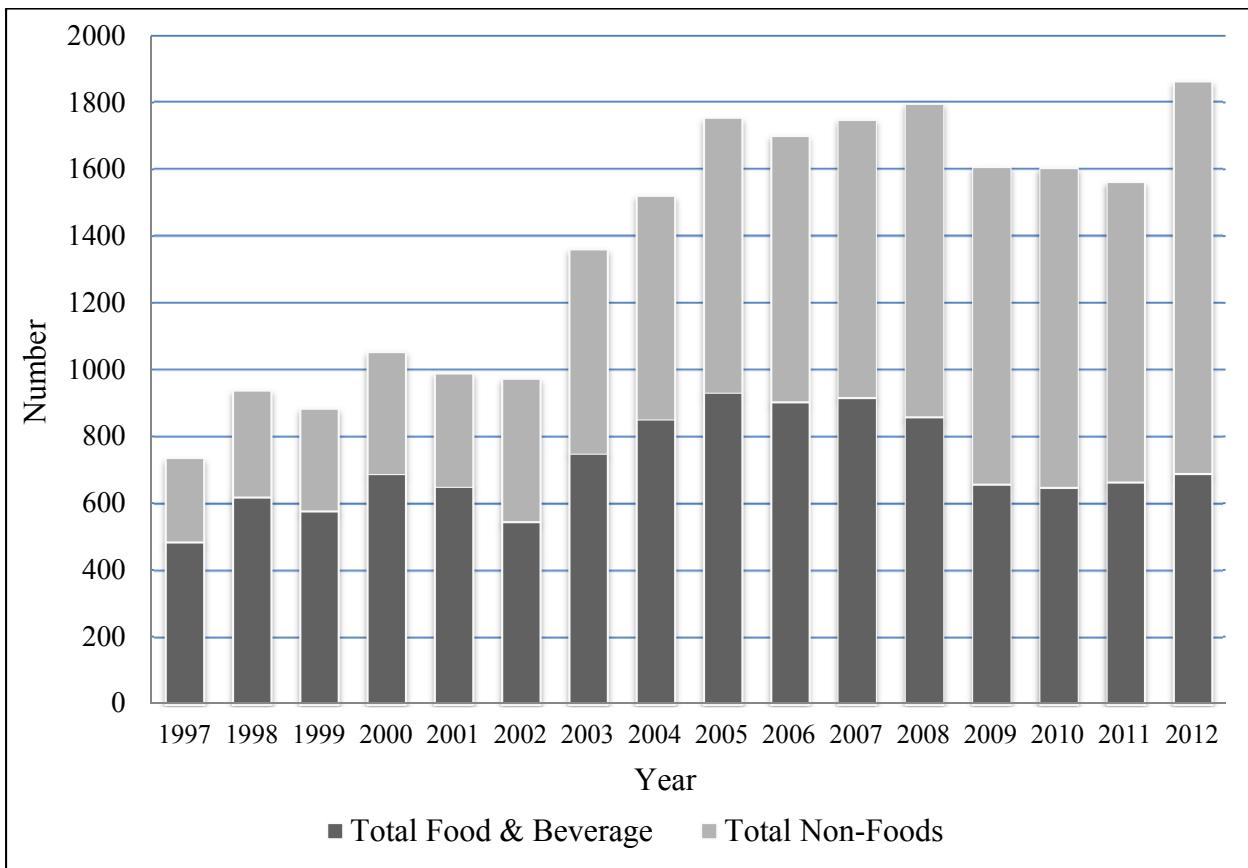
Consumer product firms typically make huge efforts to acquire and keep consumers by continuously introducing new products into what are typically mature markets. Launching new products successfully enables firms to be more competitive in an ever-changing market environment and thus to increase their long-term financial and market performance (Pauwels, Silva-Risso, Srinivasan, and Hanssens 2004; Srinivasan, Pauwels, Silva-Risso, and Hanssens 2009). In particular, manufacturers of consumer packaged goods (CPGs) make tremendous investments in new product development and launch a large number of new products into the market every year. As seen in Figure 1.1, the rate of new CPGs has been continuously increasing from 1997, except for a drop after 2008 due to the financial crisis in that year. This number has increased as the economy has improved, however, and approximately 1,900 new brands were introduced into the market and displayed on retail shelves in 2012, more than two and a half times the number ($N = 736$) launched in 1997.

However, in spite of firms' efforts to aggressively launch new products into the market, the success rate of these new products is very low. Thousands of new CPGs hit U.S. retail shelves every year, but three-quarters of them fail to reach even \$7.5 million in sales during the first year of their introduction in the market. A new product which reaches more than \$50 million in first-year sales is considered to be highly successful, but fewer than 3% of the new CPGs launched reach this milestone (Schneider and Hall 2011). Approximately 70% to 90% of the CPGs introduced into the US market every year are pulled off the shelves within a year after

their launch (Gourville 2006). These high failure rates are due to multiple factors. However, one of the most critical factors is that firms do not fully understand their target consumers' responses to the launch of new products (Bartels and Reinders 2011; Hauser, Tellis, and Griffin 2006), including the complex effects of consumer attitudes, purchases, and shopping habits.

Figure 1.1

New CPG Brand Introductions (1997-2012)



Source. IRI's 2004-2012 New Product Pacesetters Reports

A large body of academic research has accumulated in the attempt to understand the characteristics of consumers who are more likely to adopt new products and/or to adopt them earlier (e.g., Gatignon and Robertson 1985; Goldsmith, Flynn, and Goldsmith 2003; Steenkamp and Gielens 2003). For example, the effect of demographics on adoption has been well-

documented. Specifically, as consumers are younger, richer, or more educated, they are more likely to purchase new products and/or to do so earlier (Gielens and Steenkamp 2007; Im, Bayus, and Mason 2003; Im, Mason, and Houston 2007). In spite of these collective research efforts, prior research has not provided sufficient information to help firms to fully understand consumers' adoption behaviors toward new products. As several researchers have recently called for more investigation of this topic (Gielens and Steenkamp 2007; Hauser et al. 2006), this dissertation will address this research gap by exploring how consumers' past behavioral responses and firm marketing efforts act as antecedents of new product adoption.

In the adoption literature, the first purchase of a new product has been labeled differently depending on category. For durable goods/services, a single first-time purchase is generally regarded as indicating the adoption of that product/service (e.g., Prins and Verhoef 2007), since a one-time purchase has long enough usage duration to conclude that consumers have adopted the new product. In contrast, for CPGs, a single first-time purchase is typically considered to be a "trial" of the new product (e.g., Steenkamp and Gielens 2003), because the trial cost is low enough that consumers can easily make a trial before deciding whether or not to adopt it. Therefore, repeat purchases contingent upon the trial purchase need to be considered to fully understand adoption behaviors. However, most research on CPGs has mainly focused only on the trial purchase and ignored repeat purchases.

Given that, in this dissertation, I address the following research questions:

1. Which behavioral and marketing mix antecedents drive consumers to make an earlier trial purchase and an earlier repeat purchase?

2. Are the effects of these antecedents on trial purchase the same as, or different from, the effects of the antecedents on repeat purchase? If different, how are the effects on trial purchase different from the effects on repeat purchase?
3. Do these antecedents influence the repeat purchase amount or not?

Contributions of the Dissertation

This dissertation research makes several contributions to marketing theory and practice.

First, the adoption literature to date has mainly focused on the adoption of durable goods and mainly used survey methods with psychological metrics to assess what factors might impact consumers' adoption of new products. However, the use of survey methods has tended to limit researchers to the investigation of variables related to consumers' demographics and psychological measures. Durable goods are high-involvement products that require substantial consideration prior to a purchase decision, so only using those psychological measures along with demographics can be reasonably adequate in predicting adoption behaviors. However, CPGs fall under the category of low-involvement items that do not generally require pre-planning contemplation prior to a first-purchase decision, so survey methods with psychological measures are not very useful in predicting CPG purchases. Rather, predicting consumers' future behaviors based on measuring their *actual* past behaviors as antecedents appears much more relevant and important. Thus, this research extends the adoption literature by examining consumers' behavioral antecedents of new product adoption behaviors, as well as marketing antecedents, in the context of CPGs.

Second, whereas the past literature has mainly considered a single first-time purchase as constituting adoption behavior, I consider a sequence of purchases as the adoption process. Durable goods typically have high switching costs and fall under the high involvement category,

so the assumption that the first purchase of durable goods/service is synonymous with adoption is reasonable and adequate. On the other hand, because CPGs have low switching costs and fall under the low involvement category (Gatignon and Robertson 1985), consumers often make a first purchase of a new CPG as a trial before they really decide whether to adopt the product or not. In this case, a series of repeat purchases contingent on the first trial purchase is more likely to constitute adoption of the new CPG. The descriptive statistics of this research show that the average percentage of repeat purchase contingent on trial purchase across the six CPG categories is approximately 52% (see Table 5.1). Thus, only considering a single purchase as trial purchase is not sufficient to understand consumer adoption of CPGs. Rather, a series of repeat purchases over time contingent upon the first trial purchase may need to be considered in order to fully understand consumers' CPG adoption. In spite of the importance of considering a series of purchases as the adoption process, there is a dearth of research on examining the trial and repeat purchases together in the context of CPGs. In addition, there are calls in the literature for investigating these dynamics within the new product adoption process (e.g., Arts, Frambach, and Bijmolt 2011). Thus, I propose that the adoption of new products in the CPG category follows a sequence of purchases and examine how consumers' past behavioral and marketing antecedents impact the sequence of purchases: trial purchase timing, repeat purchase timing, and repeat purchase amount over time. Insights from this approach will help manufacturers and retailers to develop marketing strategies aimed at stimulating new product adoption.

Lastly, researchers in the adoption literature have focused on the effect of marketing communications and price promotion as marketing antecedents on new product adoption, but, to the best of my knowledge, assortment size has not been addressed as an antecedent of new product adoption in the literature. Given that new products are almost always competing with

existing products on the limited shelf space of retail stores, it is critical to understand the effect of assortment size on new product adoption. As such, this research examines how consumers respond to the size of assortment differently in each stage of the purchase sequence, as well as other marketing variables.

Organization of the Dissertation

Chapter 1 provides an introduction to the research topic areas, the proposed contributions of this research, and an organization of the dissertation. Chapter 2 reviews the relevant literature and theoretical background of this research. Chapter 3 proposes a conceptual framework for the research and develops the hypotheses about the antecedents of new product adoption. Chapter 4 discusses the model development for this research. Chapter 5 describes the data used to develop the models. Chapter 6 presents the descriptive statistics and main findings from the analyses of the data. Chapter 7 summarizes the findings from the study and discusses theoretical and managerial implications, limitations of this research, and directions for future research.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL BACKGROUNDS

Definitions of Innovation, Diffusion and Adoption

The body of knowledge on the concept of innovation is rooted in and applied to such diverse disciplines as geography, psychology, sociology, anthropology, rural economics, marketing, and operation management (Gatignon and Robertson 1985). In this respect, concepts borrowed from various disciplines enable us to capture several aspects of innovation. However, this also hinders progress in research because of a lack of consensus on the definitions, conceptualizations, and measurements of relevant concepts (Hauser et al. 2006). Specifically, the term “innovation” is often used interchangeably with “adoption” or “diffusion” across studies although these terms have different definitions and concepts. Therefore, before entering the main discussion of this study, I will clarify the meanings of each term and how they will be utilized in the following chapters of this dissertation.

The word innovation is defined in the online Merriam-Webster Dictionary as “the introduction of something new” to an individual, an organization, or a society. In marketing, the concept of innovation often refers to “the process of bringing products and services to market” (Hauser et al. 2006, p. 687). However, innovation can represent any effort of a firm to make a change. Meanwhile, both the adoption and diffusion literatures address an identical-looking phenomenon – the launch of a new product – but view it with different perspectives: *the consumers' acceptance of the new product versus the growth of unit sales of the new product.*

These different perspectives have influenced researchers to have different research interests and thus to develop different research areas in the literature.

Adoption refers to the decision that an individual or an organization makes to accept an innovation like a new idea, product, service, or culture. The adoption literature has developed in more consumer-oriented research (e.g., Ostlund 1974; Rogers 1976; Steenkamp and Gielens 2003). In other words, the adoption literature has focused more on identifying general traits of consumers who are likely to adopt new products earlier than others and on factors predicting their adoption of new products. For instance, some researchers have developed scales of consumers' personal traits of innovativeness (e.g., Kirton 1976; Goldsmith and Hofacker 1991), while others have examined the personal antecedents of new product adoption (e.g., Dickerson and Gentry 1983; Im et al. 2003; Steenkamp, Hofstede, and Wedel 1999).

In contrast, *diffusion* is often defined as the process of communication by which information about an innovation and purchases of that product spread through certain channels among consumers over time (Chandrasekaran and Tellis 2007; Mahajan, Muller, and Bass 1990). The diffusion literature has typically focused on new product growth models from a market-level perspective, such as the S-shaped pattern (Mahajan et al. 1990). The most well-known classical model in the diffusion literature is the Bass Model (1969). Many advanced analytic models have been extended from and based upon the Bass Model. Several well-documented reviews are available about basic as well as advanced diffusion models (e.g., Hauser et al. 2006; Mahajan et al. 1990).

Early diffusion research focused mainly on developing analytic models using market-level predictors (e.g., advertising and prices) and observing the spread of innovations across industries, countries, and cultures (e.g., Mahajan et al. 1990). More recently, researchers have

attempted to build up advanced diffusion models using individual-level predictors (e.g., consumers' preferences; Chatterjee and Eliashberg 1990; Goldenberg, Libai and Muller 2001a, 2001b). However, those models still focus on predicting a market-level outcome, such as new product growth. This focus of the diffusion literature distinguishes it from the adoption literature, which focuses mainly on consumers' innovative traits and drivers of new product adoption.

In summary, an innovation represents anything new introduced to a market, so the term innovation can be seen as a broader concept including adoption and diffusion within its construct. Regarding the terms adoption and diffusion, different perspectives on the same-looking phenomena of adoption and diffusion have led researchers to use these terms interchangeably and vaguely. In an effort to avoid vague arguments in this dissertation, the two terms are regarded as distinctive research streams of literature. Specifically, the *adoption* literature represents consumer-focused research regarding individual consumers' responses to new products. In contrast, the *diffusion* literature represents market-focused research regarding new product growth models. In the following section, I briefly introduce the new product diffusion literature on consumer segmentation and discuss in more detail the new product adoption literature which is more relevant to this research.

New Product Diffusion Literature and Consumer Segmentation

In his seminal paper, Bass (1969) introduced a diffusion model to forecast how a new product's sales can be expected to grow over time, developing a mathematical model based on Rogers' (1976) diffusion curve, but considering a different classification of consumers who adopt an innovation. Rogers classifies the population of adopters into five groups by their adoption timing: innovators, early adopters, early majority, late majority, and laggards. Bass dichotomizes the population of adopters into two groups: innovators and imitators, considering

Rogers' first group (i.e., innovators) to be the same as his own first group (i.e., innovators). According to Bass, innovators are influenced only by the mass media and decide about new product adoption independent from other consumers' decisions. Imitators are influenced only by word-of-mouth and are the aggregated groups from early adopters to laggards in Rogers' classification.

After the Bass model was published, his innovator-imitator dichotomy was widely accepted among scholars without much empirical or mathematical examination until later researchers attempted to confirm the dichotomy with empirical tests. Tanny and Derzko (1988) conduct an exemplary study, pointing out that "there remains a fundamental gap between the heuristic intuitive description of the diffusion process and the precise mathematical formulations which have been applied" (p. 226). Their empirical tests show that the Bass Model does not actually describe a dichotomy of two groups of consumers (i.e., innovators and imitators), but rather describes a single group of consumers. Their question about the innovator-imitator dichotomy was also acknowledged later by Bass and his colleagues in their review paper on diffusion models (Mahajan et al. 1990).

Since then, several researchers have attempted to develop advanced analytical models which meet the assumption of heterogeneous consumers in order to overcome the limitations of the Bass Model. Chatterjee and Eliashberg (1990) consider individual-level determinants (e.g., individuals' degree of risk aversion and price sensitivity) to predict an aggregate-level diffusion curve and develop an analytic model based on a Bayesian approach. Similarly, Goldenberg et al. (2001a, 2001b) develop their analytic models by linking individual-level determinants to aggregate-level outcomes of diffusion models.

Previous diffusion-centered research has left relatively unexplored the effects of different consumers' behaviors at both the individual level and the customer segment level. In this respect, several papers call for research on identifying subgroups using a customer-segmentation approach or developing diffusion models through the lens of an individual-level perspective (e.g., Chandrasekaran and Tellis 2007; Peres, Muller, and Mahajan 2010). Only a handful of researchers have examined how diffusion models vary across groups of consumers. Allaway, Berkowitz, and D'Souza (2003) examine the spatial diffusion of a loyalty program across five adoption groups in different diffusion stages (i.e., adoption timing) from innovators to laggards and find that the five groups show different patterns of the loyalty program. Since the main purpose of this dissertation is to explore additional antecedents of consumers' adoption of new products, the remaining discussion now turns to research focusing on consumers' adoption likelihood for new products.

New Product Adoption Literature

The early adoption literature is comprised of studies which mostly utilize surveys in which consumers are asked how many new items they have recently purchased among new products listed in a survey questionnaire (Dickerson and Gentry 1983; Foxall and Bhate 1993; Goldsmith, Freiden, and Eastman 1995) or about their intention to purchase new products in the near future (Agarwal and Prasad 1998; Kuo and Yen 2009; Okazaki 2007). These survey-based studies on new product adoption focus largely on the adoption of new durable goods. Only a few studies examine the new product adoption behavior in the context of consumer products (e.g., Foxall and Bhate 1993; Schiffman 1972). Table 2.1 briefly summarizes the survey-based studies in the adoption literature.

Table 2.1
Overview of the Survey-Based Studies in the Adoption Literature

Authors (Year)	Category /Industry	Consumer Characteristics			Marketing Variables			Outcome Variables
		State of Being	State of Mind	State of Behavior	Communication	Price Promotion	Assortment	
Schiffman (1972)	CPGs	✓	✓	-	-	-	-	trial
Dickerson and Gentry (1983)	home computer	✓	✓	✓	-	-	-	ownership
Venkatraman and Price (1990)	electronic products	✓	✓	-	-	-	-	adoption behavior
Venkatraman (1991)	electronic products	✓	✓	-	-	-	-	adoption behavior
Foxall and Bhate (1993)	CPGs	✓	✓	-	-	-	-	number of new products purchased
Vishwanath (2005)	electronic products	✓	✓	-	-	-	-	likelihood to adopt
Hirunyawipada and Paswan (2006)	electronic products	-	✓	-	-	-	-	ownership
Im et al. (2003)	electronic products	✓	✓	-	-	-	-	number of new products owned
Pagani (2004)	mobile communication service	✓	✓	-	-	-	-	intention to adopt
Im et al. (2007)	electronic products	✓	✓	-	✓	-	-	number of new products owned, time to adopt
Munnukka (2007)	mobile communication service	✓	✓	✓	-	-	-	adoption behavior
Schreier and Prügl (2008)	technology products	✓	✓	✓	-	-	-	number of new product owned, time to adopt
Timmor and Katz-Navon (2008)	electronic products	-	✓	-	-	-	-	adoption
Wang, Dou, Zhou (2008)	electronic products	✓	✓	-	-	-	-	number of new products owned
Vandecasteele and Geuens (2009)	several category products	✓	✓	-	-	-	-	trial
Fu and Elliott (2013)	electronic products	✓	✓	-	-	-	-	intention to adopt

With respect to the antecedents of new product adoption, this survey-centered literature has focused on two broad factors: consumer characteristics and marketing communications. The consumer characteristics can be categorized into three dimensions: *a state of being*, *a state of mind*, and *a state of behavior*. *A state of being* refers to consumers' demographics which include age, marital status, education, income, gender, and so on. *A state of mind* refers to consumers' emotional and attitudinal responses which are normally measured by questionnaires. *A state of behavior* refers to consumers' actual previous behaviors which are typically asked about rather than measured directly in the survey-centered literature.

Past adoption studies using survey methods have mainly focused on consumers' demographics (i.e., *a state of being*) and psychological responses (i.e., *a state of mind*) as drivers of new product adoption. In respect to demographic antecedents, past studies in the adoption literature show mixed effects of demographics on adoption across product categories, but mostly for consumer durables and services. For instance, older consumers are found to purchase more new financial products (Steenkamp and Burgess 2002), whereas younger consumers are shown to have higher ownership of new electronic products (Im et al. 2003; Im et al. 2007) and are more likely to use mobile communication services (Munnukka 2007). In terms of income, some studies find no significant effect of income on adoption (Schreier and Prügl 2008), but others show that consumers with higher income purchase more new electronic products (Im et al. 2003; Im et al. 2007) and innovative financial products (Steenkamp and Burgess 2002). In addition, some studies find a positive effect of education on adoption (Im et al. 2003; Steenkamp and Burgess 2002), whereas other studies find no significant effect (Im et al. 2007; Steenkamp and Gielens 2003). Some studies find that married consumers own more new products or are more likely to adopt new products (Steenkamp and Burgess 2002), whereas others find that married

consumers are less likely to adopt new products or show a lower level of adoption (Munnukka 2007). In general, although the effects of demographics on adoption are mixed, the consensus is that as consumers are younger and have higher income, they are more likely to purchase new products (Im et al. 2003; Im et al. 2007; Munnukka 2007). In addition, a meta-analysis conducted by Arts et al. (2011) supports these general findings across studies by showing a negative association between age and adoption and a positive association between income and adoption.

With respect to psychological antecedents, numerous studies have tested psychological variables as antecedents of new product adoption. Specifically, consumers who tend to own more new products or to purchase new products are measured as being *highly innovative* (Hirunyawipada and Paswan 2006; Im et al. 2003; Munnukka 2007), *highly self-confident* (Dickerson and Gentry 1983), *information seekers* (Dickerson and Gentry 1983), and *with lower perceived risks* (Hirunyawipada and Paswan 2006).

Whereas these above-mentioned studies have identified consumers' demographic and psychological characteristics as antecedents of new product adoption, past studies using survey methods have not given much attention to consumers' actual past behaviors (i.e., *a state of behavior*) as drivers of new product adoption. Only a handful of survey-based studies have examined the previous experience (or ownership) of other technological products/services as antecedents of purchasing new technology products (Dickerson and Gentry 1983; Munnukka 2007; Schreier and Prügl 2008). These examinations of consumers' behavioral antecedents are likely to be limited because survey methods tend to rely on consumers' memory, which makes it difficult to observe past behaviors in more detail.

In addition, most past adoption studies using survey methods do not examine marketing communications as drivers of adoption behaviors due to the lack of available data. A notable exception is a survey-based study conducted by Im et al. (2007), who measured exposure to advertising as a driver of the number of products owned among a set of eight new electronic products. They operationalized exposure to advertising by asking consumers how many new products they had seen advertised or in news articles among a set of eight new products and found that the degree of exposure to advertising has a negative effect on the number of new product ownership, which is a counterintuitive result. Although this approach is beneficial to understanding that there is a relationship between consumers' perception-based advertising exposure and new product adoption, this perception measure does not reflect real-world marketing actions which firms actually conduct for their new products.

Furthermore, the operationalization of adoption behavior in survey-centered adoption studies is primarily based on self-reports of either actual past purchase or purchase intention of the new products on a list in a questionnaire. Although the survey method has been widely accepted among scholars in the adoption literature, the limitations of both measures for adoption behavior are also well recognized. Relying only on consumers' recall about the number of new product purchases as outcome variables may lead to inaccurate measurement (McDonald 2008). In addition, intention to adopt is often a poor predictor of actual adoption behavior (Arts et al. 2011).

In efforts to overcome these limitations, a newer generation of studies has been able to use actual purchase histories in the context of new products. The increasing availability of scanner panel data which include a consumer identifier and purchase records across multiple categories, brands, and products over time enables researchers to more directly examine

consumers' past purchase records as potential drivers of new product adoption and use their actual purchases of new products as outcome variables. Table 2.2 summarizes the new product adoption studies based on the use of secondary data sources.

More recent studies using secondary data (e.g., customer database, scanner panel data, and online community data) have allowed researchers to examine the effect of various marketing communications, including mass advertisements, feature, and display, as drivers of adoption behavior. Prins and Verhoef (2007) see direct advertisement and mass advertisements as marketing antecedents of adoption timing of a new electronic service. In their unpublished working paper, Liutec, Du, and Blair (2012) consider store advertising (e.g., feature and display) as marketing antecedents of new product purchase timing. Steenkamp and Gielens (2003) and Sinapuelas, Wang, and Bohlmann (2015) consider both mass advertising and store advertising as marketing antecedents of trial purchase on new CPGs.

Table 2.2
Overview of the Secondary Data-Based Studies in the Adoption Literature

Authors (Year)	Nature of Data	Product Category /Industry	Consumer Characteristics	Communication			Price Promotion	Assortment	Outcome Variables	Repeat Purchase Timing	Repeat Purchase Amount
				Advertising	Feature & Display						
Prins and Verhoef (2007)	customer database	telecommunication service	✓	✓	-	-	-	-	time to adopt	-	-
Thomson and Sinha (2008)	online community	electronic products	✓	-	-	-	-	-	time to adopt	-	-
Steenkamp and Gielens (2003)	panel data	CPGs	✓	✓	✓	-	-	-	trial probability	-	-
Gielens and Steenkamp (2007)	panel data	CPGs	✓	✓	-	✓	✓	-	the number of purchase, purchase trend over time	-	✓
Liutec et al. (2012)'s unpublished working paper	panel data	CPGs	✓	-	✓	✓	✓	-	time to trial, time to repeat purchase	✓	-
Sinapuelas et al. (2015)	panel data	CPGs	✓	✓	✓	✓	✓	-	trial probability	-	-
Current Study	panel data	CPGs	✓	✓	✓	✓	✓	✓	time to trial, time to repeat purchase, repeat purchase amount	✓	✓

In the literature on adoption, first purchase of a new product by a consumer has been labeled differently depending on product category. For durable goods/services, consumers' first purchase of a new product/service is generally regarded as representing adoption (e.g., Prins and Verhoef 2007; Thomson and Sinha 2008), since a one-time purchase has a long enough usage duration to conclude that consumers have adopted the new product. In contrast, for frequently-purchased goods such as CPGs, the first purchase of a new product is often considered to be a "trial" (e.g., Steenkamp and Gielens 2003) rather than an adoption, since the trial cost of a new product is low enough that consumers can easily make a trial purchase before deciding whether or not to adopt it. Therefore, repeat purchases contingent upon the trial purchase should be considered to fully understand consumers' adoption behavior. Still, most research in CPGs has focused only on the first trial purchase (e.g., Steenkamp and Gielens 2003; Sinapuelas et al. 2015) and ignored repeated purchases. Exceptions include Gielens and Steenkamp (2007)'s study of purchase quantities and purchase trends of new CPGs together and Liutec et al. (2012)'s working paper on developing a forecasting model incorporating trial and repeated purchases of new CPGs together.

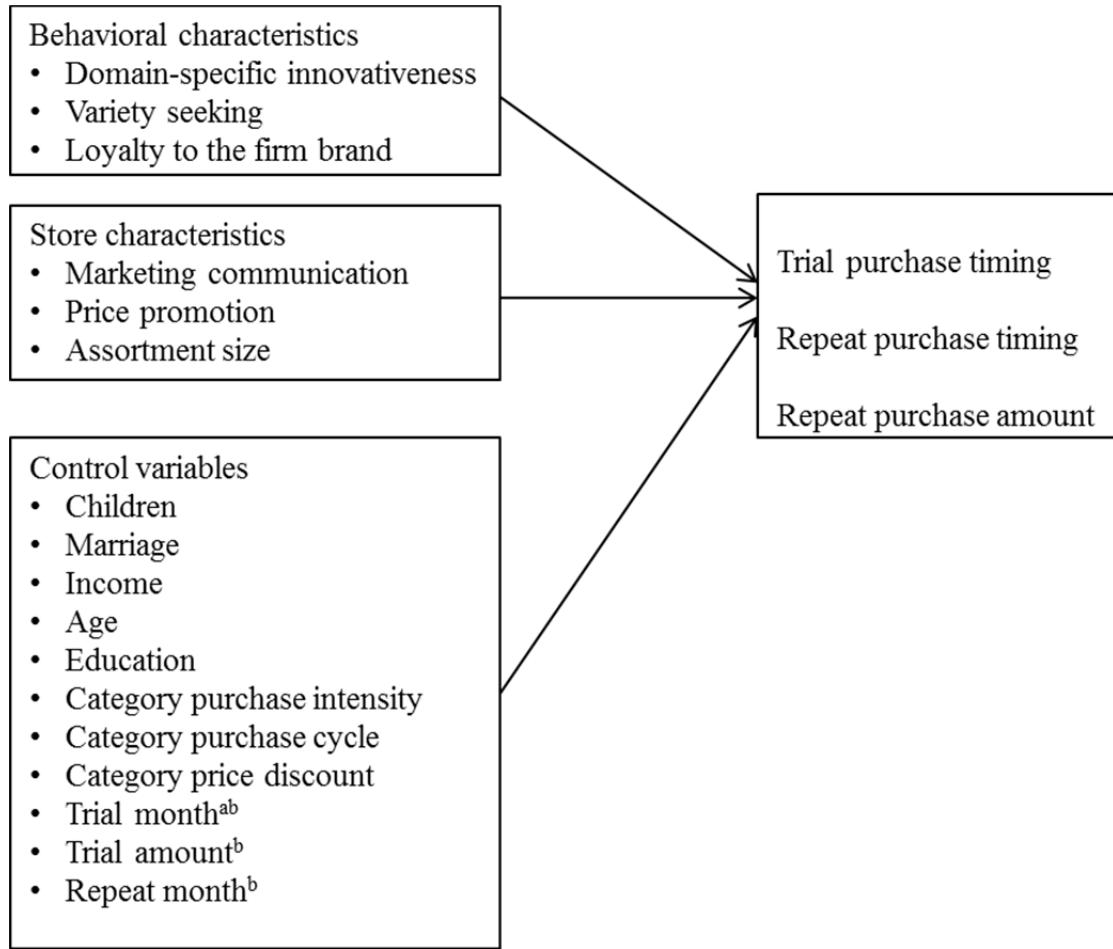
In order to extend the current research on antecedents of consumer adoption of CPGs, I consider trial purchase timing, repeat purchase timing and repeat purchase amount together as the purchase sequence of the adoption process. I address the following research questions:

1. Which behavioral and marketing mix antecedents drive consumers to make an earlier trial purchase and an earlier repeat purchase?
2. Are the effects of these antecedents on trial purchase the same as, or different from, the effects of the antecedents on repeat purchase? If different, how are the effects on trial purchase different from the effects on repeat purchase?

3. Do these antecedents influence the repeat purchase amount or not?

These research questions about how specific behavioral and marketing antecedents might impact trial and repeat purchase timing will be theoretically examined. To the best of my knowledge, this conceptualization of the comparison between trial and repeat purchase has not been discussed in the adoption literature. This comparison will be explained in more detail in the section on the hypotheses for this study. In addition, although the importance of the effect of product assortment on consumers' choice has recently been emphasized in the choice literature (Iyengar and Lepper 2000), I was unable to find any research on the relationship between assortment and new product adoption. These aspects are the most distinctive conceptual contributions of this dissertation. The conceptual model framework is presented in Figure 2.1

Figure 2.1
Conceptual Framework on Drivers of Adoption Process



Notes. a. Trial month will be used for the repeat purchase timing model.

b. Trial month, trial amount and repeat month will be used for the repeat purchase amount model.

CHAPTER 3

HYPOTHESIS DEVELOPMENT

Consumer Behavioral Antecedents

Domain-Specific Innovativeness

Consumer innovativeness is defined as the propensity of consumers to adopt new ideas and products (Hauser et al. 2006). Consumer innovativeness is broadly categorized into two types: innate innovativeness and domain-specific innovativeness. Innate innovativeness refers to the degree to which a consumer is receptive to new ideas and products in general (Midgley and Dowling 1978). Innate innovativeness is often referred to as a generalized personality trait (Bartels and Reinders 2011; Midgley and Dowling 1978), also referred to as global innovativeness (Hirunyawipada and Paswan 2006). Since consumers with high innate innovativeness have a natural tendency to accept innovative ideas and new products at a general level, they are believed to adopt products more often and faster than other types of consumers regardless of specific categories. However, the findings of empirical research on the relationship between innate innovativeness and new product adoption are somewhat inconsistent. While some studies find a positive relationship (Donthu and Garcia 1999; Im et al. 2003; Steenkamp and Burgess 2002), others find an insignificant relationship (Citrin, Sprott, Silverman, and Stem 2000; Manning, Bearden, and Madden 1995; Steenkamp and Gielens 2003; Venkatraman and Price 1990). Previous studies of innate innovativeness have typically used some set of psychometric scales measured with self-report survey methods. Kirton's adaption-innovation theory (KAI) is the most commonly-used scale for measuring innate innovativeness (e.g., Foxall

and Bhate 1993; Foxall 1995; Im et al. 2007; Schreier and Prügl 2008). Other scales are also available, including those of Leavitt and Walton (1975), Hurt, Joseph, and Cook (1977) and Raju (1980).

Researchers have raised criticisms of the concept of innate innovativeness by claiming that it is rare to find a generalized innovator across product categories or interest domains (Gatignon and Robertson 1985). Therefore, there has arisen a need to develop a measure for domain-specific innovativeness (Hirschman 1980), defined as the tendency to adopt new thoughts and/or new products within a specific domain of interest (Goldsmith, Freiden, and Eastman 1995; Goldsmith and Hofacker 1991). Goldsmith and Hofacker (1991) develop a psychometric scale for measuring innovativeness in a specific category, and numerous subsequent researchers have used this domain-specific innovativeness scale to capture consumers' innovativeness across categories (Goldsmith and Flynn 1992; Grewal, Mehta, and Kardes 2000; Klink and Smith 2001; Park and Jun 2003). Whereas the effects of innate innovativeness on adoption are somewhat inconsistent, studies utilizing domain-specific innovativeness show quite consistent results, specifically a positive relationship between domain-specific innovativeness and new product adoption. For instance, Citrin et al. (2000) find that as domain-specific innovativeness increases, the adoption of Internet shopping increases. Hirunyawipada and Paswan (2006) find that as consumers have higher domain-specific innovativeness, they tend to own more new technology products. In addition, Prins and Verhoef (2007) show that domain-specific innovativeness shortens time to adopt a new e-telecommunication service although it does not impact the likelihood of adoption. In line with these current findings, I propose that consumers with higher domain-specific innovativeness will make an earlier trial purchase. Thus, the following hypothesis is proposed:

H_{1a}: The higher the domain-specific innovativeness of a consumer, the shorter the time to trial purchase.

There has been little examination of the direct relationship between consumers' innovativeness and repeat purchase contingent upon trial purchase of a new product. In the case of durable goods, a few researchers have examined innovativeness as a driver of purchasing an updated model of new electronic products rather than examining repeat purchase of the same new product. This is because consumers normally have a long purchase interval between their first purchase and repeat purchase and tend to make a repeat purchase of an updated product. For instance, Kaya, Steffens, and Albers (2008) examine domain-specific innovativeness as a driver of replacement purchases in electronic products and find that because consumers with higher domain-specific innovativeness have a desire to seek out new and innovative products, they are more attracted to updated products including more advanced technologies, updated styles, and new product features. However, in the fast-moving and frequently-purchased field of CPGs, consumers have a relatively short purchase interval between their trial and repeat purchase and often repeat their purchase of the same new product. Although they may consider new products as new in their second choice context, consumers have already some knowledge and usage experience about the characteristics of the new product after making their first-time purchase. Thus, their tendency of innovativeness in the domain of CPGs may have less influence on their repeat purchase. For these reasons, I propose the following hypothesis:

H_{1b}: The effect of domain-specific innovativeness is stronger for trial purchase timing than for repeat purchase timing.

This hypothesis implies that as in H_{1a}, as consumers have higher levels of domain-specific innovativeness, they are more likely to make earlier repeat purchase. However, the effect

will be weaker for repeat purchases than for trial purchases such that as domain-specific innovativeness increases, the decrease in time to repeat purchase will be smaller than the decrease in time to trial purchase.

Domain-specific innovativeness may have a negative impact on the repeat purchase amount of a new product over time after the first purchase. Consumers with high domain-specific innovativeness may tend to get tired of new products more easily (Gielens and Steenkamp 2007). Thus, once their innovativeness is fulfilled by trying a new product a couple of times, they may seek out other new products rather than purchasing more of the same new product. I therefore propose the following hypothesis:

H_{1c} : The higher the domain-specific innovativeness of a consumer, the less the repeat purchase amount.

An alternative explanation can be that consumers might have some inventory from their first trial purchase that takes some time to consume so it will lengthen the time to repurchase. So, to control this alternative effect, I add trial month and trial purchase amount as control variables to the repeat purchase timing model and add trial month and trial purchase amount and repeat month as control variables to the repeat purchase amount model.

Variety-Seeking

Variety-seeking has been examined in diverse contexts (see McAlister and Pessemier 1982 for an interdisciplinary review). The term often refers to “the deliberate tendency to switch away from the brand purchased on the last one or more occasions” (Kahn, Kalwani, and Morrison, 1986, p. 90). The motivation for variety-seeking is explained by the theory of optimal stimulation level (Raju 1980). Namely, consumers have an optimal level of stimulation which satisfies them the most. Consumers may explore the environment by engaging in variety-seeking

to obtain an optimal level of stimulation (Menon and Kahn 1995). This level of optimal stimulation varies across individuals (Steenkamp and Baumgartner 1992). If the environment offers a consumer too much or too little stimulation, he or she will adjust the amount of stimulation to meet the optimal level. Variety seeking is “a means of obtaining stimulation in purchase behavior by alternating between familiar choice objects (e.g., brands and stores) simply for a change of pace” (Steenkamp and Baumgartner 1992, p. 435). In respect to exploring among *existing and familiar products*, variety-seeking is conceptually distinct from innovativeness, defined as a natural tendency to seek or adopt *new products* rather than existing products.

In this respect, consumers with a high optimal stimulation level tend to engage in more variety-seeking behaviors (Menon and Kahn 1995). Since consumers with a high optimal stimulation level are more likely to engage in curiosity-motivated behaviors, they tend to purchase new products earlier (Steenkamp and Burgess 2002; Venkatraman and Price 1990). Therefore, consumers who engage in more variety-seeking behaviors among existing and familiar products will make an earlier trial purchase. Thus, the following hypothesis is proposed:

H_{2a} : The higher the variety-seeking, the shorter the time to trial purchase.

Variety-seeking is conceptually more related to switching behaviors across products than to repeat purchase of the same product (McAlister and Pessemier 1982; Van Trijp, Hoyer, and Inman 1996). Variety-seeking is the tendency to alternate among existing products. Consumers who made a trial purchase of a new product may already satisfy their curiosity and thus may not make a faster repeat purchase of a new product which offers them a lower level of stimulation than the first trial purchase. Thus, a repeat purchase decision about the new product may not be much influenced by consumers’ variety-seeking. The following hypothesis is therefore proposed:

H_{2b}: The effect of variety-seeking is stronger for trial purchase timing than for repeat purchase timing.

Like hypothesis 2a, this hypothesis implies that consumers with higher levels of variety-seeking will make an earlier repeat purchase, but the effect on the repeat purchase will be weaker than the effect on trial purchases such that as variety-seeking increases, the decrease in time to repeat purchase will be smaller than the decrease in time to trial purchase.

In terms of the repeat purchase amount over the year, consumers with high variety-seeking tend to seek other existing products rather than to make repeat purchases of the same product. Thus, as consumers seek higher variety, their repeat purchase amount over the year after their first trial purchase will decrease.

H_{2c}: The higher the variety-seeking, the lower the repeat purchase amount.

Loyalty to the Firm Brand

Consumer's loyalty to a brand, defined as a consumer's commitment to repeat purchase, demonstrated by repeated buying of a product (Dick and Basu 1994), has been mainly researched in the brand extension literature (Aaker and Keller 1990; Smith and Park 1992). Previous studies on brand extension have been generally interested in new products introduced into different categories and the relationship between the parent brand in one category and the extended brand in another category. Specifically, the high quality of the parent brand increases the quality signals of the extended product (Bellizzi and Martin 1982; Wernerfelt 1988), so the perceived high quality of the parent brand increases the market share of the extended product (Smith and Park 1992). Consumers loyal to the parent brand can be inferred to be satisfied with the quality of the parent brand since satisfaction is a necessary step in loyalty formation (Oliver 1999). So, consumers loyal to the parent brands will perceive the higher quality of the parent brand from

their prior experience and infer the quality of the extended brand based on their experience. The high quality perception and the prior experience of the parent brand increases the likelihood of adoption of the extended product (Kim and Sullivan 1998).

In this dissertation, I consider the relationship between a firm brand (e.g., Coca Cola and Pepsi) in a category and a new product (e.g., Vanilla Coke and Sierra Mist) from the same firm launched in the same category. Consumers who have experience with existing products of a firm brand may use their prior experience of the existing products to infer the quality of the new brand of the same firm brand. As consumers are more loyal to the firm brand, they will have higher quality perceptions of the firm brand, which will lead them to adopt a new product from the same firm brand earlier. The following hypothesis is proposed:

H_{3a} : The higher the loyalty to the firm brand, the shorter the time to trial purchase.

Repeat purchase of a new product may rely on the personal experience of the trial of the new product. So, in contrast to the uncertain situation in which consumers use the quality perception of the firm brand to infer the quality of the new product before trial, in the repeat purchase situation, they already have their own usage experience from their trial of the new product, so the quality perception of the firm brand will have less influence on their repeat purchase decision. Thus, I propose that consumers loyal to the firm brand may not need to use as much of the quality perception of the firm brand to infer the quality of the new product, so the positive effect of consumers' loyalty to the firm will be weaker in repeat purchase timing than in trial purchase timing, as follows:

H_{3b} : The effect of loyalty to the firm brand is stronger for trial purchase timing than for repeat purchase timing.

In the case of repeat purchase amount over the year, loyalty to the firm brand may not be very relevant to the repeat purchase amount because consumers' own experience may help to establish their preferences for new products. For an example, consumers loyal to Classic Coke may not like the vanilla flavor of the new product, Vanilla Coke, after their trial purchase and thus decide not to make a repeat purchase. In that case, the relationship between loyalty to the firm brand and repeat purchase amount will be shown to be negative. On the other hand, consumers loyal to Pepsi may like the flavor of the new product, Sierra Mist, after their trial purchase and thus decide to make regular repeat purchases over the year. In that case, the relationship between loyalty to the firm brand and repeat purchase amount will be shown to be positive. So, the relationship between loyalty to the firm brand and repeat purchase amount can be either positive or negative depending on the consumer's experience with new products. Thus, on average, loyalty to the firm brand is not likely to influence the repeat purchase amount. So, the following hypothesis is proposed:

H_{3c} : Loyalty to the firm brand will not have a significant influence on the repeat purchase amount.

Marketing Variables

Marketing Communication

Numerous studies have been conducted on the effects of marketing communication on consumers' new product purchases, including marketing advertising, features, and in-store displays. Marketing advertising has been used to increase awareness and knowledge of new products. Some adoption and diffusion studies show that marketing advertising for a new brand tends to increase the adoption probability of a new service and shorten adoption timing (e.g., Allaway et al. 2003; Demoulin and Zidda 2009; Prins and Verhoef 2007). For example, the

target firm's marketing advertising in a category is found to shorten the time to adopt a new e-telecommunication service of the target firm, whereas competing firms' marketing advertising in the same category is shown to lengthen the time to adopt a new e-telecommunication service of the target firm (Prins and Verhoef 2007). Research on new CPG products finds that marketing advertising increases trial likelihood and shortens trial timing (Sinapuelas et al. 2015; Steenkamp and Gielens 2003). Feature advertising refers to advertising of products in newspaper inserts and store flyers (Bodapati and Srinivasan 2006). In-store display refers to setting up items in special stacked configurations at the end of an aisle. These marketing communications make new products more salient and promote them to grocery consumers (Ataman, Mela, and van Heerde 2008). Positive effects of these types of marketing communications on new product purchase probability are found in the literature (Allaway et al. 2003; Ataman, Mela, and van Heerde 2008; Prins and Verhoef 2007; Steenkamp and Gielens 2003). Thus, in line with the research findings, I propose the following hypothesis:

H_{4a} : The more the consumer is exposed to marketing communications, the shorter the time to trial purchase.

Marketing communication has been actively examined as a driver of repeat purchase behaviors of existing products in the loyalty literature (e.g., Deighton, Henderson, and Neslin 1994). To understand the mechanism of the effect of marketing communication on repeat purchase, considering interactions with consumers' own experience from the previous purchase is also important. The relationship between marketing communication and personal experience from previous purchase has been explained by two main theoretical bases: *framing* and *usage dominance* (Deighton et al. 1994). Framing theory supports the argument that advertising has an influence on consumers' repeat purchase by mitigating their own experience with the product.

Namely, advertising has a role of “framing” when consumers evaluate their own experience with the product. Consumers exposed to advertising reinforce feelings and thoughts related to their personal experience of the product and, thus, are more likely to make repeat purchases (Deighton 1984; Ehrenberg 2000). Usage dominance supports the argument that advertising has less influence on consumers’ repeat purchase because the consumers’ own usage experience is more relevant than the advertising message (Deighton et al. 1994; Vakratsas and Ambler 1999).

Although the degree to which advertising has an influence on repeat purchase is different between the two theories, both highlight the importance of considering personal usage experience in examining the effect of marketing communication on repeat purchases. Therefore, unlike trial purchase, repeat purchase of new products may be less likely to be influenced by marketing communication. The following hypothesis is proposed:

H_{4b} : The positive effect of marketing communication is stronger for trial purchase timing than for repeat purchase timing.

Like hypothesis 4a, this hypothesis implies that a higher level of marketing communication will shorten the time to repurchase, but the effect will be weaker for repeat purchase than for trial purchases such that as marketing communication increases, the decrease in time to repurchase will be smaller than the decrease in time to trial purchase. In terms of the repeat purchase amount over the year, it is proposed that marketing communication will impact the repeat purchase amount as follows:

H_{4c} : The more the consumer is exposed to the marketing communication, the higher the repeat purchase amount.

Price Promotion

Price promotion, or offering a discount on the brand, has two facets: the magnitude of the discount and the frequency of the discount (Nijs, Dekimpe, Steenkamps, and Hanssens 2001; Raju 1992). The magnitude of the discount, called *price-promotion depth*, is defined as “the average size of the promotions to which consumers are exposed” (Nijs et al. 2001, p. 4). The frequency of the discount, called *price-promotion frequency*, is defined as “the extent to which consumers are exposed to price promotion” (Nijs et al. 2001, p. 4). Previous studies in promotion clearly show that as the price-promotion depth increases, consumers perceive more value from the discount (Berkowitz and Walton 1980; Della Bitta, Monroe, and McGinnis 1981). In the case of price-promotional frequency, the consumer’s response is rather complex. During the price promotion of a brand, consumers may see the regular price (non-promotional price) of the brand as the reference, perceive the price promotion as “gain” and respond positively (Kalwani and Yim 1992). Based on Helson (1964)’s adaptation-level theory and Tversky and Kahneman (1974)’s anchoring-adjustment heuristics, other researchers have suggested that consumers’ reference price can be changed by the price-promotion frequency (Biswas and Blair 1991). Specifically, in a low-frequency price promotion context, consumers perceive the promotion as an exceptional event or opportunity and use the regular price as their anchoring point so that they perceive that they will receive a “gain” from the price promotion (Kalwani and Yim 1992) and are more likely to stockpile (Raju 1992). However, in a high-frequency price promotion context, consumers may adjust the expected price to the discount price and adjust their level of price perception to be closer to the discount price so they may no longer perceive a “gain” from the price promotion (Kalwani and Yim 1992) and are thus less likely to stockpile due to the high level of frequency (Raju 1992).

In the case of new products, consumers may perceive uncertainty in terms of product quality and attributes. Only when consumers perceive that the value is larger than the costs associated with the new products will they decide to make a trial purchase of the new product (Kalish 1985). Price promotion also serves to reduce the perceived cost which occurs from the uncertainty associated with the new product. Thus, consumers who are hesitant about whether or not to make a trial purchase will be more likely to decide to make a trial purchase with a price promotion because their level of uncertainty cost will trade off with the obtained value from the price promotion. However, the positive effect of price promotion will only be shown up to a certain level of price-promotion frequency. Too-frequent price promotion on a new product may negatively impact the new product trial because consumers do not know the actual value of the new product until they have their own experience with it. If there are too-frequent price promotions on the new product, consumers may discount its value to the discount price. Thus, consumers may not be likely to make an earlier trial purchase of the new product when the price-promotion frequency is high. So, I propose the following hypothesis:

H_{5a} : The more frequent the price promotion, the shorter the time to trial purchase up to a certain level; beyond this level, the more frequent the price promotion, the longer the time to trial purchase.

In the repeat purchase situation, consumers have their own experience of the new product from their trial purchase, so their perceived uncertainty associated with the new product will be reduced. Therefore, price-promotion frequency on the new product is expected to have less impact or no impact on consumers' time to repeat purchase than in the trial purchase situation:

H_{5b} : The inverted U-shaped effect of price promotion is stronger for trial purchase timing than for repeat purchase timing.

This hypothesis implies that the frequency level of price promotion will have either a weaker inverted U-shaped effect or no effect on the time to repeat purchase compared to trial purchases.

In terms of the repeat purchase amount, the effect of time-varying price promotion on repeat purchase amount over the 12 months will be positive. Although consumers may reduce the perceived costs associated with the uncertainty of the new product quality and attributes in repeat purchase situations, they may still perceive monetary value from the price discount and be more likely to benefit from the given price promotion. However, as price-promotion frequency increases beyond a certain level, consumers may regard the price promotion as a regular event and have less motivation to stock up on the given price promotion event. Therefore:

H_{5c} : The more frequent the price promotion, the more the repeat purchase amount is up to a certain level; beyond that level, the more frequent the price promotion, the less the repeat purchase amount.

Assortment Size

Assortment size is generally defined as the number of different products provided within a product category (Broniarczyk 2008; Levy and Weitz 2001). Since the assortment a retail store carries has a huge influence on store sales (Kök, Fisher, and Vaidyanathan 2006), assortment planning is a critical issue for retailers. Several researchers have emphasized the importance of assortment on consumers' choice decisions (Iyengar and Lepper 2000; Kahn 1999; Kahn, Weingarten, and Townsend 2013), but findings about the effect of assortment size on choice have been somewhat mixed from both the retailer and consumer perspectives.

A large assortment provides retailers with both benefits and costs. The benefits include a higher probability of carrying products that meet consumers' needs and bringing more

consumers into retail stores. In addition, consumers tend to evaluate store image higher for stores carrying a larger assortment (Oppewal and Koelemeijer 2005). However, retail stores carrying a larger assortment may also need to cover higher costs, such as inventory and shelf space costs (Bayus and Putsis Jr., 1999; Lancaster 1990).

From the consumer's perspective, some studies find that as product assortment increases, consumers have a higher possibility of finding an ideal option which perfectly meets their needs and thus are more likely to purchase a product (Kahn and Lehmann 1991; for a review, see Lancaster 1990). From this perspective, a large assortment increases shopping enjoyment (Babin et al. 1994) and enhances consumers' perception of freedom of choice (Brehm 1972). However, a negative effect of assortment size on choice has been also found in some studies (Chernev 2011; Iyengar and Lepper 2000). This negative consequence of a large assortment has been conceptualized as *information overload* or *choice overload* (Iyengar and Lepper 2000; Jacoby, Speller, and Kohn 1974; Scheibehenne, Greifeneder, and Todd 2010). Consumers with too much information (e.g., the number of attributes per brand, the number of brands, or a combination of both) can result in poorer choices (Jacoby, Speller, and Kohn 1974). Overwhelming assortment can also increase consumers' negative emotional responses (Diehl and Poynor 2010; Haynes 2009; Iyengar and Lepper 2000). Empirical studies also report that reducing the number of stock-keeping units (SKUs) can actually increase store sales (Boatwright and Nunes 2001; Drèze, Hoch, and Purk 1994).

These negative effects of large assortment on choice have been attributed to several factors. For instance, large assortments are found to increase consumers' perceived uncertainty, increase cognitive effort due to having to evaluate a larger number of products, cause consumers to feel that it is difficult to choose a product, and even demotivate a purchase choice (Iyengar

2010; Iyengar and Lepper 2000; Schwartz 2004). Recent studies have found that when consumers need to make a purchase decision for a product with higher uncertainty, such as a retirement plan, they tend to choose the default options (Madrian and Shea 2001). It can be inferred from this that in larger assortments in which consumers normally perceive higher uncertainty, they prefer to stick with their habitual purchases instead of attempting to make a risky new product purchase. In addition, a larger assortment also infers that a new product on the shelf is simply less visible among all the other brands than it would be in a case with a smaller assortment. Given that, I propose the following hypothesis:

H_{6a}: The larger the assortment size, the longer the time to trial purchase.

However, once consumers have made a trial purchase of a new product, they have their own usage experience with the new product, and thus their perception of uncertainty toward the new product will decrease. Thus, the negative effect of assortment size on new product purchase will be weaker in the situation of repeat purchase than of trial purchase. Thus, the following hypothesis is proposed:

H_{6b}: The effect of assortment size is stronger for trial purchase timing than for repeat purchase timing.

Like hypothesis 6a, this hypothesis implies that a higher level of assortment will lengthen the time to repurchase, but the effect will be weaker for repeat purchase than for trial purchase such that as the assortment increases, the increase in time to repurchase will be smaller than the increase in time to trial purchase.

In terms of the repeat purchase amount, consumers may have enough experience with the new product to form their own preference for it, so the new product is no longer considered to be a risky option. However, assortment size still can have a negative influence on consumers' repeat

purchase amount because of the above-mentioned information overload effect. Thus, the following hypothesis is proposed:

H_{6c}: The larger the assortment size, the lower the repeat purchase amount.

Socio-Demographic Covariates

Socio-demographics have been widely identified as influencers of new product adoption in the literature (e.g., Gatignon and Robertson 1991; Im et al. 2003; Im et al. 2007). As noted earlier, although the effect of socio-demographics on consumers' adoption behaviors shows mixed results across studies (Im et al. 2007; Munnukka 2007; Schreier and Prügl 2008), the overall effect of each socio-demographic variable is somewhat consistent. For example, age is negatively correlated and income is positively correlated with consumers' actual purchase behavior (Arts et al. 2011). Because the effect of socio-demographic traits on new product adoption is already well documented in the literature, socio-demographic variables are included as control variables in this study.

In addition, the positive effect of category purchase intensity on new product adoption has been shown in several studies (Citrin et al. 2000; Dickerson and Gentry 1983; Steenkamp and Gielens 2003). For instance, heavy Internet users tend to engage in more Internet shopping (Citrin et al. 2000). Thus, category purchase intensity is also considered as a control variable in this study. As mentioned above, trial month and repeat month as well as trial purchase amount are considered as control variables in the models to control alternative explanations. The hypothesized variable and covariate effects are summarized in Table 3.1.

Table 3.1
Proposed Hypotheses

Independent Variables		Proposed Relationships (Predicted Signs of the Coefficients)
H1a		Trial purchase timing (+)
H1b	Domain-specific innovativeness	Stronger for trial purchase timing than for repeat purchase timing
H1c		Repeat purchase amount (-)
H2a		Trial purchase timing (+)
H2b	Variety-seeking	Stronger for trial purchase timing than for repeat purchase timing
H2c		Repeat purchase amount (-)
H3a		Trial purchase timing (+)
H3b	Loyalty to the firm brand	Stronger for trial purchase timing than for repeat purchase timing
H3c		Repeat purchase amount (N.S.)
H4a		Trial purchase timing (+)
H4b	Marketing communication	Stronger for trial purchase timing than for repeat purchase timing
H4c		Repeat purchase amount (+)
H5a		Trial purchase timing (\cap)
H5b	Price promotion	Stronger for trial purchase timing than for repeat purchase timing
H5c		Repeat purchase amount (\cap)
H6a		Trial purchase timing (-)
H6b	Assortment size	Stronger for trial purchase timing than for repeat purchase timing
H6c		Repeat purchase amount (-)

CHAPTER 4

MODEL DEVELOPMENT

New product adoption has been researched using several approaches. Some researchers have conceptualized consumers' new product adoption as the time to adopt following the launch of the product and tested the time to adopt by using survival or hazard models (Prins and Verhoef 2007). Others have conceptualized consumers' new product adoption as the probability of adoption and tested it by using choice models (Steenkamp and Gielens 2003). Still others have examined the number of new product purchases and the purchase trend over time by using multilevel Poisson regression (Gielens and Steenkamp 2007).

In this research, I test the time to trial purchase following the launch of a new product, the time to repeat purchase, and the repeat purchase amount over the 12 months after a consumer's trial purchase as outcome variables. Two models are proposed to test the relationships among antecedents of adoption and these adoption-related variables: a discrete-time hazard model and a Type I Tobit model. The discrete-time hazard models used to test the time to trial and the time to repeat purchase are described in the following section, and the Type I Tobit model to test the repeat purchase amount is illustrated in the section after that.

Trial Purchase Timing and Repeat Purchase Timing

A discrete-time hazard model is utilized to test the proposed hypotheses about trial and repeat purchase timing. This model treats time as being divided into integer units. The discrete-time hazard model is suited to areas in which time is measured discretely (Muthén and Masyn 2005), such as in years, months, and weeks.

The data structure of a discrete-time hazard model records the dependent variables as a series of binary variables denoting whether or not an event has occurred at each interval of time point (e.g., whether or not a purchase is made each month) so that for each household, there are as many observations as there are time intervals up until the first purchase event occurring for each household. For instance, when a household makes a trial purchase of a new product in the third month after the launch of the new product, the data for the household has three observations in a row, the first two observations denoting 0 for the dependent variable and the third observation denoting 1. When another household makes a trial purchase of the new product in the eighth month after the launch of the new product, the data for this household have eight observations in a row. Thus, households' observations can have more than one row and can have different numbers of rows contingent upon the time elapsed between the new product introduction and trial purchase. Thus, the characteristic of the data structure of the discrete-time hazard model can be described as an unbalanced panel dataset. The great advantage of the discrete-time hazard model is that it enables researchers to incorporate time-varying independent variables into the model (Muthén and Masyn 2005; Singer and Willett 1993).

Discrete-time hazard models are estimated using standard binary choice functions such as logit, probit, or complementary log-log (cloglog) functions since their dependent variables are a set of binary variables. The cloglog model has three properties: *invariance*, *asymmetry*, and *parameter comparability* (Paul 2010). Whereas the logit model does not allow for direct comparison among different time intervals such as comparisons between monthly change and yearly change, the cloglog model has invariance to the length of the time interval so it can make different time interval models comparable. In addition, unlike the logit model, the shape of the cloglog model is asymmetric, so if the binary outcome is switched, such as changing from trial to

non-trial, the coefficients of the result from the switched model will be different from the coefficients of the result from the original model. The most important property of the cloglog model is that the coefficients are identical to the coefficients in Cox's proportional hazard model, which makes cloglog models comparable with other proportional hazard models. Given that the cloglog model is preferable because of these properties, it will be utilized to test the proposed hypotheses as the parametric form for the hazard function.

The cloglog model can accommodate in the hazard function both time-invariant variables (i.e., consumers' behavioral antecedents and demographics) and time-variant variables (i.e., feature, display, advertising expenditure, price promotion and assortment). To account for the time dependency of the baseline hazard rate, a time-trend variable is incorporated in the hazard function of the model. For example, suppose that a household i makes a first purchase of a new product j within the observed time period t . The hazard rate of the cloglog model is the following:

$$h_{ij}(t) = 1 - \exp\{-\exp(\alpha + D(t) + \beta' x_{ijt} + \gamma' z_{ij})\} \quad (1)$$

where α is a constant term, $D(t)$ refers to the duration dependence (i.e., time trend), and $\beta' x_{ijt}$ includes time-varying and $\gamma' z_{ij}$ includes time-invariant variables. The log-likelihood function of the cloglog model is specified as the following:

$$\ln L = \sum C_i \ln h_{ij}(t) + \sum (1 - C_i) \ln \{1 - h_{ij}(t)\} \quad (2)$$

A dummy indicator C_i is used to dichotomize the group of consumers into whether or not they purchase a new product in the observed period. C_i equals 1 if a consumer purchases a new product within the observed period. C_i equals 0 if the consumer does not purchase a new product within the period.

Unobserved Heterogeneity

Traditional survival models have an assumption that if there are no exploratory variables, the hazard function is identical across consumers. However, this assumption does not reflect reality because the variances among consumers which are not explained by independent and control variables in the model (i.e., unobserved heterogeneity) may not be captured by the model. The empirical literature has generally confirmed that the presence of unobserved heterogeneity can influence estimations of parameters such that unobserved heterogeneity will overestimate the degree of negative duration dependence and underestimate the degree of positive duration dependence. This means that if unobserved heterogeneity is ignored, model estimates can be biased.

For discrete-time hazard models accounting for unobserved heterogeneity, the random-effect cloglog model will be utilized. The hazard rate of the cloglog accounting for unobserved heterogeneity is specified as follows:

$$h_{ij}(t) = 1 - \exp\{-\exp(\alpha + D(t) + \beta' x_{ijt} + \gamma' z_{ij} + u_j)\} \quad (3)$$

where α is a constant term, $D(t)$ refers to the duration dependence (i.e., time trend), $\beta' x_{ijt}$ includes time-varying and $\gamma' z_{ij}$ includes time-invariant variables, and u_j is a random variable following normal distribution.

The measure of the degree of unobserved heterogeneity is the proportion of the total variance contributed by the panel-level variance component (ρ , labeled rho). If the hypothesis that rho is zero ($\rho = 0$) is not rejected, then unobserved heterogeneity is not significant and the model will reduce it to the cloglog model without unobserved heterogeneity. However, if the

hypothesis that rho is zero is rejected, then unobserved heterogeneity is significant and the model with unobserved heterogeneity will be used.

Repeat Purchase Amount

In order to build a model to test the repeat purchase amount over the launch period of each new product, it is necessary to consider how to deal with a large number of zeros in the data. To model the dollars each consumer spends in a month on repeat purchases of new products over the twelve months after their trial purchase, it is first necessary to consider whether a trier makes a repeat purchase or not. As seen in Table 3, approximately 35% to 70% of triers across different products and categories made at least one repeat purchase over the twelve months after their trial purchase. This means that approximately 30% to 65% of triers across products and categories make a trial purchase and decide not to make any further purchase of the new products. Thus it causes a large number of zeros in the repeat purchase dataset. In the presence of a large number of zeros, running Ordinary Least Square (OLS) is inconsistent and thus yields a downwards-biased estimate of the slope coefficient and an upward-biased estimate of the intercept. This is because consumers have a choice whether or not to make a repeat purchase but the OLS does not take that into account. The issue is that the subset of samples is censored at the certain value. In the case of repeat purchase amount, the censoring arises at zero. A Type I Tobit model (Tobin 1958) can be used to resolve this issue. Suppose that a household i makes a first purchase of a new product j within the observed time period t .

The mathematical specifications of the Type I Tobit model are illustrated as follows:

$$Y_{ijt}^* = \alpha + D(t) + X'_{ijt}\beta + Z'_{ijt}\gamma + \varepsilon_{ijt} \quad \text{where } i = 1, \dots, N; j = 1, \dots, J; t = 1, \dots, T,$$

$$Y_{ijt} = \begin{cases} Y_{ijt}^* & \text{if } Y_{ijt}^* > 0 \\ 0 & \text{if } Y_{ijt}^* \leq 0 \end{cases} \quad (4)$$

where Y_{ijt} is an indicator function which is equal to Y_{ijt}^* if the latent dependent variable Y_{ijt}^* is greater than zero and to zero for otherwise, ε_{ijt} is an error term following normal distribution, α is a constant term, $D(t)$ refers to the duration dependence (i.e., time trend), X'_{ijt} are vectors of time-variant explanatory variables and Z'_{ijt} are vectors of time-invariant explanatory variables.

CHAPTER 5

DATA DESCRIPTION AND MEASURES

Data Preparation

Scanner panel data collected and distributed by Information Resources, Inc. (IRI) is used for testing the hypotheses. The original IRI panel data consist of two levels of datasets: store-level and household-level data. The household-level data consist of up to 14,000 households' weekly purchase records over a period of six years from January 2001 to December 2006 in thirty-one categories in two US markets (Eau Claire, WI and Pittsfield, MA), which covers the entire population of the stores. The data also contain demographic information of the panelists. The store-level data contain product sales, features, and displays in 47 U.S. markets for the same six years. Additional description of the IRI panel data is available in Bronnenberg, Kruger, and Mela (2008) and Kruger and Pagni (2008). For this research, household-level data are utilized for measuring trial and repeat purchase timing, repeat purchase amount, demographics, and past behavioral antecedent variables. Store-level data are used for measuring feature, display, price promotion, and assortment. Only static households whose purchase records are available over the six consecutive years from 2001 to 2006 are used, so that household purchase behaviors across new products with different launch times can be analyzed. In total, 2,995 households who have maintained membership in the panel for all six consecutive years are included in the sample of this study. In this research, a "household" typically refers to a single consumer or a household, although it is recognized that most households include at least one other person.

Using the IRI scanner panel data has several advantages. First, although many previous empirical studies using secondary datasets view the starting date in the observation period of the data as the introduction of a new product mainly because of the lack of data on the launch of the product (e.g., Prins and Verhoef 2007), this study uses the first purchase date in the data as the introduction of a new product. The second advantage is that since the product cycle of CPGs is relatively short compared to that of durable goods, information about several new products introduced into the market over the observation period can be obtained.

In order to empirically test the hypotheses, two steps were taken in order to select new products which have enough purchase records over the period of interest. In the first step, categories were selected for analysis. Two criteria were used to obtain a large enough sample size. The first criterion is to exclude categories in which the average purchase cycle of each household is more than two months. The second criterion is to select product categories in which more than 70% of the households have purchased any products. The information for both criteria is obtained from Table 2 in Bronnenberg et al. (2008). The categories which met both criteria are: soft drinks, cold cereal, frozen dinners, milk, salty snacks, soup, and yogurt.

Category	Percent of Household Buying (%)	Purchase Cycle (days)
Soft drinks	91.9	40
Cold cereal	87.2	48
Frozen dinners	80.3	51
Milk*	93.4	29
Salty snacks	93.3	41
Soup	90.3	45
Yogurt	71.8	50

Source: Bronnenberg et al. (2008). *Milk will be deleted for the analysis because of too small sample size.

In the second step, successful new products in each chosen category were selected. One criterion was used to obtain a large enough sample size to be analyzed: new products had to be

purchased by more than 250 static households over the 12 months of the launch of the new product. After all of the new products in the category were examined, the milk category was excluded because its sample size was too small, leaving a total of 16 new products in six food categories: soft drink, cold cereal, frozen dinner, salty snacks, soup, and yogurt. The list of the new products is presented in Table 5.1

Table 5.1
New Products

	New Product	Launch Month	Number of Triers	Number of Repeaters	Percent of Repeaters
1	Soft Drink Brand1	May 2002	950	446	46.9
2	Soft Drink Brand2	January 2003	993	640	64.5
3	Soft Drink Brand3	September 2001	624	298	47.8
4	Soft Drink Brand4	September 2004	554	321	57.9
5	Cold Cereal Brand1	January 2003	481	265	55.1
6	Cold Cereal Brand2	February 2003	447	247	55.3
7	Frozen Dinners Brand1	October 2002	443	267	60.3
8	Frozen Dinners Brand2	July 2002	354	191	54.0
9	Frozen Dinners Brand3	October 2002	300	141	47.0
10	Salty Snacks Brand1	January 2003	715	503	70.3
11	Salty Snacks Brand2	June 2001	286	104	36.4
12	Soup Brand1	July 2002	492	294	59.8
13	Soup Brand2	May 2003	587	259	44.1
14	Yogurt Brand1	January 2002	602	308	51.2
15	Yogurt Brand2	May 2002	313	154	49.2
16	Yogurt Brand3	March 2003	331	117	35.3
<i>Average</i>					52.2

Note. Number of triers is static households who make a trial purchase of each target new product during 12 months after the new product has launched.

Measures

Dependent Variables

Trial Timing and Repeat Timing. As described in the section on the development of the discrete-time hazard model, dependent variables are recorded as a series of binary responses denoting whether or not a household makes a purchase of the new product during each month of the twelve-month observation period. So, across households, there are different numbers of observations contingent upon each household's time to make a first purchase. For instance, if a household makes a trial purchase of a new product in the fifth month after the launch of the product, the data for the household has five observations in a row: the first four observations denoting 0 and the fifth observation denoting 1. So, trial timing is defined as the elapsed time in months from a new product launch to a household's first purchase and is operationalized as the length of time in months (i.e., number of observation rows built in the data structure) between the launch of a new product and a household's first purchase of the new product. Repeat timing is defined as the elapsed time in months from the first purchase until the second purchase and is operationalized as the length of time in months between a household's first purchase and the second purchase of the new product. The original IRI panel data have weekly purchase records, but there are many weeks in which households do not purchase from the category, much less the new product. In order to reduce the no-purchase data, the original weekly purchase data are aggregated into monthly purchasing data.¹ The observation period for trial purchase contains the 12 months after the launch of each new product, and the observation period for repeat purchase contains the 12 months after the trial purchase.

¹ As seen in the table in the previous section, the average purchase cycles across categories are 40 days or longer. In addition, the external data for advertising expenditures have been measured on a monthly basis. For those reasons, I chose to aggregate the weekly-purchase data into monthly-purchase data.

Repeat Purchase Amount. Repeat purchase amount is measured as the dollar amount of monthly purchases households make over the 12 months after their first (trial) purchase across all of its sizes and packaging variations. If a household does not make a repeat purchase in a particular month, the dependent variable for the household in that month is recorded as zero.

Time-Invariant Independent Variables

Time-invariant variables included in the model as predictors of adoption-related behaviors include each household's computed domain-specific innovativeness, variety seeking, and loyalty to the firm brand.

Domain-Specific Innovativeness. The total number of new unique brands that each household purchases in each of the six categories being studied during 2001 to 2006 is calculated as a proxy variable for domain-specific innovativeness. The new brands being studied (i.e., the sixteen target new brands presented in Table 5.1) are excluded when developing this measure. A similar approach to measuring domain-specific innovativeness with a proxy variable can be found in the study by Prins and Verhoef (2007), who use a dummy variable of adoption of a prior-generation mobile e-service as a proxy variable for measuring domain-specific innovativeness. Whereas Prins and Verhoef regard domain-specific innovativeness as a dummy variable and use it as a control variable, this study treats it as the logged variable of the number of new products purchased and uses it as an independent variable. Domain-specific innovativeness is measured at two levels: category-specific innovativeness and CPG innovativeness. First, category-specific innovativeness for each household is measured by recording the logged total number of new unique brands purchased in the particular category over the six-year period. Second, CPG innovativeness is measured by recording the logged total

number of new unique brands purchased by each household across all six categories over the six-year period.

Variety Seeking. Variety seeking is operationalized as the logged total number of existing unique brands purchased by each household within the category during the six months before the first (trial) purchase of the particular new product.

Loyalty to the Firm Brand. Households' loyalty to the firm brand is measured as the logged total dollar amount each household spends in the firm brand of a new product during the six months before the first purchase of the particular new product.

Time-Variant Independent Variables

Advertising. The data for advertising come from the Ad\$spender database from Kantar Media. Ad\$spender provides national advertising expenditures in dollars including TV, print, and Internet. The advertising in the trial purchase data includes a total of twelve months of time-varying advertising expenditures after the launch of new products and the data on the advertising for repeat purchase include a total of twelve months of time-varying advertising expenditures after the trial month of each household.

Display. In the original IRI dataset, display is measured by week as a three-level categorical variable: minor display, major display, and no display in each store in the two Behaviorscan trade areas for each UPC of each new product. For the purposes of this research, display major and display minor are aggregated from weekly records into monthly records for each household based on the store(s) shopped in that month and are also aggregated from UPC-level records to brand-level records. Then, display major and display minor are merged into one variable, called display. Display is measured as the number of occurrences (i.e., frequency) of display advertised by the store(s) where a household shops in that month. If a household visits

multiple stores in that month, I choose the maximum value of the display among the several displays done by the multiple stores.

The data on display for trial purchase include a total of twelve months after the launch of the new products. The data on display for repeat purchase include a total of twelve months after the first trial month of each household. For instance, if a household makes a trial purchase in the fifth month after the launch of the new product, then display for repeat purchase is obtained by calculating display for twelve months after the first trial month. In other words, the sixth month after the launch of a new product is coded as the first month of the display in the repeat purchase dataset and the seventeenth month after the launch of the new product is coded as the twelfth month of display in the repeat purchase dataset.

Feature. In the original IRI dataset, feature is measured by week for each UPC of each new product as a category variable which equals “C” if a small-size advertising is conducted for that week (usually 1 line of text), “B” if a medium-size advertising is conducted, “A” if a large-size advertising is conducted, and “A+” if retailer coupon(s) and/or rebate(s) are provided for that week. However, the number of features varies across products and months. In order to reduce the fluctuations across products and months, weekly data are aggregated into monthly data and UPC-level data are aggregated into brand-level data. Then, features are merged into one variable, called feature. Feature is measured as the frequency of features advertised by the store(s) where a household shops in that month. If a household visits multiple stores in that month, I choose the maximum value of the feature among the several features done by the multiple stores. The feature in the trial purchase dataset is computed for twelve months after the launch of the new product, and the data on the feature for repeat purchase include twelve months’ time-varying features after the first trial month of each household.

Price Promotion. In the original IRI dataset, price promotion is measured weekly for each UPC of each new product as a dummy variable which equals 1 if the price reduction is 5% or greater and 0 if otherwise. After the aggregation of weekly data into monthly data and the aggregation of UPC-level data into brand-level data, price promotion is measured as the number of price promotions which occur in the store(s) where a household shopped in a specific month. Price promotion is measured as the frequency of price promotion conducted by the store(s) where a household shops in that month. If a household visits multiple stores in that month, I choose the maximum value of the price promotion done by the multiple stores. The data on the price promotion for the trial purchase include a total of twelve months of time-varying price-promotion values after the launch of new products and the data on the price promotion for repeat purchase include a total of twelve months of time-varying price-promotion values after the trial month of each household.

Assortment Size. Assortment size is used as a proxy variable measuring the total number of unique brands sold in each store shopped in that month. If a household visits multiple stores in a month, I choose the maximum value of the price promotion for the household in that month. Like other marketing-mix variables, the data on assortment in the trial purchase include time-varying twelve months of assortment values after the launch of new products and the data on the assortment for repeat purchase include time-varying twelve months of assortment values after the first trial month of each household.

Time-Invariant Covariates

Household demographics are used as covariates. Age is measured with six indicators for the age group of the head of household: 18-24 years old (1), 25-34 years old (2), 35-44 years old (3), 45-54 years old (4), 55-64 years old (5), and 65 or older (6). Level of education is measured

with eight indicators for the head of household: some grade school or less (1), completed grade school (2), some high school (3), graduated high school (4), technical school (5), some college (6), graduated from college (7), and post graduate work (8). Income is measured with twelve indicators from \$9,999 or less (1) to \$100,000 or greater (12). The presence of children is measured as a dummy variable: a household is coded as 1 if the household has any children and 0 for otherwise. Kruger and Pagni (2008) provide a detailed description of these and other demographic variables in their IRI Academic Data Set Description.

Category purchase intensity is measured as the logged purchase amount in dollars for existing products in each product category over the six months before the first purchase of the target new product. To control the category-specific effects, I include two variables: purchase cycle and average percent of price reduction. The values of both variables are obtained from Table 2 in Bronnenberg et al. (2008).

Category	Purchase Cycle (Days)	Average Percent of Price Reduction
Soft drinks	40	23.6
Cold cereal	48	30.7
Frozen dinners	51	25.7
Salty snacks	41	25.4
Soup	45	29.0
Yogurt	50	24.3

Source: Bronnenberg et al. (2008).

As discussed in the hypothesis section, trial purchase amount and trial month are included as control variables in the repeat purchase models. The summary of all the measures is presented in Table 5.2.

Table 5.2
The Measures of Variables

Variable	Operationalization
<i>Dependent Variable</i>	
Trial Purchase Timing	Whether a household makes a first purchase in a specific month (trial event) and the length of time in months between the launch of a new product and a household's first purchase of the new product (built in the data structure).
Repeat Purchase Timing	Whether a household who made a first purchase makes a repeat purchase in a specific month (repeat purchase event) and the length of time in months between a household's first purchase and the household's second purchase of the new product (built in the data structure).
Repeat Purchase Amount	The dollar amount of monthly purchases a household makes over the 12 months after the household's first (trial) purchase.
<i>Independent Variable</i>	
CPGs Innovativeness	The logged variable of the total number of new unique brands purchased from 2001 to 2006 in the six CPG categories.
Category-Specific Innovativeness	The logged variable of the total number of new unique brands purchased from 2001 to 2006 in each category.
Variety Seeking	The logged variable of the total number of existing unique brands purchased in the category over the six months before the first purchase of the target new brand.
Loyalty to the Firm Brand	The logged total dollar amount each household spends in the firm brand of a new product over the six months before the first purchase of the target new brand.

Display	The frequency of display advertised by the store that a household shopped in a given month.
Feature	The frequency of feature advertised by the store that a household shopped in a given month.
Advertising	The logged variable of national advertising expenditures in dollars in a given month.
Price Promotion	The frequency of price promotion conducted by the store that a household shopped in a given month.
Assortment Size	The number of unique brands for each category sold in each store in a given month.
<i>Control Variable</i>	
Children	One indicator: coded as 1 if the household has any child (children) and 0 for otherwise.
Marriage	One indicator: coded as 1 if the household is married and 0 for otherwise.
Income	Twelve-level measure for household income.
Age	Six-level measure for the age of the head of household.
Education	Eight-level measure for the education level of the head of household.
Category Purchase Intensity	The logged variable of the purchase amount of dollars for existing brands in the target category over the six months before the first purchase of the target new brand.
Category Purchase Cycle	The average cycle in days of making a purchase of any product in that category.
Category Price Reduction	The average percent of price reduction made in that category.
Trial Month	The length of time in months between the launch of a new product and a household's first purchase of the new product.
Trial Amount	The purchase amount of dollars a household spends on the first purchase
Repeat Month	The length of times in month between a household's first purchase and second purchase of the new product.

CHAPTER 6

RESULTS

Descriptive Analyses

Sixteen new brands introduced into the six food categories are utilized to illustrate the modeling approach and the results. Before discussing the main results, the descriptive analyses are discussed. As seen in Figure 6.1, approximately 90% ($N = 2,684$) of the total of 2,995 static households tried at least one of the sixteen products during the twelve months after each new product launched. Overall, 16% ($N = 479$) of the households made a trial purchase of only one new product among the sixteen products, 19.3% ($N = 578$) made trial purchases of unique new products, 18.3% ($N = 547$) made trial purchases of three unique new products, 14.9% ($N = 446$) made trial purchases of four unique new products, and 21.2% ($N = 634$) of the households made trial purchases of five or more unique new products.

Table 6.1 shows the descriptive statistics of households who made trial purchases of the sixteen new products in the six categories. Table 6.2 presents the descriptive statistics of households who made repeat purchases of the products in the six categories.

Figure 6.1
The Frequency of Households Who Tried New Products

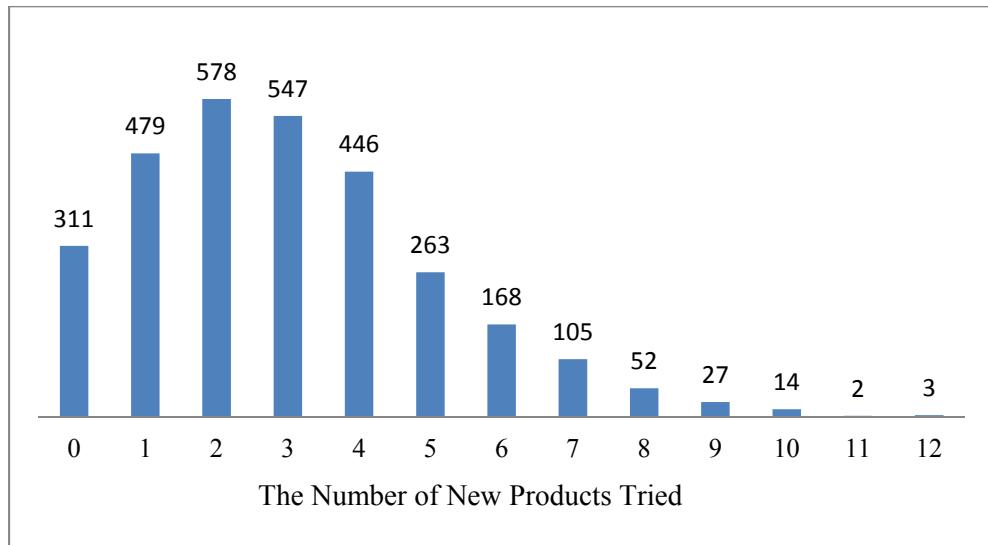


Table 6.1
Descriptive Statistics of the Trial Sample

	Soft Drink (N = 143,760)		Cold Cereal (N = 71,880)		Frozen Dinner (N = 107,820)		Salty Snack (N = 71,880)		Soup (N = 107,820)		Yogurt (N = 143,760)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
CPG innovativeness	13.14	9.82	14.40	10.21	15.70	12.03	14.46	10.93	17.83	12.80	16.00	11.55
Category-Specific Innovativeness	5.17	5.16	3.91	4.50	2.60	3.04	3.85	3.42	0.47	1.49	2.30	2.70
Variety Seeking	6.00	4.21	4.68	4.84	2.10	2.81	5.99	4.28	2.12	1.43	2.51	2.82
Loyalty to the Firm Brand	22.50	36.48	11.49	16.79	2.94	11.46	19.31	24.46	10.43	14.54	4.57	11.95
Feature	9.25	6.36	3.99	4.07	22.83	28.16	7.70	16.93	6.18	11.57	4.67	8.38
Display	14.11	6.72	2.66	3.74	2.52	5.04	10.41	25.23	3.18	5.68	0.77	2.30
Advertising Spending	2474.13	3102.19	2807.55	1787.28	0.00	0.00	1850.45	1944.88	1019.01	1682.89	635.01	847.45
Price Promotion	7.69	3.67	2.88	2.67	11.58	14.99	6.51	15.96	8.43	9.04	4.03	5.81
Assortment Size	84.73	11.16	198.54	9.57	66.87	4.35	137.32	15.26	37.41	9.36	46.42	3.21
Category Purchase Intensity	60.35	65.35	33.31	36.25	15.72	31.51	32.96	33.32	15.78	19.64	13.74	21.49
Age	4.85	1.11	4.85	1.11	4.85	1.11	4.85	1.11	4.85	1.11	4.85	1.11
Education	5.19	1.40	5.19	1.40	5.19	1.40	5.19	1.40	5.19	1.40	5.19	1.40
Income	7.12	2.88	7.12	2.88	7.12	2.88	7.12	2.88	7.12	2.88	7.12	2.88
Children	0.20	0.40	0.20	0.40	0.20	0.40	0.20	0.40	0.20	0.40	0.20	0.40
Marriage	0.67	0.47	0.67	0.47	0.67	0.47	0.67	0.47	0.67	0.47	0.67	0.47

Note. The observations (N) are obtained by multiplying the number of triers for each brand in the category times the twelve months.

Table 6.2
Descriptive Statistics of the Repeat Sample

	Soft Drink (N = 37,452)		Cold Cereal (N = 11,136)		Frozen Dinner (N = 13,164)		Salty Snack (N = 12,012)		Soup (N = 12,948)		Yogurt (N = 14,952)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
CPG innovativeness	16.66	10.85	19.80	11.77	17.97	13.06	17.02	11.18	23.12	14.34	21.85	13.27
Category-Specific Innovativeness	8.27	5.84	6.88	5.62	5.14	4.02	4.93	3.44	0.84	1.83	4.43	3.68
Variety Seeking	8.27	4.58	8.72	6.01	4.74	3.90	7.40	4.36	2.50	1.57	4.43	3.54
Loyalty to the Firm Brand	32.49	41.69	17.73	21.80	11.47	22.44	34.36	31.11	13.83	17.15	9.28	16.69
Feature	10.66	5.48	4.71	4.00	29.84	28.41	24.05	30.28	10.03	15.80	6.43	9.29
Display	15.62	6.82	2.82	4.12	4.20	6.15	48.10	35.30	4.51	6.45	1.00	2.77
Advertising Spending	2112.53	2936.80	2252.03	1636.15	137.66	372.31	1383.69	1372.88	477.94	1013.75	568.45	790.66
Price Promotion	8.23	3.82	3.47	3.01	14.87	13.26	27.75	20.32	13.22	11.28	5.64	6.69
Assortment Size	86.49	11.18	201.40	9.85	68.47	3.42	133.68	10.16	39.66	9.19	46.89	3.81
Category Purchase Intensity	81.91	72.43	50.18	46.35	39.39	51.64	39.46	34.34	20.13	22.02	25.79	28.83
Age	4.53	1.09	4.71	1.05	4.84	1.11	4.63	1.08	4.78	1.11	4.54	1.11
Education	5.25	1.36	5.28	1.40	5.15	1.39	5.27	1.32	5.17	1.38	5.32	1.34
Income	7.74	2.75	7.64	2.77	7.11	2.91	7.73	2.68	7.41	2.87	7.61	2.78
Children	0.28	0.45	0.22	0.41	0.19	0.40	0.25	0.43	0.21	0.41	0.28	0.45
Marriage	0.74	0.44	0.74	0.44	0.62	0.49	0.77	0.42	0.71	0.46	0.71	0.45
Trial Month	4.05	3.07	3.92	2.89	6.03	2.99	7.10	2.28	6.85	2.87	4.57	2.90
Trial Amount	3.33	3.63	4.65	2.60	4.67	4.10	3.12	1.84	2.85	2.03	2.53	2.33

Note The observations (N) are obtained by multiplying the number of repeaters for each brand in the category times the twelve months.

Trial Purchase Timing and Repeat Purchase Timing

For model specification, I estimate trial purchase timing and repeat purchase timing separately by utilizing the complementary log-log models without unobserved heterogeneity and with unobserved heterogeneity. I also test the presence of unobserved heterogeneity. The results from the likelihood tests of trial purchase timing and repeat purchase timing for the new CPGs show a statistically significant presence of unobserved heterogeneity (for trial purchase timing $\rho = 0.092$, $\chi^2 = 199.16$, $p = 0.000$; for repeat purchase timing $\rho = 0.032$, $\chi^2 = 5.53$, $p = 0.009$). Since ρ for both trial purchase timing and repeat purchase timing is statistically different from zero, the panel-level variance component is important, and the panel estimator is different from the pooled estimator from the complementary log-log model. Thus, I apply the discrete-time model with unobserved heterogeneity (random effects complementary log-log model) for the entire set of new products of interest and present the results from the random effects complementary log-log models which account for unobserved heterogeneity in Table 6.3.

Table 6.3**Discrete Time Hazard Model**

	Trial Purchase Timing Hazard Model				Repeat Purchase Timing Hazard Model			
	Coef.	Std. Err.	exp(b)	z	Coef.	Std. Err.	exp(b)	z
Month	-0.622	0.022	0.537	-28.190***	-1.069	0.031	0.343	-34.290***
CPG Innovativeness	0.308	0.023	1.360	13.450***	0.019	0.031	1.019	0.620
Category-Specific Innovativeness	0.563	0.020	1.756	27.750***	0.269	0.030	1.309	8.960***
Variety Seeking	0.499	0.033	1.647	15.340***	0.157	0.052	1.170	3.030**
Loyalty to the Firm Brand	0.110	0.013	1.116	8.470***	0.057	0.019	1.058	3.040**
Feature	0.006	0.001	1.006	5.970***	0.003	0.001	1.003	2.030*
Display	0.024	0.002	1.025	11.410***	0.029	0.003	1.029	9.170***
Advertising Spending	0.085	0.004	1.089	19.880***	0.036	0.007	1.037	5.580***
Price Promotion	0.066	0.003	1.068	20.800***	0.011	0.005	1.011	2.310*
Price Promotion ²	-0.001	0.000	0.999	-13.150***	0.000	0.000	1.000	-0.920
Assortment Size	-0.008	0.000	0.992	-21.260***	-0.006	0.001	0.994	-10.270***
Children	-0.133	0.043	0.875	-3.130**	-0.045	0.052	0.956	-0.860
Marriage	-0.034	0.037	0.966	-0.930	0.014	0.049	1.015	0.300
Income	0.015	0.007	1.015	2.230*	-0.008	0.008	0.992	-0.990
Age	0.000	0.017	1.000	0.000	-0.035	0.022	0.966	-1.580
Education	-0.022	0.012	0.978	-1.940	-0.008	0.015	0.992	-0.520
Category Purchase Intensity	-0.068	0.020	0.935	-3.400**	-0.006	0.031	0.994	-0.180
Purchase Cycle	0.006	0.004	1.006	1.440	0.039	0.007	1.040	5.940***
Price Percent	0.115	0.007	1.122	17.150***	0.124	0.011	1.132	10.820***
Trial Month					-0.064	0.007	0.938	-9.630***
Constant	-8.940	0.272		-32.820***	-6.226	0.411		-15.160***

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$

In Table 6.3, $\exp(b)$ for each variable in the discrete-time hazard model can be interpreted as the hazard ratio.² Time dependence (i.e., logged month), which is modeled in equation (1), is significant for both trial and repeat purchase discrete-time hazard models: the coefficient of the logged month is negative in both models, meaning that as time goes by, the probability of a trial purchase and the probability of a repeat purchase by a household in the category decreases. The hazard rate for time dependence on trial purchase timing ($\exp(b) = 0.537$) indicates that given that a household has not made a trial purchase of each new product from the launch to the previous month, the probability that the household will try the new product in the current month decreases by 46.3% ($1 - 0.537 = 0.463$). The hazard rate for time dependence on repeat purchase timing ($\exp(b) = 0.343$) indicates that given that a household has not made a repeat purchase of each new product from the launch up to the previous month, the probability of a repeat purchase in the current month decreases by 65.7% ($1 - 0.343 = 0.657$).

In the trial purchase timing model, CPG innovativeness and category-specific innovativeness, both operationalized as domain-specific innovativeness, show significant positive effects. This result supports H1a that as consumers have higher domain-specific innovativeness, they are more likely to make an earlier trial purchase. For the repeat purchase model, only category-specific innovativeness shows a significant positive influence. The effects of both measures for domain-specific innovativeness are stronger on trial purchase timing than on repeat purchase timing, which supports H1b.

Regarding category variety seeking, the result shows a significant positive effect on trial purchase timing, which supports H2a. This result means that households who have more variety-seeking behaviors are more likely to make an earlier trial purchase. The effect of category variety seeking is shown to be stronger on trial purchase timing than repeat purchase timing, supporting

² <http://www.stata.com/statalist/archive/2005-07/msg00057.html>

H2b. In addition, the results for loyalty to the firm brand shows a significant positive effect on trial purchase timing, which supports H3a. That is, households who are more loyal to the firm brand are more likely to make an earlier trial purchase. The effects of loyalty to the firm brand are shown to be stronger for trial purchase timing than for repeat purchase timing, which supports H3b.

For marketing communication variables, the effects of feature, display, and advertising on trial purchase timing are all significantly positive, solidly indicating that increased marketing communication is positively associated with shorter trial purchase timing. Specifically, the hazard rate for feature on trial purchase timing ($\exp(b) = 1.006$) indicates that given that a household has not made a trial purchase of each new product from the launch to the previous month, the probability that the household will try the new product in the current month increases by 0.6% ($1.006 - 1 = 0.006$) as the frequency of feature increases by one time in the current month. As well, the hazard rate for display on trial purchase timing ($\exp(b) = 1.025$) indicates that given that a household has not made a trial purchase of each new product up to the previous month, the probability that the household will try the new product in the current month increases by 2.5% as the frequency of display increases by one time. The effect of national advertising spending is also shown to be positive, meaning that more advertising expenditure shortens the time until trial purchase. Thus, these positive effects of feature, display, and advertising spending on trial purchase timing support H4a. Furthermore, the effects of these marketing communication variables are stronger for trial purchase timing than for repeat purchase timing, which supports H4b.

The effect of price promotion on trial purchase timing is significantly positive and the squared price promotion is significantly negative. This means that as price promotion increases,

households make an earlier trial purchase up to a certain level, but beyond that level, the more the price promotion increases, the later households make a trial purchase. So, this result supports H5a. Regarding repeat purchase timing, the effect of price promotion is significantly positive but the effect of squared price promotion is insignificant. Similarly, the effect of price promotion is shown to be weaker for repeat purchase timing than for trial purchase timing. Therefore, this result supports H5b. In the case of assortment size, the effect of assortment on trial purchase timing is significantly negative, which means that as stores have larger assortments, households are more likely to make a later trial purchase. This result supports H6a. The negative effect of store assortment on repeat purchase timing is also significant but weaker than on trial purchase timing, which supports H6b.

Repeat Purchase Amount

Table 6.4 presents the random effects Type I Tobit model. The results show that domain-specific innovativeness measured with CPG innovativeness and category-specific innovativeness does not have a significant effect on repeat purchase amount, which does not support H1c. Although this result does not support the hypothesis, it implies the important insight that innovativeness does not lead customers to keep purchasing the new products. The results also suggest that households with higher variety-seeking characteristics are more likely to spend less dollar amounts for repeat purchases of the same new CPGs over time, which supports H2c. Loyalty to the firm brand does not have a significant effect on repeat purchase amount of the same new product, which supports H3c.

In the case of marketing communication, feature and display have a significant positive effect on repeat purchase amount, but national advertising spending does not have a significant influence on repeat purchase amount. These results partially support H4c. The nonlinear effect of

price promotion on repeat purchase amount is significant, which means that up to a certain level, price promotion drives households' larger repeat purchase amount and beyond that level, the more price promotion, the less dollar amount households spend for repeat purchase of the new CPGs. Thus, H5c is supported. Assortment size does not influence repeat purchase amount, which does not support H6c.

Table 6.4
Type I Tobit Model

	Coef.	Std. Err.	<i>z</i>
Month	-2.354	0.090	-26.240 ***
CPG Innovativeness	-0.153	0.126	-1.220
Category-Specific Innovativeness	0.181	0.106	1.710
Variety Seeking	-0.875	0.182	-4.800 ***
Loyalty to the Firm Brand	0.101	0.062	1.630
Feature	0.013	0.004	3.030 **
Display	0.081	0.010	7.810 ***
Advertising Spending	0.036	0.018	1.940
Price Promotion	0.057	0.015	3.730 ***
Price Promotion ²	-0.001	0.000	-2.010 *
Assortment Size	-0.002	0.002	-0.750
Children	-0.024	0.225	-0.110
Marriage	-0.184	0.208	-0.880
Income	0.021	0.036	0.580
Age	0.015	0.095	0.160
Education	0.137	0.064	2.150 *
Category Purchase Intensity	0.812	0.109	7.420 ***
Trial Month	-0.124	0.023	-5.420 ***
Trial Amount	0.228	0.017	13.150 ***
Repeat Month	-0.492	0.022	-22.850 ***
Purchase Cycle	0.181	0.021	8.670 ***
Price Percent	-0.014	0.040	-0.350
Constant	-11.731	1.462	-8.020 ***

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$

CHAPTER 7

DISCUSSION

In this chapter, I summarize the results of this research into the antecedents of the adoption of the new CPGs and discuss its theoretical and managerial implications as well as contributions, limitations, and future research directions.

Discussion of Findings

The primary focuses of the study have been to explore the antecedents of adoption behaviors (i.e., trial purchase timing, repeat purchase timing, and repeat purchase amount) in the context of new CPGs and to develop and test a set of hypotheses predicting how these behavioral and marketing antecedents impact the adoption process of new CPGs. To test my hypotheses on trial purchase timing and repeat purchase timing, I develop discrete-time hazard models to take into account unobserved heterogeneity across individuals. To test repeat purchase amount, I utilize the random effects Type 1 Tobit model. Table 7.1 presents the proposed hypotheses and the main results as well as whether each hypothesis is statistically significant or not.

Table 7.1
Test Results of the Proposed Hypotheses

Independent Variables		Proposed Relationships (Predicted Signs of the Coefficients)	Hypotheses
H1a		Trial purchase timing (+)	Supported
H1b	Domain-specific innovativeness	Stronger for trial purchase timing than for repeat purchase timing	Supported
H1c		Repeat purchase amount (-)	Not supported
H2a		Trial purchase timing (+)	Supported
H2b	Variety-seeking	Stronger for trial purchase timing than for repeat purchase timing	Supported
H2c		Repeat purchase amount (-)	Supported
H3a		Trial purchase timing (+)	Supported
H3b	Loyalty to the firm brand	Stronger for trial purchase timing than for repeat purchase timing	Supported
H3c		Repeat purchase amount (N.S.)	Supported
H4a		Trial purchase timing (+)	Supported
H4b	Marketing communication	Stronger for trial purchase timing than for repeat purchase timing	Supported
H4c		Repeat purchase amount (+)	Partially supported
H5a		Trial purchase timing (\cap)	Supported
H5b	Price promotion	Stronger for trial purchase timing than for repeat purchase timing	Supported
H5c		Repeat purchase amount (\cap)	Supported
H6a		Trial purchase timing (-)	Supported
H6b	Assortment size	Stronger for trial purchase timing than for repeat purchase timing	Supported
H6c		Repeat purchase amount (-)	Not supported

As shown in Table 7.1, nearly all of the proposed hypotheses are supported, with the exception of certain hypotheses regarding repeat purchase amount. In general, consumers' behavioral characteristics (i.e., domain specific innovativeness, variety-seeking behaviors, and loyalty to firm brands) are found to be significant drivers of consumers' earlier trial and repeat purchases of new CPGs. Marketing variables including marketing communication, price promotion and assortment size are also shown to be significant factors of consumers' earlier trial and repeat purchases of new CPGs.

Although the effects of behavioral antecedents on trial purchase timing have been found in the previous adoption literature, the effects on repeat purchase timing have rarely been discussed. This research indicates that although behavioral antecedents also have an effect on the timing of repeat purchase of new CPGs, the magnitude of the effects on repeat purchase is smaller. In addition, the effects of these behavioral antecedents except variety seeking are not significant on repeat purchase amount over the year after the first trial. These results imply that consumers' past behavioral characteristics may be drivers of early trial and repeat purchases but may not be key drivers of consumers' final stage of the adoption process, continuing to purchase the new products as key members of the choice set.

Regarding the marketing antecedents, the effects of marketing communication on trial and repeat purchases have been found previously in the adoption and the loyalty literature. However, the inverted U-shape effects of price promotion on trial and repeat purchases and the negative effect of assortment size have not been discussed in the literature. This research finds that the inverted U-shape effect of price promotion on new product purchase still has an influence on repeat purchase amount, which implies that too much price promotion on new products will not only defer consumers' earlier trial purchase decision but also deteriorate the

purchase amount in dollars of the new products over time. Furthermore, the results of this research show that though assortment size influences earlier trial and repeat purchases, it has no long-term influence on the likelihood that consumers will keep the product in their baskets over time and continuously purchase the new CPGs.

Theoretical Implications

This dissertation contributes several theoretical implications for marketing. First, this research contributes to the adoption literature by exploring and testing the effects of behavioral and marketing antecedents on the new product adoption process in the context of CPGs. Most of the new product adoption studies have taken place in the context of durable goods. Only a handful of studies have investigated the drivers of new CPG trials. Most of these studies have focused only on the single first-time purchase as a trial of new CPGs and ignored the repeat purchases. However, our descriptive results for new products presented in Table 5.1 show that about half of the panelists who tried new CPGs did not make a repeat purchase. This highlights that only considering a trial purchase is not enough to fully understand consumers' adoption behavior of new products in the context of CPGs. Thus, this study adds a theoretical contribution to the literature by considering the adoption process as a sequence of purchases: trial purchase timing, repeat purchase timing and repeat purchase amount.

Another significant contribution of this research is its conceptualization of the differences between antecedents of trial purchase timing and repeat purchase timing. As hypothesized, all the stronger effects of behavioral and marketing antecedents on trial purchase timing compared to repeat purchase timing are either supported or at least partially supported. The main reason behind these results is that consumers add their own personal experience with new CPGs after making a trial purchase. Thus, although these behavioral and marketing antecedents are

important in causing consumers to make an earlier repeat purchase, the effects of these drivers are less influential on consumers' repeat purchase timing.

This research also conceptualizes the inverted U-shape of the effect of price promotion on adoption behaviors. The general belief in the literature has been that the effect of price promotion on new product sales is positive. However, given that consumers cannot make sure of the quality of a new product until they try it, too much price discounting can apparently backfire and retard the speedy adoption of new products. Finally, the effects of assortment size on new product trial and repeat purchase timing are also found to have a negative influence on the adoption process as hypothesized.

Managerial Implications

The findings from this study can provide beneficial guidance for store managers and/or brand managers in the context of new CPGs. First and the foremost, managers will benefit by understanding the consumers' adoption process of new CPGs, specifically looking at how consumers' behavioral and marketing antecedents play unique roles in the adoption process. Compared to most previous studies which have focused mostly on the first-time single purchase of a new product (either as trial if the new product is a CPG or as adoption if the new product is a durable good), this study shows how these antecedents impact the adoption process of new CPGs across multiple successful brands in multiple categories.

The interesting insights that the results from the models offer are that consumers' behavioral characteristics (i.e., domain specific innovativeness, variety seeking, and loyalty to the firm brand) are relatively strong drivers for consumers' earlier trial purchase but have less influence on their repeat purchase timing. As well, these behavioral drivers may not impact at all or even negatively impact repeat purchase amount over the year after the trial purchase. Rather,

marketing-mix variables appear to be more effective long-term drivers that keep consumers purchasing new products over time.

Limitations and Future Research

The findings from this study have several limitations which provide opportunities for future research. First, because of the characteristics of the dataset, this study does not include consumers' psychological measures which have played an important role as drivers of new product adoption in the previous literature. Thus, future researchers may consider including both survey-based psychological measures and scanner-panel-based behavioral measures together to see how these variables impact new product adoption behaviors in the context of consumer products.

Another limitation is that this study does not consider the effect of social media on the new product adoption process because of the lack of this information in the available dataset. Many firms advertise their new products in social media formats such as Facebook, Twitter, and so on, and consumers mention and review their experiences with new products in social media, which might influence other consumers' willingness to try the new products. Thus, the impact of social media on adoption behaviors will be important future research topics.

Finally, this study focuses on consumers only in a limited geographic area in the United States because of the availability of the IRI scanner panel data for those areas. The U.S. has been characterized as an independent culture. However, drivers of new product adoption by consumers who live in an independent culture might be different from these drivers for consumers who live in interdependent cultures. Thus, the effect of culture on new product adoption behavior is also an important and interesting subject for future research.

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