REMCO PRINS

Modeling Consumer Adoption and Usage of Value-Added Mobile Services

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Modeling Consumer Adoption and Usage of Value-Added Mobile Services

Het modelleren van adoptie en gebruik van additionele mobiele diensten door consumenten

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Chapter 1:

Introduction

1.1 Motivation

Ever since the introduction of the mobile phone several decades ago, many things have changed in telecom markets around the world. As cell phone ownership has reached its saturation level in many countries, and the revenues from voice communication are no longer growing, telecom providers need to find new sources of revenues. Therefore, they continuously work to introduce *value-added services*: mobile services in addition to the traditional voice calls, often based on new technologies. Value-added mobile services such as voicemail and text messaging have been around for some time, and have reached considerable adoption levels among consumers. In the past decade, telecom providers introduced mobile services that enable consumers to access (parts of) the internet on their mobile phone, using technologies such as Wireless Access Protocol (WAP), General Packet Radio Service (GPRS), and – most recently – the Universal Mobile Telecommunications System (UMTS).

Telecom providers invest in these new technologies to be able to cross-sell additional mobile services and enlarge their share-of-wallet with the consumer. This way, the provider does not only get more revenue from its customers, it also creates a better 'lock-in' (Bolton, Lemon, and Verhoef 2004; Eppen, Hansen, and Martin 1991; Kamakura et al. 2003). It has been shown that when the consumer is linked more tightly to the provider through the use of more services, the (perceived) switch costs increase, resulting in a lower probability that the customer will switch to a different provider (Kamakura et al. 1991). Bundling new services together with an existing service, as is often the case with mobile services, can be a very beneficial strategy for service providers (Stremersch and Tellis 2002).

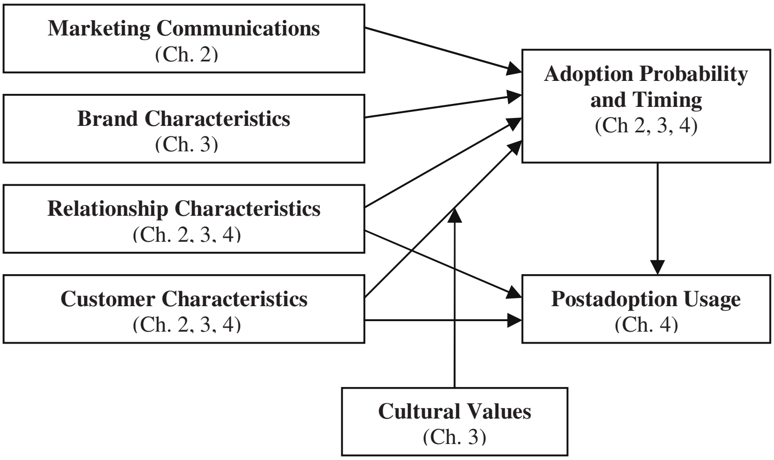
However, not all new mobile services are very successful in the first period after introduction, despite the effort service providers put in. In Europe, telecom firms invested heavily in licenses for UMTS networks, paying a total amount of 109 billion euros to the owners (i.e., the government) of these networks, hoping that new ‘third generation’ (3G) services would cause the saturated mobile telecom market to grow again (The Economist 2004). Soon it became clear that the expectations about the UMTS technology were too high and that the actual roll-out of 3G-services would take several years longer. As a consequence, market values of telecom firms dropped considerably (Van Damme 2002). Another example is the introduction of i-mode, based on GPRS technology, which proved to be very successful in Japan (Barnes and Huff 2003). However, despite the large expenditures on advertising campaigns, the adoption rates in other parts of the world remained far below the provider’s expectations. Also, the usage levels among early adopters of these GPRS services were often very low, which limited the telecom firms’ revenues from the new services even more.

These examples illustrate that the introduction of new value-added mobile services to the market is – depending on the region – often not as successful as telecom firms might hope for, although the high investments in technology and infrastructural development require a substantial number of adopters to get return on investment, preferably in an early stage. A large number of early adopters can be a key driver of new product success, as these consumers generate word-of-mouth (Bass 1969; Rogers 2003). Furthermore, if consumers have to pay additional fees per used unit, as is the case with most value-added mobile services, most of the revenues from these services will come from the usage levels after adoption. Most telecom firms however, seem to focus on the acquisition of as many adopters as possible in the first period after the service is introduced to the market, assuming that these early adopters will also turn into sustained users of the new service.

The difficulties pertaining to the market introduction of value-added mobile services raise several questions, that will be addressed in this thesis:

1. What are the antecedents of mobile service adoption timing?
2. How does mobile service adoption behavior differ across countries?
3. How does adoption timing affect postadoption usage levels of mobile services?

Figure 1.1: Theoretical framework of adoption and usage antecedents



1.2 Theoretical background

In this thesis, we will use the theoretical framework shown in Figure 1.1 to study multiple aspects of mobile service adoption by consumers and to get answers to the research questions mentioned earlier.

The first question addresses the issue of adoption timing and the factors that drive consumers to adopt a new service earlier than others. This stage of the adoption process will be studied in Chapter 2 and 3. Although trial and adoption are sometimes considered as separate events, we do not make this distinction. We define adoption timing as the time between the introduction of the service to the market and the adoption or first trial by the consumer (Steenkamp and Gielens 2003). In the marketing literature, the antecedents of adoption and/or trial probability of new products have been researched extensively (for an overview, see Arts, Frambach, and Bijmolt, 2005). Figure 1.1 shows the most important types of antecedents for the adoption of a certain product or service. Customer characteristics, such as age and gender, are widely accepted as drivers of new product adoption. In general, younger and male consumers have a higher adoption probability and a shorter adoption time (Rogers, 2003). Besides demographics, also psychographics may affect the consumer adoption decision. For example, consumers who show higher levels of innovativeness have a higher adoption probability (Im, Bayus, and Mason 2003; Midgley and Dowling 1973). Less work has been done on the effects of relationship characteristics, such as relationship length and depth (Bolton, Lemon, and Verhoef, 2004), although some studies suggest that higher category usage increases the probability to adopt a new product or service in the same category (Gatignon and Robertson 1991). We will consider customer and relationship characteristics as explanatory variables for adoption probability in chapters 2 and 3. Brand characteristics, and in particular the consumer's perceptions on the supplier brand, can have an impact on cross-buying and upgrading behavior (Ngobo 2005; Verhoef, Franses and Hoekstra 2001). We incorporate them as a covariate in chapter 3 of this thesis. An important antecendent when it comes to adoption timing are the marketing communications by the supplier, such as direct marketing efforts and advertising, that can speed up the diffusion of an innovation in the market (Bass, Krishnan, and Jain 1994; Kalish 1985). At the individual adoption level, only a few studies investigate the time-varying advertising effects (e.g. Steenkamp and Gielens 2003), showing that advertising increases the adoption probability. These advertising effects can be particularly interesting in the telecom market, because of the various mobile services that are introduced by the same brand, and possibly by multiple brands at the same time. Advertising for the telecom brand as such, which includes multiple services, serves a different purpose than advertising for a specific new mobile service, although both types of advertising may have an effect on adoption timing. Also, simultaneous advertising of competitors with similar new mobile services could affect the adoption timing of potential adopters. In Chapter 2 of this thesis, we investigate the advertising effects on adoption timing and distinguish between brand advertising and service advertising, including competitive advertising effects. At the same time, we also consider the effects of direct marketing efforts, relationship characteristics, and consumer characteristics, so that we can get to a relatively comprehensive model of mobile service adoption at the individual level. This will provide telecom providers new insights on how to shorten consumers' adoption times when a new mobile service is introduced.

The second question pertains to the differences in adoption behavior across countries. The GPRS example shows that the successful introduction of a specific mobile service in one country is by no means a guarantee for success in other parts of the world. But how can these variations between countries in adoption rates and adoption speed be explained? Besides technological difficulties, such as the homogeneity and quality of the mobile network in a specific country, differences in consumer adoption behavior may play an important role. Several cross-national studies show that some countries are more innovative than others, which is reflected in higher adoption rates of new products and services, including telecom services (Dekimpe, Parker, and Sarvary 1998). The different levels of innovativeness across countries are often linked to cultural values (Steenkamp, Ter Hofstede, and Wedel, 1999; Takada and Jain, 1991, Tellis, Stremersch, and Yin, 2003). However, most studies only investigate the effects of cultural values on the aggregate level, so little is known about the effects on individual adoption behavior across countries. Because many telecom providers operate internationally and often launch new mobile services in multiple countries at the same time, knowledge about the differences in adoption behavior across the globe can be very important. In Chapter 3, we will address this issue by exploring the moderating effects of cultural values on the relationship between customer characteristics and individual adoption of multiple mobile services in three different countries (see Figure 1.1). We will also include the influence of relationship characteristics and brand characteristics on adoption probability.

While the first two questions pertain to the antecedents of mobile service adoption, and how their effects differ across countries, the third question focuses on the next stage of the adoption process: postadoption usage. This stage is particularly important for telecom providers, because much of the new service revenues come from sustained usage rather than the mere trial or adoption of the new service. Some mobile services, such as SMS and MMS, are not subscription based, so the service provider’s revenues are proportional to the number of messages sent. Subscription based mobile services, such as GPRS and UMTS services, require a fixed monthly fee from the customer, but the usage of the service – for example the number of downloaded kilobytes per month or the number of sent messages – also creates considerable revenues that are needed to earn back the huge technology investments. In this light, it is important for mobile service providers to already have considerable usage levels among the early adopters. Besides the findings that customer characteristics and relationship characteristics may affect postadoption usage levels (Gatignon and Robertson 1985; Reinartz and Kumar 2003), the adoption literature also suggests that early adopters show higher usage levels than late adopters (Morgan 1979; Ram and Jung, 1994). However, most studies are at the aggregate level and cross-sectional, so they cannot identify changes over time. The question we address in Chapter 4 is whether postadoption usage levels of a new mobile service are affected over time by the consumer's adoption timing. At the same time, we control for the effects of customer and relationship characteristics on both adoption timing and postadoption usage. This will clarify the usage patterns of early and later adopters, thereby extending our knowledge of the mobile service adoption process beyond the adoption decision as such.

The key contributions of this thesis are as follows: First, we contribute to the adoption literature by broadening the scope on studied marketing communication drivers of new service adoption (Chapter 2), by exploring the effects of cultural values on individual adoption behavior across countries (Chapter 3), and by providing new insights into postadoption usage patterns of a new service over time (Chapter 4). Second, we contribute to the customer management literature by investigating the effects of relationship characteristics on adoption behavior (Chapter 2, 3 and 4), by studying the impact of direct marketing efforts on adoption timing by existing customers (Chapter 2), and by relating consumers' brand attitudes to new service adoption (Chapter 3).

1.3 Outline of the thesis

In Chapter 2, which is based on Prins and Verhoef (2007), we investigate the effects of direct marketing communications and mass marketing communications on the adoption timing of a new mobile service among existing customers. The mass marketing communications pertain to both specific new service advertising and brand advertising from both the focal supplier and the competitors. Using a split-hazard approach, we determine the effects of the considered marketing communications on adoption timing, accounting for a significant part of the customer base that never adopts the new e-service. We analyze individual adoption behavior with a sample of 6000 customers of a Dutch telecommunications operator over 25 months. The empirical results show that service advertising shortens the time to adoption, even when it is initiated by competitors. Furthermore, an exploratory analysis of the interaction effects between relationship characteristics and marketing efforts suggests that certain mass marketing efforts have a greater effect on loyal customers.

In Chapter 3, we explore the moderating role of cultural dimensions on the relationship between customer characteristics and the adoption probability of new mobile services. We use survey data on consumer attitudes and self-reported adoption of multiple value-added mobile services from the US, Japan and Germany. Using a multivariate probit model with latent variables, we show that the effects of age, consumer innovativeness and category related variables are consistent across countries. However, the influence of gender on adoption probability seems to be more prominent in highly masculine countries, and susceptibility to normative influence has a more prominent effect in individualistic countries than it has in collectivist countries.

In Chapter 4, we consider a longitudinal, individual-level usage data set of 5,233 adopters of a new mobile service, based on the GPRS technology, to study usage development over time. A random-effects tobit model that corrects for the endogenous nature of adoption time reveals that early adopters have lower initial usage levels than late adopters. However, early adopters show stable usage levels after adoption, whereas late adopters tend to decrease their usage levels over time. Failing to correct for the endogenous nature of adoption timing may lead to inaccurate conclusions.

In Chapter 5, we will conclude with a short overview of our findings, their implications, and some recommendations for further research.

Chapter 2:

Marketing communication drivers of adoption timing of a new mobile service among existing customers[1]

2.1 Introduction

As we discussed in Chapter 1, successful new product/service introductions are very important for a firm's long-term performance. This especially holds for industries where firms heavily invest in technologies, such as mobile networks, under the premise that firms would be able to introduce new services using these technologies. Clearly, in order to get return on the technological investments, the new services based on the new technology should be successfully introduced. To achieve this, service providers have to formulate an introduction strategy that both focuses on existing customers and potential new customers. Existing customers may be the most important target group for newly introduced products or services, as they may be more likely to adopt the innovation due to their positive attitude towards the firm.

There is a large research stream in the marketing literature on new product adoption or trial by consumers (Meuter et al. 2005; Rogers 2003; Steenkamp and Gielens 2003). An important characteristic of this research stream is that it usually studies the adoption of new products or services in the total market, which consists of both existing customers and non-customers. So far, researchers did not study the adoption of new products or services among existing customers only. Moreover, many companies now

[1] This Chapter is based on Prins and Verhoef (2007)

consider their existing customers as assets, which is reflected in the increasing importance of customer management in many industries (e.g. Boulding et al. 2005). From a customer management perspective, the cross-selling of new services to current customers can be a good strategy to increase the value of the customer base. If current customers adopt the new service, their customer lifetime value (CLV) should increase (Bolton, Lemon, and Verhoef 2004; Gupta, Lehmann, and Stuart 2004; Hitt and Frei 2002; Hogan et al. 2002; Rust, Zeithaml, and Lemon 2000), as long as the new service does not fully replace an existing one. Not only the adoption itself but also the timing of adoption is relevant in terms of a higher CLV, because increased cash flows from a new product adoption occur earlier in the relationship, and prices of new services often are higher in the early stages of the product lifecycle. In this chapter we will investigate marketing communication drivers of the adoption timing of a new mobile service among existing customers[2]. In doing so, we aim to contribute to both the adoption and customer management literature.

However, first it is important to consider the difference between cross-buying or add-on buying of services and adoption of a new service among existing customers, as one might argue that new service adoption and cross-buying of additional services is the same, because it both concerns relationship expansion through buying more services (e.g. Verhoef, Franses, and Hoekstra 2001). There are, however, some fundamental differences. First, cross-buying pertains to services that are already mature and known to the customer, whereas new service adoption involves products or services that are new-to-the-world. This newness makes it a different buying decision, as there is much more uncertainty about the characteristics and the usefulness of the new service. Second, cross-buying may also imply switching a service (e.g. a car insurance) from a competitor to the focal firm, whereas new product adoption by definition implies buying a newly introduced service which is not yet purchased from competitors. Third, whereas cross-selling of services mainly focuses on existing customers through for example direct mailings and telemarketing (e.g. Verhoef, Franses, and Hoekstra 2001), the introduction of new services both concerns the introduction to the existing customers, and to the total market. This causes large differences in the marketing communications that are used. Whereas cross-

[2] In this thesis we will mainly use the term service when discussing adoption, given our empirical focus on new mobile service adoption. However, the theoretical discussion both holds for services and products.

selling strategies mainly use below-the-line advertising, new product introductions may use both mass marketing communications and below-the-line advertising.

We contribute to the adoption literature as follows. First, this is the first study that solely considers the adoption timing decision among existing customers. Second, we broaden the scope of studied marketing communication drivers. Adoption studies generally consider the impacts of innovation characteristics, such as relative advantage, ease of use, risk, complexity, and consumer characteristics such as demographics and innovativeness (e.g. Arts, Frambach, and Bijmolt 2005; Manning, Bearden, and Madden 1995; Steenkamp and Burgess 2002). Recently, Steenkamp and Gielens (2003) included (time-varying) marketing and communication efforts, such as advertising and promotions, as predictors of new product adoption in a consumer packaged goods (CPG) context. However, attention to the impact of marketing communication efforts on new product or service adoption remains limited. Studies have generally ignored: (1) the impact of individual oriented marketing communication efforts (or direct marketing communications), such as direct mailings and e-mails; (2) the differential impact of marketing communication efforts specifically focussed on the new product/service and marketing communication efforts at the brand/company level[3]; and (3) the impact of competitive marketing communication both at the new product/service and brand/firm level.

We contribute to the customer management literature as follows. First, new product adoption as a driver of customer equity has been almost completely ignored. For example, Bolton, Lemon, and Verhoef (2004) only focus on customer retention, service usage, and cross-buying as components of CLV in their CUSAMS-framework. Hogan and colleagues (2002) merely conceptually acknowledge the importance of new product adoption for customer profitability and CLV. Empirically, Hogan, Lemon, and Libai (2003) relate service adoption behavior to CLV and state that defecting new product adopters have a significant negative impact on customer equity because of negative word of mouth. Recently, Kamakura, Kossar, and Wedel (2004) developed a methodology to identify new product adopters for cross-selling purposes, using past behavioral data as

[3] Note, this distinction is especially important for multi-product or service firms, which advertise their brand (and a portfolio of offered products or services) and their newly introduced service to both potential and current customers.

predictors, but they do not theoretically focus on drivers of new service adoption. Second, studies on the predictors of customer behavior mainly consider individual oriented- or customer-specific marketing interventions, also referred to as below-the-line advertising (Venkatesan and Kumar 2004). In this chapter, we include not only customer-specific marketing interventions, but also above-the-line advertising expenditures over time, which do not vary across customers. As noted by Bolton, Lemon, and Verhoef (2004), advertising is generally associated with mass marketing, but Ambler and colleagues (2002) argue that brand advertising may increase the value of existing customers as well. Empirical evidence for this effect from advertising data remains scarce. Third, most studies in the customer management area do not include competitive instruments, though understanding customer responses to competitive actions is essential (Keiningham, Purkins-Munn, and Evans 2003). We therefore explicitly take into account the effect of competitive advertising on individual customer adoption.

The remainder of this chapter is organized as follows: We first discuss our conceptual model, which we apply in the context of customer adoptions of a new mobile service. Subsequently, we discuss our model to explain adoption timing. It is important to note, that we use a split-hazard model, which jointly models antecedents of the adoption probability and adoption timing. In the next section, we present the empirical results and key findings pertaining to the impact of various types of mass advertising on adoption timing and the different effects of customer-specific antecedents on adoption probability and timing. In addition, we report some significant interaction effects between mass marketing efforts and customer behavior. We conclude with a discussion of the findings, implications, and limitations of our study.

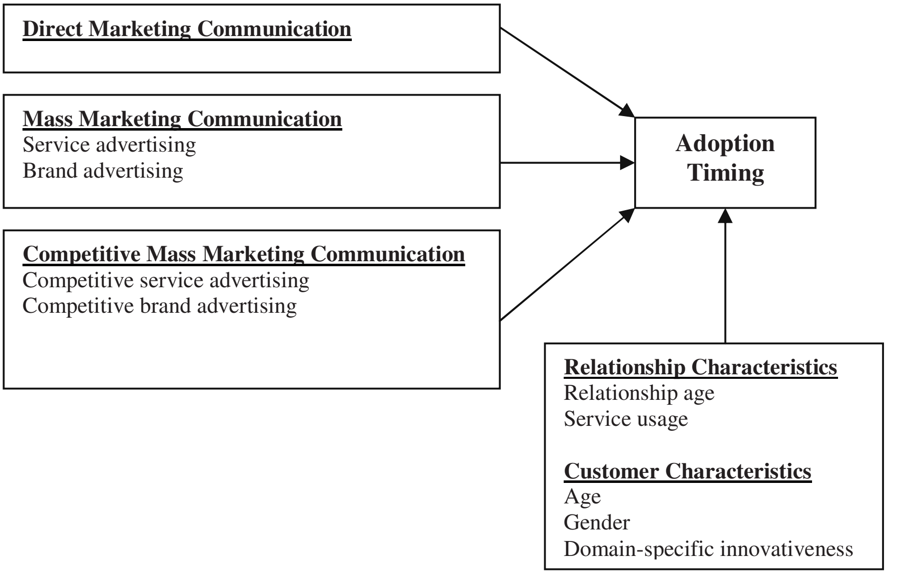
2.2 Conceptual model and hypotheses

2.2.1 Conceptual model

We display our conceptual model in Figure 2.1. In this model, we study the effect of marketing communication efforts on the adoption timing of a new service. We define *adoption timing* as the time between the introduction and the adoption of the new service

(Steenkamp and Gielens 2003). In this context adoption is defined as the actual buying of the new service by an existing customer. In our empirical model we will consider this adoption timing to be conditional on adoption. We will discuss this issue more elaborately in our methodology section. In our model, the main focus is on the effect of marketing communication efforts, as many studies in the new product diffusion literature already showed that marketing efforts can have a significant effect on adoption rates at the aggregate level (Bass, Krishnan, and Jain 1994; Horsky and Simon 1983; Kalish 1985; Simon and Sebastian 1987). We consider three groups of marketing communication variables, that potentially explain adoption timing: (1) Direct marketing communication efforts concerning the new service to existing customers (DMC); (2) Mass marketing communication efforts (MMC) (i.e. advertising) at the new service level and at the brand/firm level; and (3) Competitive mass marketing communications (CMMC) at the new service level and at the brand/firm level. We also include a set of covariates to control for customer specific effects: (1) relationship characteristics (i.e. relationship age, service usage) and (2) customer characteristics (i.e. age, gender, innovativeness).

Figure 2.1: Conceptual model



2.2.2 Direct marketing communication

DMC mainly focuses on directly influencing buying behavior of existing customers, by for example providing attractive offers, and are essentially transaction-oriented (Rust and Verhoef 2005). The effect of DMC on customer buying behavior only recently gained some attention in the academic marketing literature. Verhoef (2003) shows that DMC increases customer share. Venkatesan and Kumar (2004) report initial positive effects for reasonable amounts of DMC on purchase frequency, which become negative for large amounts of DMC (inverted U-shaped effect). Verhoef, Franses and Hoekstra (2001) report positive effects of DMC on cross-buying. In the adoption literature attention for DMC is lacking, because of its focus on adoption behavior in the total market. Steenkamp and Gielens (2003) study other below-the line actions, such as promotions, and show that these positively affect individual trial probabilities for CPGs. Together, these studies suggest that DMC directly points attention to the new service among existing customers, which may have a direct impact on their adoption behavior with respect to this new service. Hence, we hypothesize:

H_1: Direct marketing communication efforts shorten customers' time to adoption.

2.2.3 Mass marketing communication

Within the innovation diffusion/adoption literature, advertising is considered as an important marketing tactic to diffuse the innovation in the market (e.g. Bass, Krishnan, and Jain 1994; Kalish 1985). On the individual consumer level, Steenkamp and Gielens (2003) show that mass advertising accelerates adoption among individual consumers. Generally, advertising may create awareness and knowledge of the new service among both existing customers and other consumers. Next to awareness, advertising may also aim to inform potential adopters about the advantages of the new service, which may induce adoption. All of this will be predominantly accomplished through advertising that specifically mentions the new service: new service advertising. Given the strong empirical results in the innovation/adoption literature, new service advertising will most likely shorten adoption timing. However, as noted earlier, this literature studies all consumers, and does not distinguish between existing customers and non-customers.

Customer management researchers investigating antecedents of customer behavior usually do not include mass advertising efforts as a potential antecedent. A notable exception is the customer equity framework developed by Rust, Zeithaml and Lemon (2000), who acknowledge the effect of branding on customer equity. However, in their modeling framework they both include existing customers and non-customers. The absence of the effect of mass advertising is explained by two reasons. First, from a data perspective, mass advertising data are not collected in customer databases, as they are only available at an aggregate weekly or monthly level. As a consequence, time series data on customer behavior are required (i.e. per month) to match these aggregated advertising data. These data should be integrated with customer database data. Second, from a theoretical perspective, researchers have assumed that behavior of existing customers is predominantly affected by company behavior within the customer relationship. Advertising mainly plays a role in attracting new customers (e.g. Bolton, Lemon, and Verhoef 2004). This might be true for behavior such as customer retention and cross-buying. However, for newly introduced services, awareness should also be created among existing customers and information on this new product should also be communicated to existing customers. This might be done by DMC. Additionally, existing customers are likely to be confronted with mass advertising promoting the new service, which should at least have some effect on customer behavior following the noted diffusion research. Based on the above discussion we hypothesize:

H_2: *Service advertising shortens customers' time to adoption.*

Firms will not only advertise newly introduced services, but they will also continue their brand focused advertising efforts. This brand advertising mainly aims to increase brand awareness, to improve brand attitudes and to impact purchasing behavior, such as brand choice (e.g. Lodish et al. 1995; Rossiter and Percy 1997; Vakratas and Ambler 1999). The question is whether this brand advertising will also positively affect adoption of newly introduced services. One argument in favor of an effect is that brand advertising creates a more positive attitude towards the brand, which may positively affect the attitude towards the newly introduced service, which in turn may positively affect adoption behavior. In the same vain, for example, Verhoef, Franses, and Hoekstra (2002) show that customers being more committed to the firm are more likely to buy more services. The size of this effect will, however, be significantly smaller than the effect of specific service advertising, which directly aims to improve awareness for the new service and attitudes towards the brand. Hence, we hypothesize:

H_3: *Brand advertising shortens customers' time to adoption.*

H_4: *Service advertising shortens customers' time to adoption more than does brand advertising.*

2.2.4 Competitive mass marketing communication

New services are usually not introduced by a single firm in the market. Competitors may introduce a similar service as well. These competitors will also advertise their new service to stimulate adoption. Within the diffusion literature there has been particular attention for the effect of this competitive advertising. One might be inclined to think that competitive service advertising would negatively affect the adoption of the new service among existing customers of the focal supplier. However, within the diffusion literature there is ample evidence that competitive new service advertising may work positively. It may in fact accelerate individual adoption through the market-making effect; i.e., the advertising efforts of all competitors will increase the penetration rate of new services (Krishnamurthy 2000; Krishnan, Bass, and Kumar 2000). Because of this higher penetration rate, competitors will benefit from one another's advertising efforts pertaining to the new service, particularly in new markets with relatively few competitors (Mahajan, Sharma, and Buzzel 1993). Hence, we hypothesize:

H_5: *Competitive service advertising shortens customers' time to adoption.*

Like the focal supplier, competitors may also continue their brand advertising. Similar to the focal suppliers' brand advertising, competitive brand advertising aims to create competing brand awareness, to enhance positive competitive brand attitudes, and to impact competing brand buying behavior. A possible consequence of competitive brand advertising is the enhancement of positive competitive brand attitudes among existing customers. It may perhaps also decrease brand attitudes of the focal suppliers. This might negatively impact adoption. However, so far, evidence for these described paths of effects is almost absent in the marketing literature. In their customer equity model, Rust, Zeithaml and Lemon (2000) assume that when a firm increases its advertising, it creates higher perceived brand equity through increased brand awareness and positive attitude creation, which should lead to higher choice shares for the focal supplier and to lower choice shares for competing suppliers. Whether such an effect might also occur for new service adoption is an empirical question. However, for now we will formulate a hypothesis that is in line with our reasoning:

H_6: *Competitive brand advertising lengthens customers' time to adoption.*

2.2.5 Interaction effects between marketing communication efforts

In addition to the direct effects of these explanatory variables, we also explore the interaction effect between DMC and MMC. Previous research (e.g. Naik and Raman 2003; Schultz, Tannenbaum, and Lauterborn 1993) points to a synergy between different marketing communications types (i.e. DMC and MMC), which should be reflected in a positive interaction effect. This positive interaction effect may for example occur, as MMC, creating awareness and positive attitudes for the new service, may increase the effect of DMC. We have no reason to expect that there will be differences in these effects between service and brand advertising.

H_7: *There is a positive interaction effect between DMC and service advertising.*

H_8: *There is a positive interaction effect between DMC and brand advertising.*

2.2.6 Covariates

Based on prior research in the adoption and customer management literature, we include two groups of covariates in our model: relationship characteristics and customer characteristics.

We consider the relationship's length and depth as relationship characteristics (Bolton, Lemon, and Verhoef 2004). Several researchers have pointed out that relationship length may affect customer behavior (Dwyer, Schurr, and Oh 1987; Hitt and Frei 2002). This relationship may, however, be nonlinear (Bolton, Lemon, and Verhoef 2004; Hitt and Frei 2002). Relationship depth, often referred to as usage intensity or category usage, generally is considered as an antecedent of trial or adoption probability (e.g. Steenkamp and Gielens

2003). Consumers who display high category usage levels have a greater category need and therefore a higher trial probability for a new product within that category (Gatignon and Robertson 1991). Again, there may be some nonlinearities in this relationship due to customer lifecycle effects (Bolton, Lemon, and Verhoef 2004).

The included relationship characteristics are not only of interest because of possible direct effects on adoption timing. There might also be some interaction effects between relationship characteristics and communication efforts. Empirical research by Rust and Verhoef (2005) indicates significant heterogeneity of responses to marketing interventions that may be related to relationship characteristics. In particular, we explore the interactions between relationship age on the one hand and DMC, (competitive) service advertising, and (competitive) brand advertising on the other hand. Although the investigation of these interactions is not the primary objective of this study, we believe it might provide valuable insights on the effects of marketing communication efforts on adoption, which might be studied in-depth in other studies.

The customer characteristics we include as covariates are: age, gender, and domain-specific innovativeness. These customer characteristics likely play an important role in the adoption probability and timing of individual customers (Arts, Frambach, and Bijmolt 2005). For example, in general, early adopters tend to be younger (Meuter et al. 2005; Rogers 2003).

Customer innovativeness is also often considered as an important antecedent of new product adoption. Most studies (e.g. Im, Bayus, and Mason 2003; Midgley and Dowling 1993; Steenkamp, Ter Hofstede, and Wedel 1999) focus on innate innovativeness as an individual trait that can be generalized over product categories and find that innovative persons have a higher tendency to adopt new products and adopt them faster. Citrin and colleagues (2000) and Goldsmith, Freiden, and Eastman (1995) show that domain-specific innovativeness—which reflects the consumer's tendency to try the latest innovations in a product category—has a stronger relationship with individual adoption behavior than does innate innovativeness. Our data provide information on the adoption of a previously introduced new service, which may be an indicator of domain-specific innovativeness. Hence, we control for domain-specific innovativeness in our model.

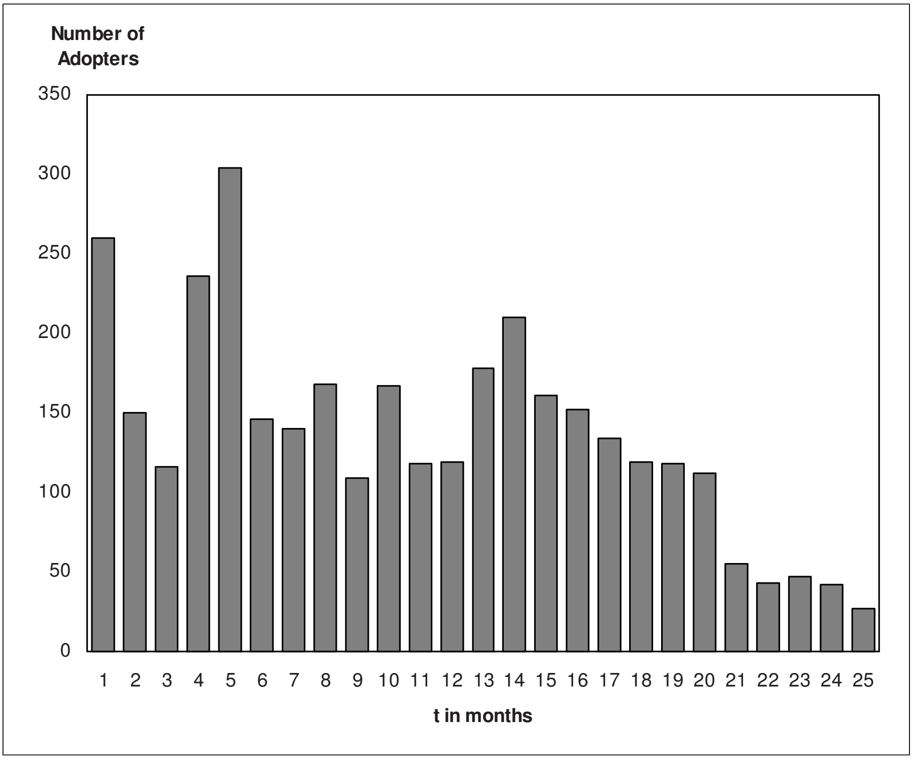
2.3 Data description

Our empirical study focuses on the adoption process of a new mobile service in the Dutch consumer market, introduced in 2002 by one of the leading Dutch mobile telephone providers. This company was the first in the Netherlands to introduce this service. Hence, the introduced service is fully new to the market. The new service uses GPRS (General Packet Radio Service) technology to give subscribers access to a range of Web sites specifically designed for mobile telephone use. For our empirical analyses, we employ the service provider’s customer database, from which we gather monthly data on mobile subscribers, starting with the introduction date of the new service. These data include information on demographics, usage levels of various services, relationship characteristics, and marketing communication efforts by the provider. After the introduction of the new mobile service, every customer could subscribe to it, in addition to their regular subscription with the mobile telephone operator. For each adopting customer, we know the first usage date of the new service, which enables us to determine the individual adoption times for those customers who adopted the new service during the observation period.

2.3.1 Sample

For our analyses, we randomly selected a total of 6,000 mobile subscribers from the provider’s customer database who were current customers at the start of the observation period, which ran from August 2002 ($t = 1$) through August 2004 ($t = 25$). The start of the observation period is marked by the introduction date of the new service. By the end of the observation period, the number of existing customers adopting the new service is rapidly declining (see Figure 2.2). Thus, we can expect that the chosen observation period will capture the effects on adoption timing for most existing customers. Although all customers were with the provider at the start of the observation period, a total of 910 left the provider before the end of the period. To avoid a selection bias, we did not exclude these customers from our sample. Switchers to the competitive entrant’s new service could have caused some of the defections, so that these customers would be labeled as non-adopters. Apart from the fact that there is no data available on this issue, we believe it is justified to label these customers as non-adopters, as we specifically investigate the adoption of the focal company's new service among existing customers.

Figure 2.2: Monthly adoptions in sample



We were confronted with the issue of a relatively small adoption rate, which is not uncommon for multigenerational products or services, because the users of the older technology will not immediately adopt the new one (Mahajan and Muller 1996; Pae and Lehmann 2003). It may take a significant amount of time before the diffusion of a new product really takes off (Golder and Tellis 1997; Tellis, Stremersch, and Yin 2003). Because we were particularly interested in the adoption of the new service but only a small portion of customers had adopted the service before September 2004, we over-sampled these adopting customers. In our procedure, we over-sampled the number of adopters, so that approximately half the sample adopted the new service during the observation period, which gave us 3,431 adopting customers, or 53% of the sample. Donkers, Franses, and Verhoef (2003) demonstrate, over-sampling a rare event in binary choice models does not affect the parameter estimates or their standard errors, as long as the over-sampling is not accompanied by stratified sampling on the independent variables. So far, there is no statistical research showing that over-sampling has an effect on the parameter estimates and standard errors of the split-hazard model. Hence, it is not clear what the effect of over-sampling is on the split hazard model results. We therefore estimated models with a smaller fraction of adopters. These models showed similar results in terms of sign and significance of the coefficients. However, models with few adopters have convergence problems. We therefore also estimated normal hazard models with different fractions of adopters. These results show that the sign of the coefficients do not change. For rather small fractions, however, a smaller number of variables become significant due to sample size effects. These additional analyses provided us with sufficient confidence in our estimation results.

2.3.2 Time to adoption

For each month in our observation period, we observed whether a customer had adopted the new service. The time to adoption for each customer represents the time elapsed in months since the introduction of the mobile service. We use the individual time to adoption as our observed dependent variable.

2.3.3 Marketing communication variables

During the observation period, the provider selected customers who would receive an individual offer by telephone to adopt the new service. Our data indicate whether and when each customer received an offer call from the provider. We operationalize these data by including a dummy variable that indicates the month(s) in which the customer received the offer. Some customers who did not respond to the first offer were subsequently selected for a second offer. Although we recognize that the provider may have selected only those customers who were most likely to adopt in the first place, which would cause an endogeneity problem, we believe that by incorporating all possible selection criteria into our model, we can avoid serious problems in estimating the effect of DMC (Franses 2005; Shugan 2004).

We use data pertaining to monthly advertising expenditures to account for advertising effects on adoption timing. We retrieve these advertising data from BBC, a Dutch division of Nielsen Media Research International. Furthermore, we distinguish among service advertising, brand advertising, competitive service advertising, and competitive brand advertising for television, radio, print, outdoor, and cinema. We define *service advertising* as the provider's monthly expenditures (in millions of euros) on advertising that explicitly features the new mobile service. In all cases, these advertisements mention the brand name of the provider as well, but the main focus was on the new service. We define *brand advertising* as the provider's expenditures on advertising not directly related to the new mobile service.

Although the mobile service was new to the market at the time of introduction by the provider, six months later, one of its competitors launched a similar service. Therefore, we include *competitive service advertising*, or the competitor's advertising that explicitly features a similar mobile service. Again, the competitor mentioned its brand name in all of these advertisements. Finally, we include *competitive brand advertising*, which is all competitors' advertising that is unrelated to any similar mobile services. To allow for possible lagged advertising effects, we also include all advertising expenditures in the previous month.

2.3.4 Covariates

As noted, we included relationship age and service usage as covariates. We define relationship age as the number of years the customer had been with the provider at t = 1, the beginning of the observation period. To measure the service usage, we compute the average monthly amount spent by each customer over his or her total customer lifetime prior to the beginning of the observation period. Thus, service usage does not include usage of the newly introduced mobile service.

The customer demographics we control for are gender and age. We set the gender dummy to zero for male customers, and we define the age variable as the customer's age in years at the start of the observation period, so that it is fixed over time. As a proxy for the domain-specific innovativeness of each customer with respect to mobile services, we include a dummy variable that indicates the adoption and use of a prior generation mobile service, which had been introduced several years before.

In Table 2.1, we summarize and describe all our included variables.

Table 2.1: Measurements and descriptives of explanatory variables

Variable	*Label*	*Average*	*Standard Deviation*
Marketing Communication			
DMC			
Dummy for individual offer by telephone for customer i in month t	DMC_{it}	.09	.13
MMC			
Service advertising			
Advertising expenditures in millions of euros in month t with respect to the new service	SA_t	1.11	.88
Brand advertising			
Advertising expenditures in millions of euros in month t, not related to the new service	BA_t	1.50	1.05
CMMC			
Competitive service advertising			
Advertising expenditures of all competitors in millions of euros in month t, related to a similar service	CSA_t	.95	1.12
Competitive brand advertising			
Advertising expenditures of all competitors in millions of euros in month t, not related to a similar service	CBA_t	6.23	2.44
Relationship Characteristics			
Relationship Age			
Number of years customer i has been with the provider at t = 1	RA_i	2.67	1.65
Service Usage			
Average monthly amount spent by customer i before t = 1	SU_i	3.39	4.03
Customer Characteristics			
Gender			
(male = 0; female = 1)	$Gend_i$	.26	.43
Age			
At t = 1	Age_i	37.93	10.45
Domain-specific innovativeness			
Dummy for usage of prior generation mobile service by customer i	$Innov_i$	.03	.18

2.4 Methodology

Adoption studies that consider adoption as a discrete event use a logit or probit-like model to assess the impact of independent variables on adoption (e.g. Meuter et al. 2005), whereas those investigating adoption timing tend to use a hazard model (e.g. Steenkamp and Gielens 2003). The hazard model makes the assumption that, eventually, every consumer will adopt the new product. Especially for products and services with greater technological complexity, there will be a significant group of consumers who will never adopt. Theoretically, this issue as been pointed to as innovation resistance, reflected in rejecting the new service, opposing against the new service, or postponing the adoption of the new service (e.g. Bagozzi and Lee 1999; Mittelstaedt et al. 1976; Ram and Sheth 1989; Szmigin and Foxall 1998) This innovation resistance may for example be caused by the fact that consumers are comfortable with the current situation, do not see the advantage of the new service, or consider it as a very risky innovation. Sheth (1981) indeed concludes that consumers resisting innovations tend to be different from consumers not resisting innovations.

The notion that a group of customers will probably never adopt the new service has important implications when studying the antecedents of adoption timing. Not only are these consumers unaffected by the time elapsed after the introduction of the product, we also assume that they are ‘immune’ to any marketing efforts. In other words, the probability of adoption for these consumers is 0. A traditional hazard approach does not account for this group, because it imagines all consumers as ’at risk’ for adoption after the product’s introduction. In practice, we cannot observe whether a consumer belongs to the immune group, but we can estimate the probability of eventual adoption by each consumer using available customer characteristics.

The econometric model accounting for the problem—that a significant portion of the subjects will never adopt—emerges through the split-hazard approach, developed by Schmidt and Witte (1989) and has been applied in various contexts, including new product adoption (e.g. Chandrashekaran and Sinha 1995; Dekimpe et al. 1998; Kamakura, Kossar, and Wedel 2004; Sinha and Chandrashekaran 1992). Following this methodology, we apply a split-hazard approach to model both the adoption probability and the adoption timing of the new service by existing customers. The time to adoption for individual i, denoted by T_i, thus is a random variable with a cumulative distribution function F(t) and density f (t) = F'(t). The probability that adoption has not yet occurred at time t is provided by the survivor function S (t) = 1 – F(t). The hazard rate h(t) = f (t) / S (t) can be defined as the conditional likelihood that adoption will occur at time t, given adoption has not occurred yet. We can only observe adoption for those consumers who adopted within the period of observation [0,T]; those who do not adopt before time T will either be censored and adopt at some time beyond T or never adopt at all. The split-hazard model enables us to estimate simultaneously the probability of eventual adoption and the time to adoption. We include a dummy variable that indicates adoption by the end of the month in the hazard part of our model as the failure indicator. Customers are considered at risk of adoption as long as they have not adopted the new service. Those customers who left the provider during the observation period can be included in the analysis only for the time periods in which they remained with the company.

We model adoption timing as a hazard function of both time-varying marketing communication efforts, and the time-invariant covariates, i.e. relationship characteristics and customer characteristics. The baseline hazard function follows a prescribed distribution and captures the longitudinal regularities in adoption time dynamics, separate from the effects of the covariates. In other words, it captures the effect of the time elapsed since the introduction of the new product. The parametric form we use for our hazard function is the complementary log-log model, which is particularly useful when data from discrete time intervals are used for a continuous underlying adoption process, because the estimates of the model do not depend on the length of the time intervals (Allison 1982; Van den Bulte and Lilien 2001). To account for (nonlinear) time dependencies of the baseline hazard rate, we include a time trend variable and the squared time trend in the hazard part of our model. Higher-order transformations result in significant coefficients but would capture too much of the effects of the time-varying variables, such as advertising effects. Therefore, we only allow for a first- and second-power time dependency of the baseline hazard in our model.

The hazard part of our model, including all explanatory variables, can be represented as follows:

(1) $h_{it} = 1 - \exp[-\exp(\beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 DMC_{it} + \beta_4 SA_t + \beta_5 SA_{t-1} + \beta_6 BA_t + \beta_7 BA_{t-1} + \beta_8 CSA_t + \beta_9 CSA_{t-1} + \beta_{10} CBA_t + \beta_{11} CBA_{t-1} + \beta_{12} RA_i + \beta_{13} RA_i^2 + \beta_{14} SU_i + \beta_{15} SU_i^2 + \beta_{16} Age_i + \beta_{17} Age_i^2 + \beta_{18} Gend_i + \beta_{19} Innov_i)]$.

Simultaneously, we estimate the unobserved probability of eventual adoption for every individual customer, which we denote by p_i. We model the probability of eventual adoption as a logit function of time-invariant customer characteristics and relationship characteristics:

(2) $p_i = 1 / [1 + \exp(\gamma_0 + \gamma_1 RA_i + \gamma_2 RA^2 + \gamma_3 SU_i + \gamma_4 SU_i^2 + \gamma_5 Age_i + \gamma_6 Age^2 + \gamma_7 Gend_i + \gamma_8 Innov_i)]$.

The log-likelihood function of our total model (including Equations 1 and 2) is as follows:

(3) $LL = \sum_{i=1}^{N} d_i \ln[p_i * h_{it} * S_{it-1}] + (1-d_i) * \ln[(1-p_i) + p_i * S_{it}]$,

where

h_{it} = hazard rate from Equation 1,

p_i = probability of eventual adoption from Equation 2,

d_i = censoring indicator (1 if observed; 0 if censored), and

S_{it} = survival rate.

For observed adoptions, the censoring indicator d_i equals 1. The contribution to the likelihood function by consumer i at time t will be the probability that he or she will eventually adopt, as given by p_i, multiplied by the conditional probability of adoption at t, as given by the hazard rate h_{it}, and by the probability that he or she has not adopted before t, as given by the survival rate S_{it-1}. Censored observations, for which d_i is 0, belong to either the non-adopters, with probability $(1 - p_i)$, or those who will eventually adopt but have not yet, given by the terms $p_i * S_{it}$. To obtain the coefficients for every explanatory variable, we use maximum likelihood estimation in STATA version 8.2.

2.5 Results

2.5.1 Model fit

To assess whether the split-hazard model is required, as we assume that a significant part of the existing customers will probably never adopt the new mobile service, we also estimated an ordinary proportional hazard model. Note that these models are nested. When we compare the fit of our split hazard model to the proportional hazard model, it shows that our model has a significantly better fit, according to the likelihood-ratio test: χ^2 (9) = 27.546 ($p<0.01$). Also, the AIC-statistic of the split hazard model is smaller (27,229.89 vs. 27,239.44), which indicates a better fit. The BIC-statistic does not show an improvement, which would imply that the split hazard model does not do a better job in explaining adoption timing than the ordinary hazard model does. Note that BIC penalizes more complex models more heavily than the AIC does. However, based on the discussed theoretical justification of the split hazard approach in the methodology section, and based on the other diagnostics, we believe that the split-hazard model is theoretically the best way to model individual adoption timing. (see also Kamakura, Kossar, and Wedel 2004). Moreover, according to the STATA program it is rather difficult for the more complex split-hazard model to deliver a better fit. Still, two out of our three fit measures favor the split-hazard. Hence, in the following we will discuss the results of the split-hazard model only. The ordinary hazard model does not lead to different conclusions with respect to the variables of interest.

In Table 2.2, we summarize the results of the split-hazard model. In the logit part of our model, positive coefficients indicate a positive effect on the probability of eventual adoption, whereas in the hazard part, positive coefficients indicate a positive effect on the hazard rate. Consequently, variables with positive coefficients shorten the time to adoption. The estimation results reveal some significant effects of our included relationship characteristics in the logit-part of the model, indicating that the non-adopters (or customers resisting the innovation) are indeed different from adopters. The results also reveal significant effects of the considered marketing communications. We will now discuss our results more specifically.

Table 2.2: Estimation Results

	Logit Part: P(Adoption)			*Hazard Part: Time to Adoption*		
	Coeff.	z-Value		Coeff.	z-Value	
t	NA			.1618	11.49	***
t^2	NA			-.0048	-9.82	***
DMC	NA			1.8652	43.20	***
Service advertising	NA			.2243	7.22	***
Service advertising (t – 1)	NA			.0012	.05	
Brand advertising	NA			.0521	2.25	**
Brand advertising (t – 1)	NA			.0432	1.88	*
Comp. service advertising	NA			.0969	4.85	***
Comp. service advertising (t – 1)	NA			-.0065	-.29	
Comp. brand advertising	NA			-.0863	-10.26	***
Comp. brand advertising (t – 1)	NA			-.0078	-.85	
Relationship age	.8493	1.75	*	.0521	1.00	
Relationship age^2	-.1296	-1.86	*	-.0033	-.42	
Service usage	-.2164	-3.00	***	.0580	4.45	***
Service usage^2	.0032	2.35	**	-.0009	-2.45	**
Age	-1.6270	-.88		-.2123	-1.55	
Age^2	.2413	.97		-.0075	-.46	
Gender	.4401	.62		-.1486	-2.44	**
Domain-specific innovativeness	-.2685	-.44		.3166	2.84	***
Constant	5.5730	1.67	*	-3.6189	-11.98	***
Log-likelihood	-13,586.947					
Likelihood ratio test	χ^2 (28) = 1935.99 ***					
AIC-statistic	27,229.89					
BIC-statistic	27,401.83					

* $p < .10$ (two-sided).
** $p < .05$ (two-sided).
*** $p < .01$ (two-sided).

2.5.2 Marketing communications

Direct marketing communications have a significant positive effect on the hazard rate; these effects substantially shorten consumers' time to adoption. We also find a positive effect for service and brand advertising on adoption timing. When we test for the equality of the coefficients of service and brand advertising, we find that the effect of service advertising is significantly greater than that of brand advertising ($p < .01$). Therefore, H_1, H_2, H_3, and H_4 are all supported. In addition, our hypothesis regarding the market-making effect of competitive service advertising (H_5) is confirmed; we find a positive significant effect on adoption timing. Finally, brand advertising by competitors has a significant negative effect, which implies that it lengthens the time to adoption, as we hypothesized in H_6. Overall, the lagged effects of advertising expenditures are not significant, except for that of brand advertising[4]. The size of all mass advertising effects is considerably smaller than the size of the DMC effects; i.e. no increase in advertising expenditures can equal the effect of a DMC offer on individual hazard rates. However, the stronger DMC effect may be context dependent, as we will discuss in our discussion and limitations section.

2.5.3 Covariates

Relationship age has a significant (nonlinear) effect on adoption probability. Specifically, the probability of eventual adoption increases as the age of the customer's relationship with the provider increases, up to approximately three years. For customers that have been with the provider for more than three years, the adoption probability decreases. This finding is to some extent in line with Reinartz and Kumar (2003), who report a nonlinear relationship between interpurchase times and lifetime duration. We do not find a significant effect of relationship age on adoption timing.

Service usage appears to be a significant indicator of both adoption probability and adoption timing. Customers with high usage levels are less likely to adopt the new service eventually than are customers with low usage levels. This effect might occur, because customers with high usage levels are very satisfied with the services they currently receive. Hence, they see no need for adopting a new developed service. Given that they adopt, customers with high usage levels turn out to be the fastest adopters. This positive

[4] We also did an additional analysis to further assess potential long-term effects of our included marketing communications, where we considered the cumulative effects of advertising expenditures for all four types of marketing communications using the approach of Nerlove and Arrow (1962). Our estimation results did not reveal any cumulative effects for service- and brand advertising of the focal supplier, service advertising of competitors. We found an unexpected positive effect of cumulative competitive brand advertising. Given the absence of strong support for cumulative advertising effects, we do not report these effects in the paper.

relationship between service usage and adoption timing suggests that, despite a low adoption probability, heavy users tend to adopt faster than lighter users.

2.5.4 Interaction effects

In addition to our analyses of the main effects displayed in Table 2.2, we also perform an analysis on any possible interaction effects between DMC and MMC, as well as between marketing communications and relationship characteristics. We include all interaction terms simultaneously in the split-hazard model we used previously, which does not change the other coefficients significantly. Therefore, we report only the interaction effects and relevant main effects in Table 2.3. Adding the interaction effects to the model improves the total model fit significantly ($\chi^2(7) = 24.724$; p<0.001); the AIC statistic also decreases from 27,229.89 to 27,219.17.

Table 2.3: Estimation results interaction effects

	Hazard Part: Time to Adoption		
	Coeff.	z-Value	
DMC	1.9558	16.44	***
Service advertising (SA)	.1841	4.88	***
Brand advertising (BA)	.0323	1.06	
Competitive service advertising (CSA)	.0829	3.48	***
Competitive brand advertising (CBA)	-.0819	-8.01	***
Relationship age (RA)	-.0345	-.41	
RA^2	.0038	.36	
DMC × SA	-.1226	-1.97	**
DMC × BA	.0424	.92	
RA × DM	-.0202	-.43	
RA × SA	.0742	2.89	***
RA × BA	.0004	0.02	
RA × CSA	.0380	2.12	**
RA × CBA	-.0059	-.71	
Log-likelihood	-13,574.585		
Likelihood-ratio test	χ^2 (35) = 1960.71 ***		
AIC-statistic	27,219.17		
BIC-statistic	27,434.09		

* *p* < .10 (two-sided).
** *p* < .05 (two-sided).
*** *p* < .01 (two-sided).

The first interaction effect we investigate is between DMC and service and brand advertising. The results suggest a negative interaction effect between DMC and service advertising, which indicates that the combined effect of the two types of marketing efforts on adoption timing is less than the sum of the separate positive effects. The interaction effect between DMC and brand advertising is not significant. Therefore, we do not find evidence for communication synergies between DMC and brand advertising, as we hypothesized in H_7 and H_8.

The second interaction effect we examine is that between relationship age and all types of marketing communications. The results suggest that the influence of service advertising efforts—whether by the provider or its competitors—is greater for customers that have been with the provider for a longer time. We cannot find any significant interaction effects between (competitive) brand advertising and relationship age or between DMC and relationship age.

2.6 Discussion and Implications

2.6.1 Summary and contributions

In this chapter, we investigate the effects of marketing communications on the individual adoption timing of a new mobile service by existing customers of a large Dutch telecom provider. In doing so, we integrate the literature streams of new product adoption and customer management. This integration and our data—including customer adoption behavior, customer-specific marketing interventions, advertising expenditure data, customer relationship characteristics, and customer characteristics—enable us to contribute to both literature streams. We report a summary of our hypothesis testing results in Table 2.4, and we discuss our most important findings and contributions next.

Table 2.4: Summary of hypothesis testing results

Variable	*Hypothesis*	*Hypothesized Effect on Adoption Timing*[a]	*Finding*	*Conclusion*
DMC	H_1	+	+	Supported
Service advertising	H_2, H_4	+	+	Supported
Brand advertising	H_3, H_4	+	+	Supported
Competitive service advertising	H_5	+	+	Supported
Competitive brand advertising	H_6	-	-	Supported
DMC × Service advertising	H_7	+	-	Not supported
DMC × Brand advertising	H_8	+	n.s.	Not supported

[a]Positive effects indicate a shorter time to adoption

First, we study both direct marketing communications and mass communications. These mass communications include both advertisings communicating the new mobile service and brand advertisings, while we also consider the impact of these two advertising types from competing suppliers. In support of prior customer management research findings, we find that DMC shortens adoption timing (e.g. Verhoef, Franses, and Hoekstra 2001). This is an important extension of our knowledge on the possible effects of DMC. It not only influences for example cross-buying of existing services, it also impacts the purchase of newly introduced services. The finding of an effect of DMC is also important for the adoption literature, as so far adoption researchers have ignored the impact of DMC on individual adoption behavior. Our study results clearly emphasize the importance of DMC in influencing the adoption behavior of existing customers. Consistent with previous adoption studies and diffusion research, we find a positive effect of mass advertising expenditures of the focal supplier on the adoption speed of individual customers. The effect on adoption timing is, however, remarkably smaller than the effect of DMC. This could point to the fact that, in this particular setting, mass communication, due to its focus on creating awareness and information provision, does not influence adoption behavior very strongly. In order to really affect behavior, more action-oriented communications, such as DMC, are required. However, this stronger effect of DMC may also be explained by the fact that we study adoption behavior of existing customers, who might be more responsive to individually targeted marketing efforts. Furthermore, this result may be context dependent, since we could only investigate one type of DMC, and did not have any influence on the content of the message. For example, it might have been possible for the provider to adjust the message to the individual customer's situation. Moreover, the strong effect of DMC might also be due to the firm doing a good job of selecting customers who to contact by phone. Note, however, that we controlled for this by including several covariates. Overall, we cannot draw any generalizable conclusions from the relatively strong DMC effect compared to the effect of MMC. Future research might aim to replicate our findings.

Second, this is the first study explicitly distinguishing between brand advertising and service advertising. We show that the effects of each type of mass advertising on individual adoption timing are notably different. Mass advertising specifically related to the new service has a greater effect on the time to adoption than does general mass advertising for the service provider's brand. This is of course not an unexpected finding, as service advertising has a more specific focus on the new service. Through service advertising, service providers mainly build consumer awareness and interest with respect to the new service category. However, the positive effect of general brand advertising on adoption behavior is remarkable. Based on general advertising theories, we argued that brand advertising positively impacts the attitude towards the brand, which then positively affects adoption behavior. There is, however, still much unknown about this effect. For example, do improved brand perceptions indeed positively affect adoption behavior? In this study, we did not account for intervening brand attitudes (nor service attitudes). It would be very interesting to include these attitudes in more extended models in future research. As noted, mass advertising has been ignored by customer management research for several reasons. Our study indeed shows that mass communication affects adoption behavior of existing customers. This is an important finding, although it might be due to the specific nature of the behavior: existing customers also need to be informed about the new service, providing a more important role for mass advertising. However, it may also point to a too narrow view of customer management researchers, who assume that after acquisition, existing customers mainly focus on the relationship itself and are no longer affected by mass advertising efforts. The important role of advertising is generally acknowledged in frequently consumed packaged goods, where advertising elasticity's are found between 0 and 0.2 percent (Assmus, Farley, and Lehmann 1984; Vakratas and Ambler 1999). In these markets, advertising is required to continuously reinforce the brand position in the consumers' mind in order to affect buying behavior and thus brand loyalty in the store. The question is whether advertising also affects customer behaviors, such as customer retention or cross-buying, of existing customers in more long-term (contractual) relationships. Our study may indeed point to the existence of these effects. However, future research should empirically establish whether these effects are actually present.

Third, our results show that competitive advertising efforts featuring similar services can accelerate the adoption process for first movers as well, which suggests that through service advertising, service providers mainly build consumer awareness and interest with respect to the new service category. It also confirms the market-making effect, which has been shown to be relevant at the aggregate diffusion level (e.g. Krishnan, Bass, and Kumar 2000). Our study is the first to show this effect at the individual adoption level. Our results also show that competitive brand advertising lengthens adoption timing. This finding is rather interesting, as it shows that even the adoption of new services by existing customers is affected by competitive actions not related to the specific new service. Theoretically, we reasoned that this effect might exist, because of the effects of competitive advertising on brand attitudes of both the focal supplier and the competitor. We do, however, have no empirical evidence for this link, as we do not observe brand attitudes. Clearly, more research is required here. The inclusion of competitive mass communication efforts is totally new for the customer management research literature. Most researchers have ignored the impact of competitive actions, although they are acknowledged to be relevant (e.g. Keiningham, Purkins-Munn, and Evans 2003). Our results emphasize the importance of these competitive actions. A next step in customer management research would be that researchers would include more competitive variables in their models.

Fourth, we examined various possible interaction effects in our analysis. Although we expected a positive synergy between DM and mass marketing efforts, we find some rather less straightforward effects, including an unexpected negative interaction between service advertising and DMC. Past research have also identified some negative interaction effects. Naik, Raman and Winer (2005) argue that the price oriented nature of promotions may reduce the effectiveness of advertising in building brands. On the other hand advertising may lower the consumer sensitivity to promotions. Narayanan, Desiraju and Chintagunta (2004) report a negative interaction effect between detailing and advertising in pharmaceutical markets. The reasoning of Bass et al. (2006) is that there might be a kind of overkill. The advertising combined with DMC may result in too much attention for the new service, resulting in a negative interaction effect. Overall, there is clearly more research required in understanding these negative interaction effects, which are found more commonly in empirical research. We cannot find any significant interactions between brand advertising and DMC, which implies that there is no synergy between these marketing variables.

The interaction effects between marketing efforts and relationship age provide some more intuitive results. Service advertising has a greater impact on more loyal customers, and the positive interaction effect between competitive service advertising and relationship age implies that the market-making effect does not work well for relatively new customers. Overall, the interaction effects between relationship age and marketing efforts provide further evidence that customers' heterogeneous responses to marketing efforts may be explained, at least partially, by relationship characteristics such as relationship age (Rust and Verhoef 2005).

Fifth, from a modeling perspective, our research clearly shows that one should account for the fact that a certain part of the customers will probably never adopt the new service. This supports the theoretical notion of innovation resistance mentioned in de adoption literature. So far, most adoption researchers do not account for this in their econometric model (e.g. Steenkamp and Gielens 2003). Hence, our study is one of the few studies using a split-hazard model accounting for this effect at the individual adoption level. We should, however, mention that our model might also work well, because of the limited time frame of the data. Usually, the take-off of a new product of service may take several years (Tellis, Stremersch, and Yin 2003). Hence, we do not observe adoption for a large part of the existing customers included in our study, which might now be considered as non-adopters in our model, but in fact will adopt the product several years from now. However, recent adoption figures about the studied new service still show a limited number of adopters (see also Figure 2.2), indicating that innovation resistance might indeed be a problem. Notably, the split hazard model may also have other applications in customer management research. For example, when modeling relationship duration one might assume that there is a group of customers very unlikely to churn due to for example high switching costs, while there is another group of customers who is clearly at risk for churning. The latter group might be very receptive to service improvement efforts, while the first group is almost non-responsive. So far, researchers have not acknowledged modeling relationship duration accounting for the appearance of these two groups of customers (e.g. Bolton 1998).

Sixth, our study is the first to investigate customer adoption of new services using customer database data. These data offer some interesting insights, especially with respect to the effects of behavioral relationship characteristics on customer adoption behavior. Customers who have been with the provider for two or three years have the highest probability to adopt the new mobile service eventually. The lower adoption probability for new customers may be explained by the contractual setting; these customers are still locked in to their recently established contract with the provider, and upgrading to a contract that includes the new service would be costly. The low adoption probability of customers who have been with the provider for a very long time could be explained by customer lifecycle effects, such that in the later stages of the customer lifecycle, customers are not likely to adopt new products or services. Customers with high usage levels, who are assumed to have a deeper relationship with the provider, are less likely to adopt the new service, which seems counterintuitive. However, customers with high usage levels who do adopt indicate a relatively short time to adoption. Furthermore, we find that domain-specific innovativeness does not affect the probability of eventual adoption but does shorten the time to adoption. One cautious note is required, as our measure for domain specific innovativeness might be imperfect. Future research might for example use perceptual innovativeness measures instead of our used behavioral indicator.

2.6.2 Management implications

Speeding up the adoption of newly introduced services is very important to many firms. This especially holds in the telecom industry, where services are linked to large network technology investments. A successful introduction of these new services is required in order to get return on these investments. Existing customers are an important target group in the introduction of new services. The question is, however, which marketing communications the firm should use to speed up adoption. Our results indicate that firms can both use DMC and MMC to shorten adoption timing. However, the effect of DMC is much larger than the effect of MMC. Hence, our results seem to suggest that speeding up adoption timing among existing customers should mainly be done with DMC. The role of MMC is only limited. MMC may, however, still be required to reach non-customers as well. On the other hand, one strategy might be to focus on existing customers first, in order to create a sufficiently large customer base to further spread the new technology into the market. This might point to potential cost-savings for firms, if they first use relatively cheap and more effective DMC, and after that use the existing customer base to create network effects.

Our results also show the importance of competitive advertising effects on the new service. A useful strategy therefore might involve two or more competitors that simultaneously introduce a new service; this approach should accelerate the adoption process for every player in the market.

The results of our study, particularly the exploratory analyses of the interaction effects between marketing efforts and relationship age, reveal that customer loyalty plays a significant role in the adoption process of existing customers. We find that loyal customers adopt sooner than relatively new customers and have a better response to mass marketing efforts. Therefore, building customer loyalty is not only important for customer retention and cross-selling but also for the adoption of new and additional services.

2.6.3 Research limitations and further research

Our study has several limitations that suggest possible directions for further research. First, we only consider one mobile service introduction for a specific company. The question is whether our findings are generalizable to other contexts as well. Of course, this specific industry, company, and service have specific characteristics (i.e. a high degree of technological turbulence, one of the larger market players, etc.). One can imagine that in markets with lower involvement products, the effects of mass advertising will be smaller. Clearly, more research is required to study the effect of marketing communications on adoption behavior. Studying other industries and services will allow us to study which market- and service characteristics moderate the effects of marketing communications.

Another important limitation is our consideration of the adoption behavior of existing customers only. Accordingly, our findings apply to this group alone. However, a considerable number of adopters had not been customers of the provider before they adopted the new service. These customer acquisitions as a result of the introduction of the new service were not observed by the provider prior to the adoption, so we do not take them into account. It would be interesting to investigate the specific effects of marketing communications on the adoption behavior of this specific group of consumers.

Furthermore, we do not have any data about prices, income levels, or customer attitudes. Prices will most likely have a considerable impact on the adoption timing of customers, but such data typically are difficult to retrieve in a mobile service context. Including customer attitudes in the model, such as customer satisfaction and the perceived usefulness of the new service, also would be an interesting extension that could provide new and valuable insights into individual adoption behavior (e.g. Meuter et al. 2005). Our results are also limited to the used communication types and content used by this provider. For example, the DMC efforts consisted of phone calls from the provider to existing customers. The found effects might be different if other instruments or content would be used. Therefore, we cannot generalize our findings on the relative size of the effects of DMC and MMC on adoption timing. Future research might consider how instruments and content moderate the effect of marketing communications on adoption behavior.

Finally, we defined individual adoption as a dichotomous event, that is, the first trial of a new service. Continuous usage of the new service may be a better characterization of the adoption decision, because some adopters could cease to use the service after the first trial. Therefore, a promising direction for further research would be to investigate postadoption usage and disadoption of new services in a customer management context.

Chapter 3:

Adoption of value-added mobile services: a cross-national investigation

3.1 Introduction

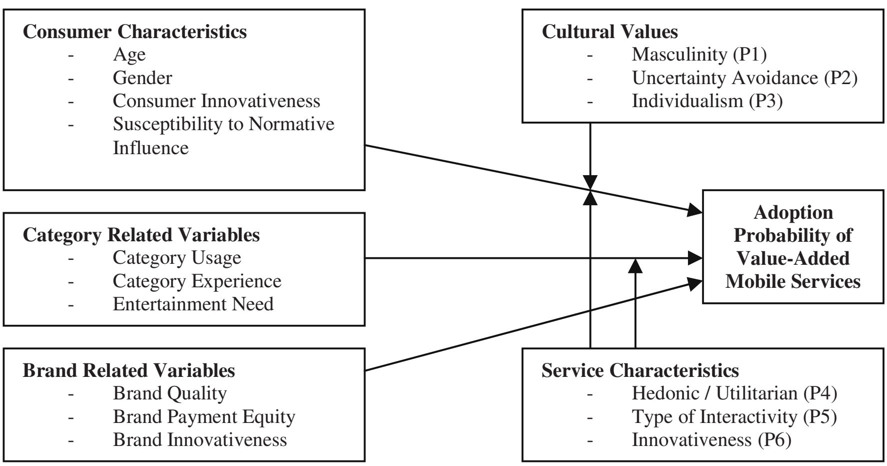
The examples of GPRS adoption rates in Chapter 1 illustrate that consumers across countries have very different needs and motivations, that can have a large impact on their adoption behavior and on the eventual success of a service in a certain country. The marketing literature has addressed this issue, but some questions remain. First, evidence of the impact of cultural values on new product adoption across countries remains limited to the aggregate market level. A number of international adoption studies have explicitly linked cultural differences – as described by for example Hofstede (1991) and Schwartz (1994) – to the diffusion of innovations (e.g. Takada and Jain 1991; Tellis, Stremersch, and Yin 2003, Van den Bulte and Stremersch 2004). These studies show that cultural differences affect the speed of diffusion across countries. However, they only consider market-level variables and do not study the individual characteristics and adoption decisions of consumers. The direct effects of cultural values on new product adoption that they find may be less straightforward at the individual consumer level, where differences in consumer characteristics and consumer perceptions will play a role in the adoption decision. The study by Steenkamp, Ter Hofstede, and Wedel (1999) supports this notion, by finding several interaction effects between national cultural values and individual differences. Although their findings suggest that these interactions could also affect actual behavior, their empirical evidence remains limited to the effects on consumer innovativeness. Second, not much is known about differences in antecedents of individual adoption across countries. Recently, Gielens and Steenkamp (2007) were the first to investigate the individual adoption of new products across countries and found different effects for product characteristics, competitive environment, and consumer characteristics such as innovativeness. Their study provides important empirical evidence that the effects of individual adoption antecedents may vary across countries, although they only consider four Western European countries that do not differ much in their cultural dimensions and limit their study to consumer packaged goods. To our knowledge, the antecedents of individual adoption across countries have never been studied in a service context. Third, not much research has been done on the characteristics of new mobile services and the impact they have on the individual adoption process. Several differences between types of communication-services have been identified, such as the level of interactivity and whether the service has an hedonic or utilitarian purpose (Hoffman and Novak 1996). However, empirical evidence of a moderating effect of these characteristics on the antecedents of mobile service adoption remains scarce. One of the exceptions is the study by Nysveen, Pedersen, and Thorbjørnsen (2005), who find differences in antecedents of usage intention of different mobile services. Furthermore, no study has investigated the possible dependencies between the adoption decisions of various mobile services.

Considering these limitations in the prior literature, the purpose of our study is threefold. First, we aim to investigate how cultural values affect new product adoption at the individual level across countries. Specifically, we will explore the moderating effects of cultural values on individual adoption decisions, by studying consumer adoption of value-added mobile services in the US, Germany and Japan, and relating this behavior to the cultural dimensions described by Hofstede (1980). Second, we aim to indentify differences in antecedents of new service adoption across countries. Consumer survey data on consumer characteristics, category related variables, and brand related variables will help to clarify the different effects of these antecedents across countries, possibly caused by the moderating effects from the countries' cultural values. Third, we aim to explore the effects of mobile service characteristics on the adoption decision of these services. We do this by studying the moderating role of the characteristics of five different mobile services in terms of motivation, interactivity, and innovativeness. Additionally, a multivariate probit model with latent variables will enable us to find possible dependencies between the adoption decisions of the different types of mobile services.

3.2 Antecedents of mobile service adoption

The literature on new product adoption has identified a broad range of antecedents for the individual adoption decisions. Figure 3.1 shows the theoretical framework that we will use for our study. The main focus will be on the moderating effects of cultural values, which possibly influence the effects of consumer characteristics on the adoption probability of new mobile services. Category usage variables and attitudes toward the provider will be used as control variables.

Figure 3.1: Conceptual model



3.2.1 Effect of consumer characteristics

Consumer characteristics as antecedents of adoption behavior typically consist of socio-demographics and psychographics (Arts, Frambach, and Bijmolt 2005). Demographics can be a very important driver of adoption probability, as younger and male consumes are more likely to adopt (Rogers 2003). This effect will be stronger in high-tech categories such as telecommunication services, that usually have a higher complexity.

The considered psychographics in this study are consumer innovativeness and the susceptibility to normative influence. First, consumer innovativeness can be defined as a “desire to seek out the new and the different” (Hirschman 1980), or, in the context of adoption behavior, as “the predisposition to buy new and different products and brands” (Steenkamp, Ter Hofstede, and Wedel 1999). This innate innovativeness is not restricted to certain products or categories and makes the consumer adopt relatively earlier than others (Midgley and Dowling 1993).

A second important construct in the adoption process will be the consumer’s susceptibility to normative influence (Bearden 1989). Normative influence can be separated in two components: utilitarian influence and value expressive influence (Bearden and Etzel 1982, Park and Lessig 1977). The utilitarian influence refers to the consumer’s willingness to conform to other people’s expectations pertaining to purchase behavior. The value expressive influence refers to the consumer’s need to improve his/her image by using certain products. For telecommunication services, the utilitarian aspect can play an important role, because of the interactive nature of the innovation. Consumers will be influenced by earlier adopters because of the positive direct network externalities: the value of the network increases as the number of users goes up (Fisher and Price 1992, Kraut et al. 1998, Nysveen, Pedersen, and Thorbjørnsen2005). This will have a negative effect on adoption in the early stages of the product lifecycle, when there are only a few users. In later stages, however, this type of normative influence will have a positive effect on adoption, because the number of users has reached its ‘critical mass’ (Mahler and Rogers 1999). Furthermore, because of the high visibility of telecom services among users, the value expressive influence will also positively affect the adoption probability (Bearden, Netemeyer, and Teel 1989). Therefore, we expect that consumers who are more susceptible to normative influence will have a larger probability to adopt a telecom service, although this effect will be smaller for services that have not reached their critical mass.

3.2.2 Category related variables

We consider three category usage variables in our study: (1) category usage level, (2) category experience, and (3) need for entertainment. The category usage level and the number of years of experience can be seen as an indication of category expertise. It has been shown that higher category usage can lead to a higher adoption probability (Gatignon and Robertson 1991, Steenkamp and Gielens 2003). For more complex innovations, more experience in the category will not only result in a lower perceived complexity, but also in a higher level of compatibility with current purchase patterns, which both increases the adoption probability (Rogers 2003, Taylor and Todd 1995). This will be highly relevant in the context of mobile services, because they could be perceived as complex if the adopter is inexperienced with cell phone use. Thus, we expect that category usage and years of experience will be positively related to the adoption of mobile services.

The needs of the consumer while using the cell phone can have an influence on the adoption probability. Mobile services can be based on hedonic needs or utilitarian needs (Kim, Chan and Gupta 2007). Mobile services that are based on hedonic needs are mainly used for fun or entertainment, such as mms and games, whereas mobile services based on utilitarian needs will mainly be used because of the mobility aspect, such as e-mail and voicemail (Nysveen, Pedersen, and Thorbjørnsen 2005). We will therefore control for the consumer's overall usage needs, that may have different effects on the adoption probability, depending on the nature of the mobile service.

3.2.3 Brand related variables

In our model we also control for brand related variables, as certain brands may be more able to sell innovations (i.e. early entrants, innovative brands). Moreover, specific brands may attract less innovative consumers, as they for example mainly focus on price. We control for these brand related effects, by including customer attitudes on quality, innovativeness and price. An additional rationale for including these variables is that various studies show that the consumer's perceived service quality and perceived payment equity of the provider positively influence cross-buying and upgrading (Ngobo 2005; Verhoef, Franses and Hoekstra 2001). Also, brand reputation in terms of perceived quality can have a positive effect on the acceptance of new products (Gielens and Steenkamp 2007).

To summarize, the expected direct effects for consumer characteristics, category related variables and brand related variables are displayed in Table 3.1. In the following section, we will discuss the expected moderating effects of cultural values and formulate several propositions.

Table 3.1: Expected main effects on adoption probability of mobile services

Variable	Expected main effect on adoption probability
Consumer Characteristics	
Age	negative
Gender (m=1)	positive
Consumer Innovativeness	positive
Susceptibility to normative influence	positive
Category Related Variables	
Category usage level	positive
Category experience	positive
Entertainment need	positive
Brand Related Variables	
Brand payment equity	positive
Brand quality	positive
Brand innovativeness	positive

3.3 Moderating role of culture

Hofstede (1980) describes the cultural differences between countries in five dimensions, of which Masculinity, Individualism, and Uncertainty Avoidance have been linked to consumer innovativeness and the diffusion of new products (Steenkamp, Ter Hofstede, and Wedel 1999; Sundqvist, Frank, and Puumalainen 2005; Tellis, Stremersch, and Yin 2003). In our study, we consider three countries: the US, Japan, and Germany. Although these are all relatively wealthy nations, they differ substantially on the Hofstede cultural values. Table 3.2 shows the scores of the US, Japan, and Germany on each of these dimensions. Although the scores were determined several decades ago, and most likely the cultural values will have shifted somewhat over the years (Hoppe 1990, Schwartz 1994), the scores for the three countries in our study are quite distinct and will still be useful.

Table 3.2: Hofstede (1980) scores for the countries in this study

	Masculinity	Uncertainty Avoidance	Individualism
Germany	66 (moderate)	65 (moderate)	67 (moderate)
US	62 (moderate)	46 (low)	91 (high)
Japan	95 (high)	92 (high)	46 (low)

3.3.1 Masculinity

Masculinity is described as the extent to which the role of men differs from that of women in a particular country (Hofstede 1991). Whereas women's values are relatively similar across the world, those of men may vary much more across cultures. In more masculine countries, men act more competitive and assertive, and are more materialistic than women. With respect to innovation adoption, masculine countries have been shown to be more innovative (Steenkamp, Ter Hofstede, and Wedel 1999). So at the individual adoption level, we would expect a significantly higher adoption probability for men than for women in countries that score high on the masculinity dimension, because the higher competitiveness and materialism of men in these countries could lead to a higher tendency to adopt new technologies. In more feminine countries (i.e. where the differences in values and behavior between men and women are less pronounced), we expect a smaller gender effect on the adoption probability.

P1: The effect of gender on adoption probability will be more prominent in more masculine countries

When we combine this proposition with the cultural scores on masculinity from Table 3.2, we see that Japan has a high score, and the US and Germany have a moderate score. Thus, for our study we assume that the effect of gender will be most prominent in Japan, followed by both the US and Germany.

3.3.2 Uncertainty avoidance

Uncertainty avoidance is, according to Hofstede (1991), the extent to which people prefer to work within predefined structures. This means that in countries with high uncertainty avoidance, people tend to stick to the existing rules and try to avoid unknown or surprising situations. Cultures with low uncertainty avoidance are less relying on existing structures and more open to new ideas. As a result, uncertainty avoidance is negatively related to consumer innovativeness (Steenkamp, Ter Hofstede, and Wedel 1999) and new products seem to take off faster in countries with low uncertainty avoidance (Tellis, Stremersch, and Yin 2003). Still, countries with high uncertainty avoidance can be innovative, but consumers will mainly imitate and adopt incremental innovations (Sundqvist, Frank, and Puumalainen 2005, Van den Bulte and Stremersch 2004). In these countries, the high uncertainty avoidance will, to some extent, restrict the influence of consumer innovativeness on adoption behavior. Under low uncertainty avoidance this restriction does not occur, and thus we expect that the effects of consumer innovativeness on adoption probability will be higher in countries with a low uncertainly avoidance.

P2: The effect of innovativeness on adoption probability will be more prominent in countries with low uncertainty avoidance.

As the score on uncertainty avoidance is high for Japan, moderate for Germany, and low for the US (see Table 3.2), we assume that the effect of innovativeness will be most prominent in the US, and least prominent in Japan.

3.3.3 Individualism

Individualism refers to the extent to which people take their own responsibilities rather than relying on a group that they belong to (Hofstede 1991). More individualistic countries are more innovative, because consumers want to ‘stick out from the crowd’ and have a stronger need for novelty (Roth 1995, Van den Bulte and Stremersch 2004). In contrast, consumers in collectivist countries may be less innovative, because they have a stronger need to conform to existing group norms and values (Steenkamp, Ter Hofstede, and Wedel 1999). In line with this reasoning, we expect that consumers in more individualistic countries will be less susceptible to normative influence than consumers in more collectivist countries (Van den Bulte and Stremersch 2004). However, consumers in individualistic countries that are highly susceptible to normative influence, will experience the value expressive influence most: the improvement of social image. The other component of normative influence, the utilitarian influence – i.e. the direct network externalities (Fisher and Price 1992, Kraut et al. 1998) – will also have a positive effect on adoption probability. So consumers who are more susceptible to the opinions of others will have a higher adoption probability because of both value-expressive and utilitarian influence. Consumers in collectivist countries will experience a considerable amount of utilitarian normative influence from friends and family – i.e. conformation to group norms and values – which could have the same positive effect as in individualistic countries. However, they will experience a much smaller amount of value expressive influence, as they are less concerned about personal goals (Steenkamp, Ter Hofstede, and Wedel 1999). Consumers in collectivist countries may still be susceptible to the opinions of others, but they will predominantly be affected by utilitarian influence. Thus, in collectivist countries, we expect that a higher susceptibility to normative influence will have a less important effect on adoption probability of mobile services than in individualistic countries, because of the absence of value expressive influence.

P3: The effects of susceptibility to normative influence on adoption probability will be more prominent in individualistic countries

Individualism is high in the US, moderate in Germany, and low in Japan (see Table 3.2), so we expect the most prominent effect of susceptibility to normative influence in the US, and the least prominent effect in Japan.

3.4 Moderating role of mobile service characteristics

In our study, we consider the following types of mobile services: SMS, voicemail, MMS, e-mail, and download services. A short description of each type of mobile service is given in Table 3.3. Although in general we expect to find the effects as formulated in the propositions, there may be some differences between various types of value added mobile services.

Table 3.3: Mobile service characteristics

service	*description*	*use motivation*	*interactivity*	*innovativeness*
SMS	Text messaging	utilitarian	person interactive	low
voicemail	Voice messaging	utilitarian	person interactive	low
e-mail	Mobile e-mail access	utilitarian	person interactive	high
MMS	Content messaging	hedonic	person interactive	high
downloads	Games, pictures, etc.	hedonic	machine interactive	high

3.4.1 Hedonic vs. utilitarian services

First, as we already pointed out, some services are utilitarian by nature whereas others are hedonic, or, as Hoffman and Novak (1996) put it, goal-directed services and experiential services. The use motivations of the consumer will differ between these two types (Holbrook and Hirschman 1982). The consumer's need for entertainment will predominantly affect the adoption probability of hedonic mobile services, which are MMS and download services. The adoption of the more utilitarian services, such as SMS, voicemail, and e-mail, will be less affected. Although SMS also has some hedonic aspects, the utilitarian aspect is more prominent, as it is mostly used for goal directed activities (Nysveen, Pedersen, and Thorbjørnsen 2005). Thus, our proposition will be:

P4: Entertainment need will have a more prominent effect on the adoption probability of hedonic services than on the adoption probability of utilitarian services.

Thus, for our study, we expect more prominent effects on the adoption probability of MMS and downloads, and less prominent effects on the adoption probability of SMS, e-mail, and voicemail.

3.4.2 Type of interactivity

Second, mobile services will differ in the type of interactivity, which can be person interactive or machine interactive (Hoffman and Novak 1996, Nysveen, Pedersen, and Thorbjørnsen 2005). Person interactive services involve (in)direct communication between people, whereas machine interactive services refer to the interaction between a person and a medium – in the case of mobile services the person's cell phone. SMS, voicemail, MMS and e-mail are examples of person interactive services (Nysveen, Pedersen, and Thorbjørnsen 2005). Downloading of games, pictures, and ringtones can in most cases be classified as machine interactive. The type of interactivity may affect the normative influence pertaining to the adoption of a new mobile service. Person-interactive services require other adopters to use the service, whereas machine interactive services do not require this. The direct network externalities that typically play a role in telecom services will not be relevant for machine interactive services, which could lead to smaller effects of susceptibility to normative influence on the adoption probability of these services (Nysveen, Pedersen, and Thorbjørnsen 2005).

P5: The effects susceptibility to normative influence will be more prominent for person interactive mobile services than for machine interactive mobile services.

This would imply less prominent effects on the adoption of download services than on the adoption of SMS, MMS, e-mail, and voicemail.

3.4.3 Mobile service innovativeness

Third, mobile services may differ in levels of innovativeness and complexity, partly depending on the time they have been on the market. Mature services such as sms and voicemail are relatively basic and are probably perceived by the user as an extension of voice calling (Nysveen, Pedersen, and Thorbjørnsen 2005). However, many other mobile services, such as e-mail, downloads, games, and mms messaging serve different purposes and might require more innovativeness from the consumer to use it. Thus, the effects of innovativeness on adoption probability may be more prominent for more innovative mobile services.

P6: The effects of consumer innovativeness will be more prominent for more innovative mobile services.

In our study, this means more prominent effects of consumer innovativeness on the adoption of MMS, e-mail, and downloads than on the adoption of SMS and voicemail.

3.5 Data and measurements

The data for this study were provided to us by a German market research company, that conducted a web-based survey in 2004 among an existing panel of consumers in Japan, Germany, and the US. All respondents were between 14 and 69 years old and representative for the cell phone users in each of the three countries in terms of age, gender, and geographical location. The survey questions for this study were part of a larger survey on cell phone usage and were offered to the respondents in two parts, each part taking about 30 minutes. For this study we only select respondents who indicated that they own a cell phone for (predominantly) non-business use. The number of useful respondents was 1392 for Japan, 1255 for Germany and 1559 for the US.

To measure the adoption of value-added services, the respondents are asked whether they have ever used sms, mms, e-mail, download services, or voicemail on their cell phone. Cell phone experience is measured as the number of years the consumer has owned a cell phone. Usage levels are self-reported, consisting of the average monthly phone bill of the respondents. The following attitudes towards the telecom provider are measured using multi-item 7-point likert scales: provider payment equity, provider quality and provider innovativeness. Psychographics, consumer innovativeness and susceptibility to normative influence, are also measured with multi-item scales on a 7-point scale. Likewise for the measurement of entertainment needs we also use a multi-item scale. Appendix 3A shows the items that are used to measure each construct.

The reliability for the multi-item scales per country is reported in Table 3.4. The coefficient alphas are all above the requested thresholds suggesting sufficient reliability. Additionally, a factor analysis was conducted showing that the constructs were classified as separate factors. Using subsets of factors, the factor structures and factor loadings proved to be similar across countries, which indicates at least partial measurement invariance (Steenkamp and Baumgartner 1999).

Table 3.4: Measurements and reliability of explanatory variables

variable	measurement	reliability (alpha score, if applicable)			
		US	Jap	Ger	Total sample
Age	in years				
Gender	f=0, m=1				
Consumer Innovativeness	3 items, 7-point scale	.83	.82	.76	.81
Susceptibility to normative influence	3 items, 7-point scale	.82	.75	.64	.78
Category usage level	avg. monthly bill (standard.)				
Category experience	years of cell phone ownership				
Entertainment need	3 items, 7-point scale	.80	.73	.72	.76
Brand payment equity	3 items, 7-point scale	.85	.73	.80	.81
Brand quality	2 items, 7-point scale	.83	.62	.72	.76
Brand innovativeness	3 items, 7-point scale	.82	.87	.81	.83

3.6 Model

To determine the effects of consumer characteristics, attitudes, and category usage on each of the five value added services, we estimate a multivariate probit latent variable (MVP LV) model for each country separately. The dependent variable (A^*_{ik}) is the latent adoption utility of service k (1 to 5) for subject i within a certain country. We observe every individual's adoption of the 5 services (A_{ik}), that will equal 1 if $A^*_{ik} > 0$. These adoption decisions will not be independent of each other, which will be accommodated in the correlated error structure ε_{ik} (Capellari and Jenkins 2003) within each country. This way, a high latent adoption utility for one service could lead to a higher (or lower) latent adoption utility for the same individual for other services. Comparable multivariate choice models have been used in other marketing applications, such as fast moving consumer goods (Manchanda, Ansari, and Gupta 1999). We use the same set of explanatory variables (X_i) for each value added service, consisting of consumer characteristics, category related variables, and brand related variables.

(1) $$A^*_{ik} = \alpha_k + \beta_k X_i + \varepsilon_{ik}$$

$$A_{ik} = 1 \text{ if } A^*_{ik} > 0, \qquad A_{ik} = 0 \text{ otherwise}$$

(2) $$\varepsilon_{ik} = \lambda_k f_i + \eta_{ik}$$

$$\varepsilon_{ik} \sim N(0, I_f)$$
$$\eta_{ik} \sim N(0, I_k)$$

In addition to the regular MVP model, we estimate a factor structure within the error component of the MVP model for each country separately, to find possible latent factors that underlie the adoption decisions for the value-added services (Bock and Gibbons 1996; Donkers, Verhoef, and De Jong 2007; Kamakura et al. 2003). As shown in equation (2), we use f_i as the vector of unobserved factor scores and λ_k as the factor loading matrix. The number of factors in this model will be determined empirically by varying this number in several alternative models and comparing the loglikelihood. The rotated factor loadings of the eventual model on each of the five value-added services will indicate the possible dependencies between the separate latent adoption utilities.

We will test the fit of this MVP latent variable model against that of five separate probit models, and of a standard MVP model without the factor structure. Furthermore, we will estimate our model on a pooled sample of the data, that is, over all countries, and test whether the separate country models together have a better fit than the pooled sample model. To test the significance of the effects across services and across countries, we will use a Rosenthal test, and in particular the method of adding weighted Z's (Rosenthal 1991). By performing a meta-analysis on the p-values, it enables us to find collective evidence for the significance of each explanatory variable. This method has been applied before in a marketing context by Dekimpe, Parker, and Sarvary (1997) and by Deleersnyder et al. (2002).

3.7 Results

3.7.1 Descriptives

The adoption rates for each of the five mobile services are displayed in Table 3.5. Japan has the highest overall adoption rates and Japanese respondents on average also use the highest number of value added mobile services. In contrast, the US has the lowest adoption rates and US consumers use the lowest amount of services. Voicemail seems to be adopted by about 70% in each of the three countries, but the adoption rate of most other mobile services varies significantly over countries. For SMS, we see an equally high adoption rate for Germany (94%) and Japan (93%), with the US (30%) lagging behind. MMS, e-mail, and downloads all show a high adoption rate in Japan, followed by Germany, and lastly the US. The lower adoption rates in the US are in line with prior studies on adoption of cell phones and mobile services, and are mainly caused by the heterogeneous US cell phone network (Fife and Pereira 2003). Japan has long been identified as one of the countries to adopt the cell phone technology (Dekimpe, Parker, and Sarvary 1998), which explains the higher adoption rates. However, our focus will not be on the adoption rates itself, but on the effects of the antecedents on the individual adoption probability.

Table 3.5: Descriptive statistics of dependent and explanatory variables

	USA (n=1559)		Japan (n=1392)		Germany (n=1255)		Total sample (n=4206)	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
SMS	.30	.46	.93	.26	.94	.23	.70	.46
MMS	.08	.28	.66	.47	.21	.41	.31	.46
E-mail	.18	.38	.44	.49	.28	.45	.29	.46
Downloads	.27	.44	.72	.45	.42	.49	.46	.50
Voicemail	.71	.45	.68	.47	.73	.45	.71	.46
Number of services	1.54	1.42	3.42	1.35	2.58	1.18	2.47	1.55
Age	39.17	14.7	37.57	14.51	40.84	13.58	39.14	14.35
Gender (m=1)	.47	.50	.47	.50	.49	.50	.48	.50
Consumer innovativeness	4.30	1.63	4.62	1.40	4.57	1.45	4.49	1.51
Susceptibility to normative influence	2.12	1.43	3.15	1.38	1.93	1.09	2.41	1.43
Category usage level	.00	.87	.00	.80	.00	.44	.00	.74
Category experience	4.62	3.03	4.61	2.86	4.74	2.51	4.65	2.83
Entertainment need	1.94	1.28	2.81	1.48	1.76	1.15	2.18	1.39
Brand payment equity	5.09	1.17	4.37	1.35	4.98	1.40	4.82	1.34
Brand service quality	5.05	1.39	4.21	1.43	5.62	1.26	4.94	1.48
Brand innovativeness	4.02	1.25	3.67	1.38	4.61	1.36	4.08	1.38

3.7.2 Model fit

Table 3.6 displays the fit statistics of the MVP LV model and the comparison models. In each of the three countries, the MVP LV model has a significant better log-likelihood than the five separate probit models per country (p=.0000 for all countries) and the MVP model without latent factor analysis. (US: $\chi^2(10)$ = (p=.0000); Japan: $\chi^2(5)$ = (p=.0000); Germany: $\chi^2(10)$ = (p<.01)). Also, both the AIC and BIC statistics of the MVP LV model for all countries are better than those of the comparison models, which clearly indicates a better fit. Additionally, we estimated a MVP LV model on a pooled sample of the data, which resulted in a 2 factor solution. However, the loglikelihood of this model (-10636.20) is significantly worse (p=.0000) than that of the 3 country models together and also the AIC and BIC statistics are much larger for the pooled sample model. This indicates that there are significant differences in the effects across countries, and that the use of country specific models is justified.

Table 3.6: Fit statistics of compared models by country

		MVP LV	Probit	MVP	Pooled MVP LV
US	Logl	-3002.97	-3427.82	-3052.52	-10636.20
(n=1559)	AIC	6135.94	6965.65	6255.05	21402.40
	BIC	6483.81	7260.00	6656.43	21814.77
Japan	Logl	-3272.31	-3394.91	-3288.39	
(n=1392)	AIC	6674.62	6899.82	6726.79	
	BIC	7015.12	7187.93	7119.67	
Germany	Logl	-2807.37	-2890.84	-2819.88	
(n=1255)	AIC	5734.74	5891.68	5789.75	
	BIC	6042.831	6174.10	6174.87	

Table 3.7: Factor loadings of MVP LV model by country

	USA		Japan	Germany		Pooled sample	
	Factor 1	Factor 2	Factor 1	Factor 1	Factor 2	Factor 1	Factor 2
SMS	.00	-.65	-.47	.98	.00	.00	.14
MMS	-1.05	.69	-.74	.15	-.23	-2.03	-.38
e-mail	-.48	.13	-.26	.09	-.02	1.16	.42
download	-.45	.12	-.40	-.10	.88	.39	.24
voicemail	-.22	-.27	-.02	-.05	.45	2.59	.78

3.7.3 Model estimation results: main effects

The MVP LV model is estimated for each country separately, and results in a 2-factor solution for the US and Germany, and a 1-factor solution for Japan (see Table 3.7). In Appendix 3B we show the parameter estimates per country and service. A summary of the findings across countries is shown in Table 3.8, in which we also state the level of the cultural values again, for reference.

We will first focus on the overall effects of the explanatory variables. For each explanatory variable, we estimated the effect on the adoption probability of 5 services in 3 countries, which makes 15 estimates in total (see Appendix 3B). We summarize the collective results of the three country studies in the fourth column of Table 3.8. Across countries, we find consistent support for our expectations pertaining to the effects of age (negative) and consumer innovativeness (positive), as the majority of estimated effects was significant in the expected direction. The Rosenthal test provides significant collective results ($p<.01$) for each of these variables across countries. Thus, in all countries in our study, younger consumers and more innovative consumers have a higher probability to adopt a new mobile service. Although we also find a significant collective effect over countries (p<.01) for gender and susceptibility to normative influence, the results do not show consistent significant effects in each country. We will discuss these effects further in the next section, where we compare the results between countries. All category related variables show consistent results across countries. Category usage level, category experience and entertainment need all have a significant positive collective effect on the adoption probability, as expected. The main effects of brand related variables are less consistent across countries. We can only find a significant collective effect for provider innovativeness: the more innovative the supplier's brand is perceived, the higher the adoption probability of mobile services. We find very few significant results for provider service quality, with no significant collective effect. Provider payment equity appears to have a significant negative collective effect on adoption probability, although the expected effect was positive and the results are inconsistent between countries.

Table 3.8: Summary of significant results (p<.1) by country

	USA		Japan		Germany		Total of 3 studies		
Masculinity	moderate		high		moderate				
Uncertainty Avoidance	low		high		moderate				
Individualism	high		low		moderate				
	+	-	+	-	+	-	+	-	
Age	0	5	0	5	0	3	0	13	***
Gender (m=1)	1	1	0	4	1	0	2	5	***
Consumer innovativeness	4	0	4	0	4	0	12	0	***
Susceptibility to normative influence	4	0	0	0	2	0	6	0	***
Category usage level	2	0	5	0	4	0	11	0	***
Category experience	3	0	5	0	3	0	11	0	***
Entertainment need	5	0	3	0	3	0	11	0	***
Brand payment equity	0	2	0	2	1	0	1	4	**
Brand service quality	0	1	0	0	0	0	0	1	
Brand innovativeness	4	0	4	0	1	0	9	0	***

* Rosenthal 1-sided p<.1
** Rosenthal 1-sided p<.05
*** Rosenthal 1-sided p<.01

3.7.4 Differences across countries

For all countries, we find consistent results for age, consumer innovativeness, category experience, and entertainment need (see Table 3.8). Slight differences between countries occur for the effects of category usage level, as the US only shows significant effects for 2 services, whereas Japan and Germany show significant effects for 5 and 4 services, respectively. Provider innovativeness has consistent positive effects across services in Japan and the US, but only for one service in Germany. Finally, the significant negative effects of payment equity can only be found in the US and Japan. To check our propositions, we will compare the country specific effects of gender, susceptibility to normative influence, and consumer innovativeness.

According to proposition 1, we expect a more prominent gender effect on adoption probability in countries with a high masculinity score (i.e. Japan). This is exactly what we find: whereas the moderately masculine countries Germany and US show a significant gender effect in only 1 or 2 of the 5 services, the highly masculine country Japan displays a significant gender effect for 4 services. Specifically, Japanese women have a significantly higher probability than Japanese men to adopt a value added mobile service. In our second proposition, we postulate that the effect of innovativeness will be more prominent in countries with low uncertainty avoidance, which would be the US and to a lesser extent Germany. However, we find significant positive effects for 4 out of 5 services in all 3 countries, so our proposition is not supported. Consumer innovativeness seems to significantly affect adoption behavior across countries with different cultural values. The third proposition about susceptibility to normative influence would imply that the effect of this variable will be least prominent in the highly collectivist country Japan, and the most prominent in the US. Our findings support this proposition, as we find no significant effects in Japan, significant positive effects for 2 services in Germany, and significant positive effects for 4 services in the US.

3.7.5 Differences across services

The rotated factor loadings, that should reflect possible dependencies between the different adoption decisions, are displayed in Table 3.7. The results for the US clearly show a high loading of SMS on the first factor, whereas MMS, downloads and e-mail have high loadings on the second factor. Voicemail has about the same loading on both factors, although slightly higher on the first one. This is more or less in line with the notion that SMS and voicemail are more basic services, whereas the other three are more innovative in nature. The second factor thus reflects the consumers' innovative motivations to adopt value added mobile services. The results for Germany show that SMS, MMS, and e-mail load high on one factor, and downloads and voicemail on the other. Here, the type of interactivity seems to be driving the consumers' motivation. The person interactive services (except for voicemail) all load high on factor 1, and the machine interactive service (downloads) on factor 2.

Table 3.9: Number and direction of significant results (p<.1) by service

	SMS		MMS		e-mail		download		voicemail	
utilitarian/hedonic	utilitarian		hedonic		utilitarian		hedonic		utilitarian	
person/machine interactive	person		person		person		machine		person	
innovativeness	low		high		high		high		low	
	+	-	+	-	+	-	+	-	+	-
Age	0	3	0	3	0	2	0	3	0	2
Gender (m=1)	0	1	0	1	2	0	0	1	0	2
Consumer innovativeness	1	0	2	0	3	0	3	0	3	0
Susceptibility to normative influence	1	0	1	0	2	0	1	0	1	0
Category usage level	1	0	2	0	2	0	3	0	3	0
Category experience	2	0	3	0	3	0	1	0	2	0
Entertainment need	1	0	3	0	3	0	3	0	1	0
Brand payment equity	0	0	0	1	1	1	0	0	0	2
Brand service quality	0	1	0	0	0	0	0	0	0	0
Brand innovativeness	2	0	3	0	1	0	2	0	1	0

Table 3.9 summarizes the results for each mobile service and shows for how many countries significant results were found and in what direction. Again, we state the service characteristics for reference. As we expected, the effect of need for entertainment is very prominent for the hedonic services MMS and downloads, although we also find a significant effect on the adoption probability of e-mail in 3 countries and of SMS in 1 country. Proposition 4 is therefore partly supported. Consumer innovativeness has a more prominent effect on the adoption of innovative mobile services compared to the effect on the less-innovative service SMS, but the effect on the less-innovative service voicemail is also significant in three countries. Proposition 5 is therefore not supported by our results. We do not find contrasting effects for susceptibility to normative influence on the adoption of machine interactive service versus person interactive services, so Proposition 6 is also not supported. An additional finding from Table 3.9 is the mixed gender effect. Whereas female consumers tend to have a higher adoption probability for SMS, MMS, downloads

and voicemail, male consumers have a higher adoption probability for e-mail on their cell phone in 2 of the 3 countries. Finally, provider innovativeness has the most prominent effect for MMS, and the least prominent effect for e-mail and voicemail. Overall, our results show several differences between services. However, it is difficult to come up with a consistent story. Our results only suggest that hedonic services tend to be adopted more by consumers with a higher need for entertainment.

3.8 Discussion and implications

3.8.1 Summary and contributions

In this cross-national study across three countries we explore the effects of customer characteristics on the adoption probability of five mobile services, as well as the moderating effects of cultural dimensions and mobile service characteristics. We will now discuss our most important findings and contributions.

First, we show that the main effects of customer characteristics on the adoption probability of mobile services may be consistent across countries with different cultural values. We find significant positive effects on adoption probability across all countries for consumer innovativeness and susceptibility to normative influence, and a significant negative effect for age, which confirms earlier findings in the adoption literature. In contrast to our expectations, the adoption probability of women appeared to be significantly higher than that of men. Although the overall gender effect is only caused by the effects from one country, it is still somewhat counter-intuitive, because it is generally believed that men are more innovative, and thus would have a higher adoption probability (Rogers 2003). However, prior studies on mobile service adoption (Nysveen, Pedersen, and Thorbjørnsen 2005) also report varying gender effects, depending on the type of service. Possibly, the social aspect of mobile services causes these higher adoption rates for females, but further research would be needed to clarify this issue. Furthermore, the effects of the category related variables are all consistent across countries and in the expected direction: category usage level, category experience, and the need for mobile entertainment increase the adoption probability of mobile services.

Second, we show that country specific cultural values such as individualism, masculinity, may moderate the effects of customer demographics and psychographics on the individual adoption probability of value-added mobile services. The finding that gender has a much more important role in the adoption behavior in Japan than in the other two countries, could be directly linked to the higher masculinity of the Japanese culture (Hofstede 1991). More than in other countries, the gender roles in Japan are very different from each other, which in our study results in a higher adoption probability for female consumers. In less masculine countries, we hardly observe any significant gender effects, which is a result of the relatively small differences in values between men and women. Although most prior studies (e.g. Steenkamp, Ter Hofstede, and Wedel 1999, Tellis, Stremersch, and Yin 2003) argue that a high level of masculinity in a country will just increase the overall innovativeness and the adoption rates, our results suggest that this cultural dimension also causes larger differences in adoption behavior between men and women. The differences in the effects of susceptibility to normative influence on adoption behavior that we find across countries can be ascribed to the individualism of the countries. Our results show that the most prominent effects occur in the US, which is highly individualistic. The value expressive element of normative influence may be driving consumers to adopt new mobile services, in order to stick out from the crowd and improve their social image. In contrast, in less individualistic countries such as Germany and even more so in collectivist countries such as Japan, the consumer susceptibility to normative influence plays a less important role in the consumers' adoption behavior. We believe this is due to the less pronounced value expressive element in normative influence. Consumers in these countries are more likely to conform to group norms rather than differentiate themselves from others. Whereas other studies (e.g. Steenkamp, Ter Hofstede, and Wedel 1999) predominantly look at the direct effects of individualism on innovativeness or adoption behavior, our results suggest that the degree of individualism could also moderate the effects of consumer psychographics, thereby influencing the consumer's motivation to adopt. However, more research is needed to better understand the effects of both types of normative influence. Although we expected to find different effects of innovativeness on adoption behavior across countries, because of high uncertainty avoidance in certain countries, our results did not confirm this. The degree of innovativeness seems to be driving the adoption of mobile services in a similar way across countries. The notion that consumer innovativeness in uncertainty avoidant cultures has somewhat limited effects on adoption behavior and will only lead to the adoption of more imitative and incremental innovations (Sundqvist, Frank, and Puumalainen 2005) may still hold, because our study was limited to mobile services, that cannot be considered to be very radical innovations.

Third, we show that some effects are heterogeneous across services and that the adoption of several mobile services may depend on each other. Our exploratory factor analysis revealed some underlying latent motivations for adoption behavior. The factor loadings of the services have different patterns across countries, which indicates that consumers in different countries have different motivations. In the US, the adoption of MMS, downloads and e-mail seems to be driven by the same underlying factor. These mobile services distinguish themselves by their newness and innovativeness compared to the others. For German consumers, the type of interactiveness seems to be a underlying motivation, as the adoption of the person interactive services (except for voicemail), are driven by the same factor. This could point to the presence of network externalities, because the person interactive services will be more valuable to the consumer when the number of adopters in the social environment increases (Fisher and Price 1992, Kraut et al. 1998). In addition to the factor results, we find differences between services pertaining to the effects of consumer innovativeness, need for entertainment, and gender. As expected, more innovative consumers have a higher probability to adopt innovative mobile services, and consumers with a higher need for entertainment are more likely to adopt mobile services with hedonic value, in line with earlier findings by Nysveen, Pedersen, and Thorbjørnsen (2005). Our results could not confirm the expected difference between person interactive and machine interactive services with respect to normative influence. In total, the findings pertaining to the effects of mobile service characteristics are not very consistent with our initial expectations, suggesting that differences in adoption behavior for various services cannot be easily explained by dimensions such as interactivity and innovativeness. In line with the Nysveen, Pedersen, and Thorbjørnsen (2005) study, the hedonic or utilitarian nature of the service seems to be the best categorization to explain adoption behavior.

3.8.2 Management implications

Firms that aim to introduce new services in multiple countries across the globe should be aware that of possible differences in adoption behavior between these countries, and adapt their launch strategies for new services accordingly. For example, adoption behavior of men and women can differ substantially in highly masculine countries such as Japan. Gender specific marketing campaigns may be beneficial in these countries, whereas in low masculine countries men and women can be targeted in the same way. Also, the value-expressive need to stick out from the crowd by adopting a new service seems to be more important in individualistic countries. Service providers could stress the value-expressive elements of the new service in these countries, and the 'sense of belonging to a group' in collectivist countries. On the other hand, the effects of age, consumer innovativeness, and category related antecedents seem to be very consistent across countries and services, which implies that firms should always target young and innovative consumers, who are relatively heavy users and have considerable experience in the category. This contrast between the 'globally valid' antecedents and the 'locally different' makes the 'think global, act local' strategy (Taylor 1991) very well applicable in the context of a cross-national new service launch. Furthermore, our results indicate that for different types of mobile services the antecedents may have different effects on the adoption probability. This suggests that new service launch strategies should also be adapted to the service characteristics, although we cannot find very consistent patterns at this point.

3.8.3 Limitations and further research

One of the most important limitations of this study is that the data was provided to us after the data collection, so that the data collection itself and the measurements it contained were beyond our control. Although the survey data contains many useful measurements, some additional data would have been a valuable addition to our study. For example, survey data on cultural values and more specific data on psychographics related to the adoption decision could help us to test our propositions more substantially. Second, the international scope of the study is limited, as we only investigated mobile service adoption in 3 countries. Therefore, it was difficult to statistically test the effects of cultural dimensions, and thus our findings in this area remain exploratory. A broader set of countries, with more variety in cultural dimensions, could strengthen our arguments. This would also enable us to estimate direct effects of cultural dimensions on adoption probability. Third, because of possible response style biases across countries, we cannot compare mean levels of survey measurements, such as the level of innovativeness, or the susceptibility to normative influence. The same holds for the adoption rates, because of possible unobserved country specific factors, such as market conditions. Finally, this is a cross-sectional study, in which we only observe whether or not the consumer has adopted a specific mobile service. The adoption decision itself could have taken place several years ago, especially for the more mature mobile services such as voicemail and SMS, so the consumer's attitudes and usage patterns may have changed in the meantime. Therefore, the differences we find across services may be partly due to the different moments of adoption.

Chapter 4:

Do early adopters use more? The influence of adoption timing on new service usage over time

4.1 Introduction

In the introduction phase of a new mobile service, many firms attempt to attract as many adopters as possible for their new service, without considering their postadoption usage potential. Rather, they tend to assume that these innovative adopters will be heavy users of the new service, though in practice, this assumption does not always hold. As a consequence, the service provider may end up with a large population of adopters, most of whom hardly use the new service, even though they started with high usage levels. Apparently, the innovativeness of early adopters, which prompted them to adopt the new service, does not guarantee their sustained postadoption usage. We address this issue by focusing on the effect of adoption timing on the usage of newly introduced services.

Although the adoption process itself has gained considerable recent attention in marketing, most adoption studies (e.g., Meuter et al. 2005; Prins and Verhoef 2007; Steenkamp and Gielens 2003) only model trial probability, even though knowledge about the degree of use after an initial adoption decision is required for a complete picture of the overall adoption process of an innovation (Mahajan, Muller, and Bass 1990; Robertson and Gatignon 1986). Diffusion literature includes several studies that integrate repeat purchases in their models (e.g., Kamakura and Balasubramanian 1987; Norton and Bass 1987), and several researchers consider postadoption usage at the individual customer level

(Gielens and Steenkamp 2007; Shih and Venkatesh 2004, Wood and Moreau 2006), mainly using cross-sectional data to gain insights into various determinants of postadoption usage, such as ease of use. Other studies focus on the differences between early and late adopters in terms of their usage level (e.g., Danko and MacLachlan 1983; Mahajan, Muller and Srivastava 1990; Morgan 1979; Ram and Jung 1994), but they offer no conclusive evidence and only use cross-sectional data. Hence, we lack understanding of usage development over time and how it might be affected by adoption timing. This knowledge is critical though, because usage levels likely vary substantially over time and among customers, especially for more complex innovations, such as high-tech consumer products or services, that consumers cannot evaluate fully at first trial. Rather, consumers try the new product several times, gradually learn about its advantages and disadvantages, and adjust their behavior accordingly (Boulding et al. 1993; Hoch and Deighton 1989; Shih and Venkatesh 2004; Villas-Boas 2004; Wood and Moreau 2006). The dynamic nature of individual usage patterns therefore requires a longitudinal approach.

The objectives of this chapter are twofold. First, we study the effect of adoption timing within the product lifecycle on new service usage. Second, we investigate how this effect changes over time, if at all. We use longitudinal data pertaining to 5,233 individual adopters of a newly introduced telecommunications service and thereby show that adoption time initially has a positive effect on service usage. However, over time, later adopters tend to show decreasing usage levels. We also demonstrate that if researchers fail to correct for the endogenous nature of adoption timing, they will underestimate its effect. Our findings thus have important implications for new service introduction strategies.

Our research also contributes to adoption literature in several ways. First, we investigate the influence of adoption timing using longitudinal data on service usage among a large sample of adopters. Second, on the basis of our longitudinal data, we assess how the effect of adoption timing changes over time. Third, we treat adoption timing as an endogenous variable to determine its true effect on service usage, and we show that this assumption is important. Fourth, we study the effects of relationship characteristics on new service usage.

In the next section, we discuss prior literature in more depth. Subsequently, we present our hypotheses about the effect of adoption timing and relationship characteristics on service usage levels over time. In the following sections, we describe our data, the statistical model, and the results of our analysis. We end with a discussion of the most important findings, managerial implications, research limitations, and various issues for further research.

4.2 Conceptual background

Throughout innovation literature, the notion that early adopters differ substantially from late adopters prevails, such as in terms of demographics (Rogers 2003) or innovativeness (Hirschman 1980; Midgley and Dowling 1978). These differences are reflected in their adoption behavior, so certain consumers adopt sooner than others. However, the effect of adoption timing on postadoption usage is not as clear. Rogers (2003) posits that early adopters, because of their innovative nature, typically have better technological skills that enable them to use the new product or service more extensively, so early adopters should display higher usage levels than later adopters. Some empirical evidence at the aggregate level supports this theory. In addition, Morgan (1979) finds that early adopters of banking services, on average, use the service more than later adopters, and multiple studies provide similar results for home-PC usage (Danko and MacLachlan 1983; Dickerson and Gentry 1983; Mahajan, Muller, and Srivastava 1990). However, Ram and Jung (1994) find no significant difference in usage frequency between early adopters and the early majority for household technologies. In the mobile telecommunications industry, Jain, Muller, and Vilcassim (1999) find that the first adopters of mobile phones have higher usage levels than the later adopters. This difference is mainly caused by the fact that the earliest adopters are using their mobile phone for business purposes, whereas the regular consumers adopt the mobile phone in a later stage.

Despite these findings, several other issues need resolution before more conclusive evidence regarding the effect of adoption timing on service usage can emerge. First, we might question the innovative nature of early adopters. Diffusion literature defines the concept of consumers as “innovators” in several ways (Hirschman 1980; Midgley and Dowling 1978). The first interpretation only refers to adoption timing and is best reflected by Rogers's (2003) classification of adopter categories, in which first adopters are called "innovators" by definition. An alternative classification by Bass (1969) distinguishes between "innovators" and "imitators" on the basis of the assumption that some consumers are innately more innovative than others and do not need word-of-mouth information to adopt. As Mahajan, Muller, and Srivastava (1990) show, Bass-type innovators are not necessarily among the first cohort of adopters, though the majority of them adopt early. Furthermore, a certain proportion of the first cohort of adopters will be imitators who, though they adopt very early, lack the innovative characteristics of a true innovator. Empirically, Midgley and Dowling (1993) show that consumers with innovative predispositions adopt sooner, but their adoption timing is affected by other factors, which may prompt early adoptions by consumers with less innovative predispositions. Thus, we expect that the first group of adopters of a certain innovation is heterogeneous in terms of their innovativeness, which could lead to heterogeneous usage patterns. Moreover, we cannot be sure that postadoption usage is driven by the same type of innovativeness that causes consumers to adopt early. Chandrashekaran and Sinha (1995), in a business-to-business context, illustrate this uncertainty by separating the determinants of adoption timing and adoption volume to reveal that different effects occur for the two concepts. Therefore, we cannot straightforwardly conclude that early adopters will be heavy users of an innovation.

Second, the moment of adoption that the consumer chooses is not independent of other factors that affect postadoption usage. Adoption literature generally asserts that more innovative customers, who usually are younger (Rogers 2003) and display more domain-specific innovativeness (Im, Bayus, and Mason 2003), adopt the new service faster. Therefore, postadoption usage levels should depend partially on demographics and innovativeness, not just adoption timing. Because these various factors play roles, the nature of the overall effect is not straightforward. For example, many early adopters might already represent heavy users in the product category before they adopt the innovation (Gatignon and Robertson 1985; Jain, Muller, and Vilcassim 1999; Mahajan, Muller, and Srivastava 1990), which would imply that the effect of adoption timing is partly an indirect effect of category usage. Moreover, if the provider of a new service wants to persuade existing customers to adopt the innovation, it will first target the so-called high potentials, that is, customers who are most likely to adopt. Assuming that the provider uses some type of selection criterion based on demographics or past purchase behavior, the adoption timing of customers cannot be independent of these factors (Prins and Verhoef 2007). However, simply including such variables in a postadoption analysis could still cause a misspecification of the true effects, because adoption timing may correlate with the other explanatory variables. We therefore treat adoption timing as an endogenous variable that is affected by consumer characteristics and prior purchase behavior and that, in turn, could affect postadoption usage. A conceptually similar approach is used by Chandrashekaran and Sinha (1995), who simultaneously model adoption timing and the volume of adoption.

Third, by taking a cross-sectional point of view, previous studies fail to capture any dynamics in consumer usage levels, though such dynamics have vital importance if we want to take consumer learning processes in the postadoption period into account. Measuring new service usage at a single point in time or employing just the average usage level over the total observation period could lead to erroneous conclusions. As an example, consider two consumers, one of whom starts at a high usage level but gradually decreases his usage over time, and another who uses very little at first but increases her usage level each month, such that after some time, the two consumers arrive at the same monthly usage level. A cross-sectional study at that point in time cannot identify the difference between the two consumers, though they clearly are very different users. Moreover, a longitudinal approach is required to disentangle the effects of adoption timing and usage experience on postadoption usage. Specifically, a cross-sectional approach that measures a single point in time ensures that early adopters have more usage experience than late adopters, which makes it difficult to distinguish adoption time effects from learning effects. Therefore, we use a longitudinal approach to identify the changes in usage levels of a new service over time and focus specifically on the influence of adoption timing.

In summary, the influence of adoption timing on postadoption usage is not yet clear. Although prior research suggests that early adopters use more because of their innovative nature, not all early adopters are highly innovative, and adoption timing is driven by other factors as well. We therefore treat adoption timing as an endogenous variable to derive its proper relationship with postadoption usage. Because usage of new (high-tech) services represents a dynamic process that involves learning through experience by the adopter, we model new service usage not only across adopters but also over time.

4.3 Hypotheses

In our attempt to map the dynamics of individual usage levels, we distinguish between initial usage levels and the development of usage levels over time. Consumers' initial usage levels reflect their usage in the first period after adoption, at which point we assume they have no prior experience with the new service. Subsequently, consumers continue to use the new service and gradually adjust their usage levels as they learn over time about the (dis)advantages of the new service. Eventually, consumers either arrive at a stage of sustained continuous use at a certain level or decide to reject or disadopt the innovation altogether (Libai, Muller, and Peres 2006; Shih and Venkatesh 2004). Most prior studies, which use cross-sectional data, measure usage at some moment in time after adoption, which does not exactly reflect initial usage, because the user has had time to learn from his or her experience with the new product and might have adapted usage levels already. In contrast, we develop and test hypotheses about both initial usage levels and changes in usage levels over time, with a focus on the effects of adoption timing.

4.3.1 Adoption timing and initial usage

Our first hypothesis pertains to the effect of adoption timing on initial usage levels. We posit that this initial adoption usage level will be higher for late adopters than for early adopters5. Prior to adoption, late adopters are influenced mainly by their interpersonal communication with earlier adopters (Bass 1969; Rogers 2003). Because of their lower innovativeness, they cannot assess this subjective information effectively, which may lead to high initial expectations about the new service at the moment of adoption (Keaveney and Parthasarathy 2003; Parthasarathy and Bhattacherjee 1998). In contrast, early adopters

[5] We use the term *early adopters* to refer to the fastest adopters of the service. According to the adopter classification of Rogers (2003), they would be called *innovators*, but we prefer not to use this term, because it suggests an innovative disposition, which we do not assume is necessarily present. Our terminology refers only to the time of adoption.

make their initial adoption decision on more rational grounds, because though they are predominantly influenced by external information sources such as advertising (Bass 1969; Rogers 2003), they have the ability to process this external information well through their (domain-specific) innovativeness and expertise in the product category. The early adopters' initial expectations about the new service therefore should be more realistic, which will result in a smaller gap between prior expectations and actual experience. Following this line of thought—namely, that the prior expectations of late adopters are higher—we anticipate that the initial usage levels of a new service will be higher among late adopters. Thus, we hypothesize:

H1: *Adoption timing has a positive effect on initial usage levels.*

4.3.2 Effect of adoption timing on usage over time

From their initial usage levels, based on their prior expectations, consumers experience the actual benefits of the new service and adjust their expectations accordingly (Boulding et al. 1993). Among late adopters, high initial expectations may cause dissatisfaction when the reality cannot meet these expectations (Anderson 1973; Oliver 1980); as Bolton and Drew (1991) show in a telecommunications setting, the differences between prior expectations and service performance affect perceived service quality even more than service performance itself. In an empirical study on PDA adoption, Wood and Moreau (2006) also find that the disconfirmation of prior complexity expectations affects future usage expectations and product evaluations in the first period after adoption. Moreover, empirical findings from various studies show that (dis)satisfaction represents an important driver of service usage and discontinuance of services (Bitner 1990; Bolton and Lemon 1999; Keaveney and Parthasarathy 2003; Shih and Venkatesh 2004). Effectively, late adopters gradually learn that their expectations were too high, and their usage levels decline. For some users, this decline ultimately leads to discontinuance of the service, which Rogers (2003) describes as discontinuance from disenchantment, which occurs more often among later adopters, as Parthasarathy and Bhattacherjee (1998) show. In contrast, early adopters with their more realistic prior expectations are not as easily dissatisfied when using the service, which should result in relatively constant usage levels over time.

On the basis of the preceding arguments, we expect that the time since adoption decreases the effect of adoption timing on postadoption usage over time. In practice, this divergence between early and late adopters could mean that the usage levels of early adopters will exceed those of late adopters. Thus, we hypothesize:

H2: *The positive effect of adoption timing on postadoption usage decreases with greater time since adoption.*

To test for these hypotheses, we estimate the main effects of adoption timing, time since adoption, and an interaction effect between adoption timing and time since adoption. Using the model results, we assess the validity of our claims that early adopters (short adoption time) have higher initial usage levels (time since adoption = 0) than do late adopters (long adoption time). Our model results also reveal whether the expected higher usage levels of later adopters decrease over time.

4.3.3 Effects of relationship characteristics

Next to adoption timing effects, we also investigate the impact of relationship characteristics on postadoption usage. Relational variables, such as relationship age and category usage, may affect the use of additional services (Bolton, Lemon, and Verhoef 2004; Prins and Verhoef 2007; Reinartz and Kumar 2003). The cross-selling literature already suggests that relationship age positively affects cross-buying (Kamakura et al. 2003). Both the adopter's usage level of a preexisting service and the relationship age may serve as an indicator for the consumer's experience in the category and with the service provider. Consequently, this higher experience may lead to a higher probability to adopt the service (Gatignon and Robertson 1991; Steenkamp and Gielens 2003) and possibly to a higher usage of the new service (Gatignon and Robertson 1985; Mahajan, Muller, and Srivastava 1990). We therefore hypothesize:

H3: *Relationship age has a positive effect on postadoption usage.*

H4: *Category usage has a positive effect on postadoption usage.*

It may even be conceivable that because of the higher level of experience of loyal customers and heavy category users, these customers will have more realistic expectations about the new service, and will not be dissatisfied after initial usage. Whether this also leads to stable or increasing usage levels is an empirical question, which we test by including interaction terms between both relationship variables and time since adoption.

4.3.4 General market trends

For high-tech services, the associated technology often is not developed to its fullest extent at the moment of introduction to the market. Because service providers invest heavily in innovations, they want to launch their new services as soon as possible to obtain returns on their investments and possibly achieve a first-mover advantage. In many cases, the technology behind the new service still requires substantial improvements after its introduction, which may limit the usage possibilities in the first months because of, for example, compatibility issues between hardware and software (e.g., Gupta, Jain, and Sawhney 1999; Nair, Chintagunta, and Dubé 2004; Stremersch et al. 2007). After some time, the technology improves, and usage possibilities increase. Related to this argument, direct network effects are important for these technologies, in that more people in the network will have adopted by the time late adopters enter the market, which might stimulate their usage (e.g., Fisher and Price 1992). We try to control for technology effects and direct network effects by estimating a time period specific fixed effect in our model.

4.3.5 Covariates

We include several covariates in our analyses, which appear in previous studies as possible determinants of adoption and postadoption usage. Including these factors enables us to separate their effects on postadoption usage from the effects of adoption timing itself. First, we expect consumer innovativeness to affect postadoption usage positively (Ram and Jung 1994; Rogers 2003), because adopters who display high domain-specific innovativeness—which reflects their interests and knowledge within a certain product category (Goldsmith and Hofacker 1991)—should have higher postadoption usage levels. Second, we control for the effects of demographics, because we expect younger, male adopters to reveal higher usage levels (Rogers 2003).

4.4 Data description

We investigate postadoption usage in the context of a new mobile telecommunication service in the Netherlands that allows subscribers to browse on the Web via their mobile phones. This service, based on GPRS (General Packet Radio Service) technology, was introduced to the Dutch consumer market in September 2002 by a single telecom provider.

From the provider's customer database, we collect monthly data about adoption time, service usage, past purchase behavior, and consumer characteristics for 5,233 randomly selected individual adopters, after removing some extremely heavy users from the sample that were clear outliers. For our final sample, we observe from the product introduction date of August 2002 until August 2004. For each adopting customer, we record service usage levels for the 12 months after adoption, which means we must remove the latest adopters from our sample because we need at least 12 months of postadoption data. In our study, our use of the term late adopter is relative, because given the time frame, we do not have truly late adopters in our sample.

The dependent variable new service usage is time varying, measured in downloaded kilobytes per month. The service usage in the first month after adoption represents the adopter's initial usage level, as explained in section 4.3. Choosing an observation period of 12 months may seem rather arbitrary, because adopters may not have reached a stable end usage level, but preliminary analyses at the aggregate level show that most changes in usage levels occur during the first few months after adoption and that usage has more or less leveled off after 12 months. Enlarging the observation window to 18 months does not change our results fundamentally, although we are left with much less observations, because we do not have 18 months of usage data for a significant part of our sample.

Our key explanatory variable, adoption time, reflects the number of months between the introduction date of the service—which is the same for all customers—and the adoption date by the specific customer. We use the time elapsed since adoption, measured in months and starting at zero at the time of adoption, to assess the customer-specific time since adoption. Note that we measure adoption time from a fixed point in time (i.e., introduction date of new service), whereas time since adoption initiates at a different point in time for each adopter (see Figure 4.1). Time since adoption thus captures changes in usage levels over time, which are caused by consumer learning effects.

As we noted, we also include relationship characteristics in our model. First, we measure use of preexisting telecom services (category usage) according to the average monthly amount spent by a customer over his or her total customer lifetime before adopting the new service. Second, we consider relationship age, measured as the number of months an adopter has been a customer of the provider at the time of adoption.

Finally, we include several customer characteristics as covariates. We use a dummy variable to indicate whether the customer had adopted a previous generation mobile service as a proxy for domain-specific innovativeness. The demographics we control for are age and gender. Age, measured at the time of adoption, does not vary over time to avoid identification problems. The gender dummy equals 1 for male subjects. In Table 4.1, we summarize the included variables and their descriptive statistics, and we depict the correlation matrix in Table 4.2.

Figure 4.1: Adoption time and time since adoption

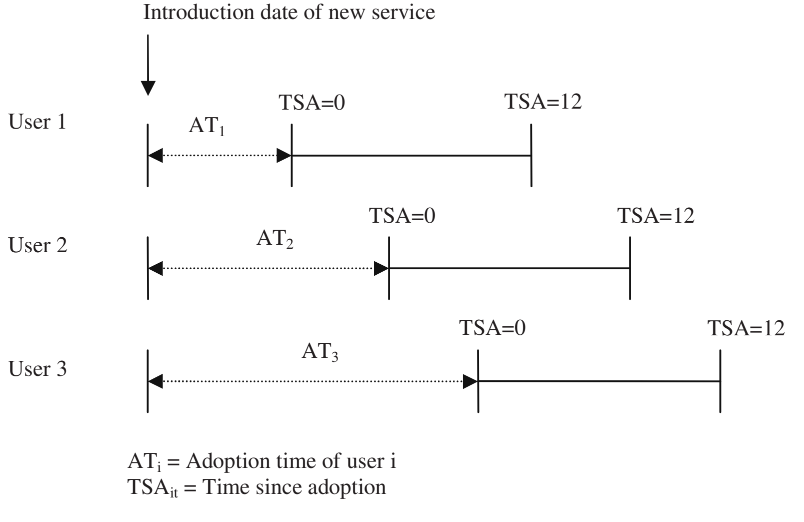


Table 4.1: Measurements and descriptive statistics

Variable	**Measurement**	**Mean**	**St. Dev.**
New service usage	Downloaded kilobytes per month (log transformation)	2.73	2.56
Adoption time	Number of days between service introduction and adoption (log transformation)	5.47	.76
Relationship age	Number of months the adopter has been with the service provider at the moment of adoption (log transformation)	2.26	1.54
Category usage	Average monthly amount spent with the service provider before adoption (log transformation)	.57	1.37
Age	Age in years at the moment of adoption (log transformation)	3.58	.33
Gender	Dummy variable (male = 1)	.71	.45
Domain-specific innovativeness	Dummy variable (1 = adopted previous generation e-service)	.02	.15

Table 4.2: Correlation matrix

	NSU	AT	RA	CU	Age	Gend	DSI
New service usage	1.00	-.04	.05	.18	-.12	-.06	.05
Adoption time	-.04	1.00	-.12	-.10	.07	-.06	-.02
Relationship age	.05	-.12	1.00	.32	.12	.18	.13
Category usage	.18	-.10	.32	1.00	-.16	.07	.07
Age	-.12	.07	.12	-.16	1.00	.08	-.03
Gender (m =1)	-.06	-.06	.18	.07	.08	1.00	.05
Domain-specific innovativeness	.05	-.02	.13	.07	-.03	.05	1.00

4.5 Econometric model

Because we have observations both across and within individuals over time, we use a random-effects panel data model to estimate the effects of customer characteristics, past purchase behavior, and adoption timing on new service usage. When modeling new service usage in our chosen empirical setting, we encounter two problems. First, a large proportion of observations consists of zero use (33% in our data set); that is, adopters did not download anything during certain months. We account for the large proportion of zero observations by using a tobit model, in which zero use can be interpreted as a censored observation. Second, endogeneity exists for the key explanatory variable, adoption time, as we explained previously. We account for this problem by estimating two equations simultaneously, one for adoption time (AT_i) and one for new service usage (NSU_{it}), and include adoption time as an explanatory variable in the second equation. Thus, we separate the direct effects of consumer characteristics and past purchase behavior on new service usage from the indirect effects through adoption time (Greene 2002).

Using a linear regression, we let (log) adoption time depend on relationship age (RA_i), category usage (CU_i), and on the vector of covariates Z_i , consisting of age, gender, and domain-specific innovativeness (see Equation 1). Prior adoption literature suggests that these variables may affect adoption behavior (e.g., Arts, Frambach, and Bijmolt 2006; Prins and Verhoef 2007; Rogers 2003; Steenkamp and Gielens 2003). All variables in Equation 1 are fixed over time. In Equation 2, we allow new service usage to depend on the same set of covariates Z_i, as well as on relationship age (RA_i), category usage (CU_i), adoption time (AT_i), time since adoption (TSA_{it}), and the interaction term of the latter two variables. A time period specific fixed effect (τ_t) is added to control for general market trends and unobserved events during the observation period. We use a simultaneous equations model, consisting of an OLS specification for adoption time (1), and a random-effects tobit specification for new service usage (2), in LIMDEP 8.0 to estimate the coefficients. We allow the error terms ε_i and ν_{it} to correlate (Greene 2002), so that we can test for the exogeneity of adoption time through a t-test of $\rho[\varepsilon_i,\nu_{it}]=0$. If the correlation between the error terms of both equations differs significantly from zero, adoption time is not exogenous (Greene 2002), and our model with endogenous adoption time should reflect the true relationships better than a model that does not account for it.

(1) $\ln(AT_i) = \alpha + \beta_1 \ln(RA_i) + \beta_2 \ln(CU_i) + \beta_3 Z_i + \varepsilon_i$, and

(2) $NSU_{it}^* = \gamma_1 \ln(AT_i) + \gamma_2 \ln(TSA_{it}) + \gamma_3 \ln(RA_i) + \gamma_4 \ln(CU_i)$
$+ \gamma_5((\ln(AT_i) \text{ x } \ln(TSA_{it})) + \tau_t + u_i + \nu_{it}$,

where
AT_i = adoption time,
RA_i = relationship age
CU_i = category usage
Z_i = vector of consumer characteristics,
TSA_{it} = time since adoption
NSU_{it}^* = latent utility of new service usage,
NSU_{it} = observed new service usage; and
if $NSU_{it}^* \leq 0$, then $NSU_{it} = 0$; whereas
if $NSU_{it}^* > 0$, then $NSU_{it} = NSU_{it}^*$.

As a result of the log-transformation of time since adoption, both this variable and the interaction term will cancel out of Equation 2 when time since adoption equals 1, that is, in the first month after adoption. This method enables us to interpret γ_1 as the influence of adoption time on the consumer's initial usage level. In line with our hypotheses, we expect a positive value for γ_1 and a negative value for γ_5. We do not have a specific expectation for γ_2, which represents the direct effect of time since adoption. As we hypothesize a positive effect of the relationship characteristics, we expect positive values for γ_3 and γ_4. In addition, we will also test this model including interaction effects between relationship characteristics and time since adoption.

4.6 Empirical results

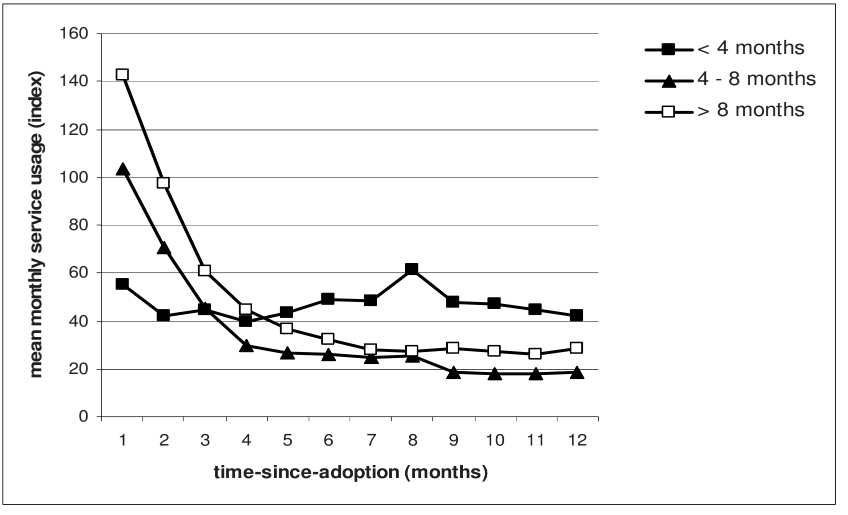
We first present some descriptive and aggregate statistics to offer preliminary insights on the data and the dynamics that might occur. Subsequently, we present the results of our econometric model to test our hypotheses.

4.6.1 Descriptive analyses

In Table 4.1, we provide the mean values and standard deviations of the variables in our model, which help interpret the size of the effects in subsequent analyses. As a first glance at postadoption usage dynamics, we divide our sample into three adoption categories. The first group consists of 1,684 consumers who adopted within 4 months of the introduction of the new service, the second group consists of 1,926 consumers who adopted between 4 and 8 months after introduction, and the third group consists of 1,623 consumers who adopted after 8 months. The cut-off dates are arbitrary, but they result in clear differences in usage patterns among the adoption categories (see Figure 4.2), and changes to the dates do not offer any significant changes in the interpretation. We index monthly usage, such that the mean usage rate in the first month after adoption equals 100.

As we depict in Figure 4.2, on average, early adopters initially display usage levels of approximately 50 per month and continue to use at near this level. The second adopter category starts off at a usage level that is twice as high but gradually decreases its usage to a more or less stable level of approximately 20. The third category, which contains late adopters, eventually arrives at a stable level of 30 but starts at a much higher usage level of 140. According to this graph, initial usage levels are lower for early adopters, but their usage levels remain more or less constant over time, whereas later adopters reveal a sharp decrease in usage in the first six months. We note that the differences between the two groups of later adopters can be ascribed almost entirely to discontinuing users; if we were to remove these discontinuers from the sample, more or less equal usage levels for those groups would emerge after a few months. The usage levels of early adopters, in contrast, are much less affected by discontinuers. Another important observation from this figure reveals that the usage levels of later adopters fall below those of earlier adopters.

Figure 4.2: Mean service usage over time by adoption category



In Figure 4.2, we provide some initial evidence to support our theory, though we recognize these are aggregate-level results that only take adoption time into account, without distinction between general time trends and developments in individual usage levels. Moreover, the different postadoption usage patterns that we find among adopter categories could be caused by other factors, such as consumer or relationship characteristics. We therefore present the results of the random effects tobit model at the individual level, which provides more conclusive outcomes regarding our hypotheses.

4.6.2 Model estimation results

In Table 4.3, we show the results of the econometric analysis. Model 1 represents the benchmark model that does not take endogenous adoption timing into account. Model 2a/b is the random effects tobit model with endogenous adoption time that uses 5,233 observations over 12 periods. The model with endogenous adoption timing (Model 2b) has a significantly better fit than the one without (Model 1) according to the likelihood-ratio test (p = .0000). To test for the exogeneity of adoption timing, we consider the correlation between the error terms of Equations 1 and 2 (Greene 2002); according to a t-test, this correlation is significantly larger than zero (p = .0000), so we must reject the null hypothesis of exogeneity.

Table 4.3: Model estimation results

	Model 1			**Model 2a**			**Model 2b**		
Dependent	**New Service Usage**			**Adoption Time**			**New Service Usage**		
Independent	**Effect**	**t-Value**		**Effect[a]**	**t-Value**		**Effect**	**t-Value**	
Age	-.97	-38.25	**	.19	18.71	**	-1.04	-45.15	**
Gender (m=1)	.44	25.08	**	-.07	-8.97	**	.47	26.67	**
Domain-specific innovativeness	.61	13.80	**	-.00	-.21		.61	13.87	**
Relationship age	.01	2.52	*	-.05	-17.82	**	.04	6.37	**
Category usage	.44	62.32	**	-.03	-7.97	**	.45	64.31	**
Adoption time	.83	22.27	**				1.22	56.01	**
Time since adoption	1.92	16.49	**				1.91	24.96	**
Adoption time × Time since adoption	-.77	-40.06	**				-.77	-59.93	**
Log-likelihood		-105889.3						-105197.6	

[a] Positive effect means a longer adoption time.
* $p < .05$.
** $p < .01$.

Regarding the results for adoption timing in Model 2a, we observe a positive effect of age and a negative effect of gender, which indicates that younger and male consumers have shorter adoption times. Relationship age has a negative effect; consumers who have been with the company for a longer time adopt the new service earlier. In line with our expectations, consumers with high category usage levels tend to adopt earlier, though those who adopted an earlier generation mobile service do not seem to adopt faster, because domain-specific innovativeness does not have a significant effect on adoption time. We must point out, however, that the effects on adoption timing that we find in model 2a are the effects conditional upon adoption of the new mobile service, because we only consider adopters. Therefore, the results for adoption timing cannot be directly compared with duration model studies in which adoption timing is the main variable of interest and both adopters and non-adopters are included (e.g Prins and Verhoef 2007). The estimated effects on new service usage (Model 2b) are similar when it comes to customer characteristics: younger and male adopters have higher usage levels and adopters who previously adopted an earlier generation mobile service also use more. We find all time period specific fixed effects to be significant and positive, although we do not report them in the table.

With regard to the coefficients that directly test our hypotheses, we find that initial usage levels are higher for later adopters, given the positive effect of adoption time on new service usage, which supports H1. Although the direct effect of time since adoption is positive, our results show a negative interaction effect between time since adoption and adoption time. Thus, the positive effect of adoption time decreases over time, which implies later adopters decrease their usage, after starting at a higher initial usage level, in support of H2. Adopters with higher usage levels for the category tend to have significantly higher usage levels for the new service, and customers with a higher relationship age use more of the new service as well. This supports Hypotheses 3 and 4.

The results in Table 4.3 indicate that including adoption time as an endogenous variable changes some of the effects on new service usage significantly. Although we do not find any changes in the direction of the effects, the coefficients of relationship age and adoption time become significantly greater compared with those in Model 1. This implies that failing to account for the endogenous nature of adoption time will result in an underestimation of the effect of time since adoption. Our results suggest that this underestimation is mainly caused by the fact that loyal customers tend to adopt early and initially use more, despite the finding that in general, early adopters initially use less.

We can investigate this further by including interaction terms between relationship characteristics and time since adoption in our model. Table 4.4 shows the estimation results of this model. The model fit improves significantly ($p < .0000$). For this model we also treated adoption timing as an endogenous variable, but these parameters are exactly the same as in model 2a, so we do not report them again. If we compare the estimation results of model 3b to those of model 2b, we see that the interaction effects change the direct effects of the relationship characteristics as well. Although we found a positive effect from relationship age on postadoption usage in model 2b, this turns into a negative direct effect if we take the interaction effect with time-since-adoption into account. This means that more loyal customers start at a lower usage level, but increase their usage over time, resulting in a higher than average overall usage level. Category usage still has a positive direct effect on postadoption usage. In combination with the positive interaction effect with time-since-adoption, this means that heavy users of the category start at higher usage levels and increase their usage over time.

Table 4.4: Estimation results relationship interaction effects

	Model 3b		
Dependent	**New Service Usage**		
Independent	**Effect**	**t-Value**	
Age	-1.10	-45.75	**
Gender (m=1)	.49	27.75	**
Domain-specific innovativeness	.60	14.05	**
Relationship age	-.11	-4.24	**
Category usage	.14	4.76	**
Adoption time	1.34	56.39	**
Time since adoption	.84	10.31	**
Adoption time × Time since adoption	-.65	-46.24	**
Rel. age x Time since adoption	.09	5.93	**
Category usage x Time since adoption	..20	12.82	**
Log-likelihood	-103174.1		

[a] Positive effect means a longer adoption time.
* $p < .05$.
** $p < .01$.

4.6.3 Robustness checks

We use several checks to test the stability of our model results. First, we randomly split our sample in two equal groups and find no differences in the model results. Second, we add several nonlinear terms of time since adoption to our model, but the empirical finding of a negative interaction effect between adoption timing and time since adoption do not change. Third, we reestimate the model after excluding the discontinuers who display a zero monthly usage for at least four months to determine whether the decreasing usage rates for late adopters are caused mainly by these discontinuers. However, the results remain similar to those of the full sample analyses. Together, these robustness checks provide evidence of the stability of our findings.

4.7 Discussion and implications

We investigate the relationship between adoption timing and postadoption usage of new services with a longitudinal approach that enables us to recognize new insights into the changing usage levels within adopters over time. We therefore discuss our most important empirical findings next, followed by the limitations of this study and some directions for further research.

4.7.1 Summary and contributions

First, early adopters initially do not use more but rather less than late adopters when they start using the new service. This distinction may seem counterintuitive, because early adopters should be more innovative and therefore use more. However, the effects of innovativeness and other personal characteristics already get captured by separate explanatory variables, and adopting early, in itself, is not sufficient to result in high initial usage levels. Our findings support the theory that late adopters have higher expectations of the service and therefore start off with higher usage levels.

Second, we clearly identify some postadoption usage patterns over time. Early adopters show stable usage levels over time, whereas late adopters tend to use less as time goes by. Although this result is driven partly by the larger number of discontinuers among late adopters, additional analyses that exclude discontinuers still result in the same pattern. At the aggregate level, monthly usage seems to stabilize at a certain level after some months, in support of the idea of a learning consumer (Hoch and Deighton 1989; Villas-Boas 2004). The eventual usage level among early adopters remains at about the same level as their initial usage, which suggests that early adopters had realistic expectations about the service, so their usage is minimally affected by their experience over time. Later adopters, in contrast, begin with high usage levels but may find the service less useful than they expected because their expectations were too high and therefore decrease their usage levels. The same mechanism could explain the larger proportion of discontinuers among late adopters (Parthasarathy and Bhattacherjee 1998). From a customer management point of view, our results provide some new insights into the customer value of different adopter groups. Although initial usage levels among the earliest adopters may not be very high, these customers can be very valuable to the service provider, because not only will their service usage remain constant over time, but their discontinuance rates are lower than those of later adopters. Our finding thus enhances Hogan, Lemon, and Libai's (2003) proposition that early adopters have the highest customer value, whereas later adopters seem valuable only in the short run, when their usage levels are high. Service providers therefore should not focus too long on acquiring as many adopters as possible for a new service but instead should attempt to stimulate usage among the group of later adopters and prevent them from discontinuing the service, even if they display high usage levels initially.

Third, because we separate the direct effects of personal characteristics and past purchase behavior on postadoption usage from their indirect effects through adoption timing, we demonstrate that these factors still have an impact on usage levels, beyond their influence through adoption timing. In other words, adoption timing alone cannot explain the differences in usage levels. Moreover, treating adoption time as an endogenous variable increases the magnitude of some effects. As we expected, loyal customers develop higher usage levels than relatively new customers, and heavy users of the category use more of the new service and even increase their usage over time, which supports the notion that heavy users of the category derive more utility from an additional compatible service (Gatignon and Robertson 1985; Mahajan, Muller, and Srivastava 1990). These positive effects from relationship characteristics are in line with earlier studies that suggest higher new product usage levels for more experienced consumers (Gatignon and Robertson 1985; Mahajan, Muller, and Srivastava 1990). The increasing usage levels over time for loyal customers and heavy category users could point to more realistic initial expectations, possibly because of their higher experience with the category and the service provider. Overall, we conclude that relationship characteristics can have an important effect on postadoption usage, in addition to earlier findings of effects on adoption timing and probability alone (Prins and Verhoef 2007, Steenkamp and Gielens 2003). Finally, we find significant effects from customer characteristics: younger and male consumers have higher usage levels than older or female adopters. We also find that consumers who have shown their category innovativeness by adopting a previous generation mobile service tend to have higher usage levels for the new service.

4.7.2 Limitations and further research

This study has several limitations. First, our results are based on data from a single service, which makes it difficult to generalize our findings. Some of our findings may be specific to this particular mobile service or the telecom industry.

Second, our data entail additional limitations. We can observe postadoption usage only within a limited time frame, so even though we measure usage in the first 12 months after adoption, we fail to capture long-term developments in usage levels. Such developments could make for interesting further research, particularly if they can be linked to the long-term profitability of early and late adopters. In addition, we only observe adoptions within the first two years of the introduction to the market, which implies that all adopters in our sample are relatively quick to adopt the new service. A study that contains a full spectrum of adopters (i.e., including late majority and laggards) may obtain different results.

Third, we only use transactional data. Attitudinal data and, in particular, measures of consumer innovativeness and prior expectations could offer more insights into the processes that underlie postadoption usage patterns. Furthermore, the effects of marketing communications on postadoption usage have not been taken into account.

Fourth, our model does not take non-adopters into account, which implies that the effects of customer characteristics and past purchase behavior on adoption timing are only valid for adopters of the new service. A more comprehensive econometric model may also include adoption probability, in addition to adoption timing and postadoption usage over time.

Chapter 5:

Summary and conclusion

In this thesis we study the individual adoption and usage of value-added mobile services by consumers. This chapter will summarize our most important findings, their implications for theory and practice, and discuss some directions for further research.

5.1 Summary

In recent years, the mobile telecom market has been very dynamic in terms of innovations. Mobile service providers continuously invest in new technologies and introduce many new mobile services for consumers, such as MMS and web services. However, adoption rates are often not very high, which makes it difficult for firms to get return on their technology investments. Important questions regarding this issue that were discussed in this thesis are:

1. What are the antecedents of mobile service adoption timing? (Chapter 2)
2. How does mobile service adoption behavior differ across countries? (Chapter 3)
3. How does adoption timing affect postadoption usage levels of mobile services? (Chapter 4)

Although the new product adoption literature has investigated these issues to some extent, most studies were done at the aggregate level – that is, only considering the overall adoption rates in the market – and evidence from service contexts remains scarce. By specifically investigating the impact of marketing communications, cultural values, and relating adoption timing to postadoption usage, we believe that this thesis provided a significant contribution to the adoption literature.

In Chapter 2 we investigated the effects of marketing communications on the individual adoption timing of a new GPRS-based mobile service by existing customers of a large Dutch telecom provider. Our main contribution to the adoption literature was that we studied both direct marketing communication and mass marketing communication, and that we distinguished between brand and service advertising, by the focal firm and competitors. Considering a large sample of customers from the firm's customer database over a period of 25 months after the first introduction of the new service to the market, we observed if and when a customer subscribed for the new service and we analyzed how this adoption timing was affected by time-varying marketing communications and other explanatory variables, such as customer characteristics and relationship characteristics. We used a split-hazard model to account for the fact that a significant part of the customer base will probably never adopt the new service, also depending on customer and relationship characteristics. This may be particularly relevant for new high-tech products, such as mobile services. The split-hazard model showed a better fit than a model that did not account for this.

We found that direct marketing efforts shorten the time to adoption for individual customers and that this effect is much more important than that of mass marketing efforts. Although we only studied the effect of one type of direct marketing in the specific context of a new mobile service, this is one of the first studies in the adoption literature that investigates the impact of both direct marketing and mass marketing efforts. We also found that mass marketing efforts shorten the time to adoption for individual customers. However, mass marketing efforts directly related to the new service (service advertising) have a larger impact on the adoption timing of the new mobile service than mass marketing efforts related to the brand only (brand advertising). These results suggest that advertising unrelated to the new service can still speed up the adoption process, even for existing customers, possibly through an improved attitude towards the brand. Competitive brand advertising on the other hand, had the opposite effect on adoption timing, which also suggests that brand attitudes may play a role. We found that competitive advertising for similar new mobile services shortens adoption time for the focal firm's new service as well. This market-making effect from a more generic type of advertising was known in the diffusion literature, but so far had never been shown in an individual adoption context. Competitive marketing efforts had mostly been ignored in the adoption literature. Our study showed that competitive advertising can have a significant impact on individual adoption timing, and that the direction of this effect partly depends on whether the advertising refers to the new service or to the brand only. From a firm perspective, the findings pertaining to the marketing communication effects suggest that direct marketing efforts are an important tool for the adoption of new services among existing customers. Mass marketing efforts may still be important for new customers, although it can also persuade customers of competitors to adopt the new service with their own provider. At the market level, competitors may benefit from each other's service advertising by launching a new service simultaneously.

In addition, we contributed to the customer management literature by exploring the interaction effects between relationship characteristics and advertising on adoption behavior. So far, new product adoption had been largely ignored as a way to increase customer value. We found that service advertising, both from the focal firm and competitors, has a larger impact on the adoption timing of more loyal customers. This suggests that loyal customers can be very valuable when it comes to new service adoption, because they are more easily persuaded by service advertising and will experience competitive service advertising more as generic advertising, which stimulates them to adopt the new service with their own service provider.

To fully understand the different effects of the various types of advertising on adoption behavior, more research is needed. A particularly interesting direction would be to further study the interaction effects between direct marketing and mass marketing efforts and possibly relate them to brand and service attitudes. Conducting a similar study outside the telecom sector would test the generalizability of our findings.

In Chapter 3, we conducted a cross-national study across three countries and explored the effects of customer characteristics on the adoption probability of five mobile services, as well as the moderating effects of cultural dimensions and mobile service characteristics.

We used the Hofstede cultural dimensions to explain differences in mobile service adoption behavior across countries, in addition to the effects of consumer characteristics, category related variables and brand related variables. Although many innovation diffusion studies investigate the influence of cultural values, studies on the impact of cultural values on individual adoption decisions are scarce. The data were obtained from a market research company that had conducted a cross-national consumer survey on mobile service usage in the US, Japan and Germany, that contained the self-reported adoption of five mobile services: SMS, MMS, e-mail, downloads, and voicemail.

Using a multivariate probit model with latent variables, we showed that consumer characteristics such as age and consumer innovativeness, and category related variables such as category usage and category experience, have consistent effects on adoption across these three countries. However, we also found that gender only has consistent significant effects on adoption probability in Japan, the most masculine of the three countries. This confirmed the notion that the differences in consumer behavior between men and women are more notable in masculine countries, although this had never been shown in an individual adoption context. We also found that susceptibility to normative influence had a consistent positive impact on adoption probability in the highly individualistic US, and no significant effect in the collectivist country of Japan. We attributed this difference to the more prominent effects of value-expressive influence in individualistic countries, that is, these consumers have a higher need to stick out from the crowd through mobile service adoption than consumers in collectivist countries. Firms that aim to introduce new mobile services in multiple countries should be aware of the moderating effects of cultural values, which means they should differentiate between men and women in highly masculine countries and use value-expressive influence in individualistic countries. Although our study only covers three countries, the consistency of many effects across these countries suggests that firms should always target the young, innovative and experienced consumer.

Because we considered five different mobile services, we could identify several heterogeneous effects across services. More innovative consumers were more likely to adopt innovative mobile services and consumers with a higher need for entertainment were more likely to adopt mobile services with an hedonic nature, although these results were not always consistent. Also, the factor structures that reflected the underlying adoption motivations and possible dependencies between the adoption decisions of the 5 mobile services could not be easily interpreted in terms of service characteristics, so clearly more research has to be done into the impact of mobile service characteristics on adoption probability. Other directions for further research are the use of attitudinal data on cultural values, that would really capture the moderating effects at the individual level. Furthermore, a longitudinal research design would enable us to relate the adoption timing of the various mobile services to each other, and find possible dependencies between the adoption decisions.

Chapter 4 focused on the next stage in the adoption process: postadoption usage. We studied the relationship between adoption timing and postadoption usage of a new GPRS-based mobile service by telecom customers in the first 12 months after adoption. The longitudinal approach enabled us to gain new insights into the changing usage levels over time, which had not been done before in an individual adoption study. Adoption timing was our main explanatory variable for postadoption usage and was treated as an endogenous variable. We included customer characteristics and relationship characteristics as explanatory variables for both adoption timing and postadoption usage (downloaded kilobytes per month).

Using a random effects tobit model with endogenous adoption timing, we found that early adopters initially used less than later adopters, which we attributed to the higher expectations of later adopters. However, after some time, the later adopters decreased their usage levels, possibly because the service does not fully meet their high expectations. We did not find this pattern for early adopters: their usage levels remained more or less stable over time or even increased. These differences in usage patterns between early and later adopters support and strengthen earlier findings that later adopters have a higher probability to discontinue, although we did not study discontinuance as such.

Firms that introduce a new service should be aware that a high initial usage level of later adopters cannot guarantee sustained usage. On the other hand, the earliest adopters may show relatively low usage levels in the first months after adoption, but can be very valuable in the long run, because they are more likely to continue using the service at a regular basis. Besides the effects of adoption timing, we also found important effects from relationship characteristics on postadoption usage, which have received little attention in the adoption literature so far. We found that category usage and relationship age have a positive effect on postadoption usage. Moreover, heavy users and loyal customers tend to increase their usage over time, which stresses the importance of relationship characteristics in new service usage behavior.

Although we only studied postadoption usage of one particular service over a limited period, our findings provide a starting point for further research in this area. Data on consumer expectations and service satisfaction over time could shed more light on the underlying usage motivations of adopters. Long-term effects of adoption timing on usage levels are still unknown, and also the possible impact of marketing communications to stimulate usage need to be taken into consideration.

5.2 Concluding remarks

By studying various aspects of the individual adoption process of new mobile services, we contributed to both the adoption literature and the customer management literature. We considered a broad range of antecedents of new service adoption, of which marketing communications (Chapter 2) and cultural values as moderators (Chapter 3) were the most notable ones, because knowledge of their effects on individual adoption was scarce. In addition, we considered the next step in the adoption process, being postadoption usage (Chapter 4), that had received little attention in the adoption literature so far. Together, our three studies provide a more comprehensive picture of the adoption process as a whole (see the theoretical framework in Figure 1.1). The exploratory nature of some parts of our study provide new directions for future research.

Although this thesis was written from an adoption perspective, many elements relate to customer management issues as well. In Chapter 2 and 4, we used transactional data from the customer database of a telecom firm. Both studies revealed that relationship characteristics can have a significant impact on customer adoption behavior and that the more loyal and experienced customer can be a valuable asset to companies. This supports the notion in the customer management literature of the higher profitability of loyal customers.

The fact that we focused on new mobile services only could be seen as a limitation, because the telecom sector is very specific high-tech market, with many innovations, and often a high level of competition between the service providers. However, the dynamic nature of the telecom market enabled us to study adoption behavior of large samples of consumers over a relative short time period. The new services that are offered are relatively homogenous across competitors and across countries, so that we could study competitive advertising effects and adoption behavior across countries. To what extent our results can be generalized across service industries has to be investigated, although we find theoretical support for many of our findings.

Appendix 3A: Measurements of multi-item constructs

Consumer Innovativeness (alpha = .81)
I like to try new things
I'm excited about the opportunities to explore new things on the internet
I look forward to technological developments that will be useful in my life
I always want to stay informed in my key areas of interest

Susceptibility to Normative Influence (.78)
It is important that people recognize the brands I use
I imagine my friends and family's reactions to a product before buying it
The name of the shop I buy from is as important as what I buy

Usage level
What is the average amount of your monthly cell phone bill?

Category Experience
How long have you been using a cell phone altogether? (no. of years)

Entertainment Needs (.76)
My cell phone provides me with a lot of entertainment options
I like to listen to music on my cell phone
I enjoy playing games on my cell phone

Brand payment equity (.81)
My cell phone operator provides a good value for money
My cell phone operator provides simple and transparent plans
My cell phone operator provides clear and accurate billing statements

Brand quality (.76)
My cell phone operator provides high network quality and good connections everywhere
My cell phone operator is reliable

Brand innovativeness (.83)
My cell phone operator provides me with a lot of entertainment options
My cell phone operator offers innovative products and services
My cell phone operator is innovative

Appendix 3B: Model estimation results across countries

service	variable	US beta	US p-value	Japan beta	Japan p-value	Germany beta	Germany p-value
SMS	Age	-.03	.00	-.05	.00	-.06	.07
	Gender (m=1)	-.01	.46	-.80	.00	-.17	.31
	Consumer innovativeness	.23	.00	.08	.14	.27	.11
	Susceptibility to normative influence	.13	.02	-.01	.45	-.22	.14
	Category usage level	.06	.23	.50	.00	.11	.37
	Category experience	.07	.01	.08	.02	.05	.25
	Entertainment need	.35	.00	-.04	.30	.31	.14
	Brand payment equity	-.04	.29	.01	.47	.05	.33
	Brand service quality	-.11	.06	-.02	.39	.15	.17
	Brand innovativeness	.20	.01	.18	.02	.12	.16
MMS	Age	-.02	.01	-.04	.00	-.02	.00
	Gender (m=1)	.03	.45	-.45	.00	-.11	.22
	Consumer innovativeness	.09	.11	.05	.08	.18	.00
	Susceptibility to normative influence	.12	.08	-.04	.18	.04	.24
	Category usage level	-.03	.44	.36	.00	.91	.00
	Category experience	.08	.02	.04	.01	.04	.05
	Entertainment need	.45	.00	.09	.01	.22	.00
	Brand payment equity	-.22	.03	-.06	.10	.00	.48
	Brand service quality	-.10	.13	.04	.17	-.01	.46
	Brand innovativeness	.31	.01	.16	.00	.17	.01
e-mail	Age	-.02	.00	-.01	.00	.00	.32
	Gender (m=1)	.42	.00	.03	.34	.45	.00
	Consumer innovativeness	.22	.00	.06	.02	.10	.00
	Susceptibility to normative influence	.11	.02	-.02	.26	.07	.06
	Category usage level	.04	.29	.12	.02	.38	.00
	Category experience	.05	.01	.05	.00	.07	.00
	Entertainment need	.32	.00	.07	.01	.17	.00
	Brand payment equity	-.05	.22	-.07	.03	.07	.05
	Brand service quality	-.06	.13	.00	.49	.03	.26
	Brand innovativeness	.08	.12	.06	.05	-.01	.38

Appendix 3B (continued)

		US		Japan		Germany	
service	variable	beta	p-value	beta	p-value	beta	p-value
downloads	Age	-.02	.00	-.05	.00	-.04	.00
	Gender (m=1)	-.04	.36	-.37	.00	-.02	.41
	Consumer innovativeness	.16	.00	.08	.03	.12	.00
	Susceptibility to normative influence	.14	.00	-.05	.11	.05	.12
	Category usage level	.10	.05	.32	.00	.31	.00
	Category experience	.01	.22	.05	.01	.01	.30
	Entertainment need	.41	.00	.16	.00	.34	.00
	Brand payment equity	.01	.44	-.06	.10	.00	.46
	Brand service quality	.01	.44	-.01	.41	.05	.17
	Brand innovativeness	.11	.03	.20	.00	.05	.16
voicemail	Age	-.02	.00	-.01	.00	.00	.34
	Gender (m=1)	-.30	.01	-.18	.01	-.05	.27
	Consumer innovativeness	.25	.00	.06	.03	.11	.00
	Susceptibility to normative influence	-.01	.42	.03	.22	.06	.08
	Category usage level	.15	.09	.28	.00	.26	.01
	Category experience	-.02	.15	.07	.00	.05	.00
	Entertainment need	.12	.03	.00	.45	.01	.36
	Brand payment equity	-.13	.04	-.05	.09	.00	.50
	Brand service quality	.04	.25	.01	.43	-.03	.25
	Brand innovativeness	.11	.06	.04	.12	.02	.31

Nederlandse samenvatting (Summary in Dutch)

In de afgelopen tijd is de markt voor mobiele telefonie zeer dynamisch geweest op het gebied van innovaties. Telecom providers investeren continu in nieuwe technologieën en introduceren vele nieuwe mobiele diensten voor consumenten, zoals MMS en web-diensten. Echter, het aantal consumenten dat deze nieuwe mobiele diensten ook daadwerkelijk adopteert en gebruikt is, zeker in het begin, vaak niet zo hoog. Dit maakt het voor de providers moeilijk om hun technologische investeringen terug te verdienen. Dit proefschrift houdt zich bezig met de volgende vragen:

1. Wat zijn de antecedenten van adoptie timing van nieuwe mobiele diensten?
2. Op welke manier verschilt het adoptiegedrag met betrekking tot mobiele diensten tussen verschillende landen?
3. Op welke manier beïnvloedt adoptie timing het gebruik na adoptie van mobiele diensten?

In de adoptieliteratuur zijn deze onderwerpen tot op zekere hoogte onderzocht, maar de meeste onderzoeken richten zich op een geaggregeerd niveau (dat wil zeggen, men bekijkt slechts de adoptie op marktniveau). Ook is er nog weinig onderzoek gedaan naar de adoptie van nieuwe diensten. Door specifiek de invloed van marketing communicatie en culturele waarden te onderzoeken en de adoptie timing te relateren aan het gebruik na adoptie, menen we met dit proefschrift een significante bijdrage aan de adoptieliteratuur te leveren.

In hoofdstuk 2 hebben we de effecten onderzocht van marketing communicatie op de individuele adoptie timing van een nieuwe mobiele GPRS service door bestaande klanten van een grote telecom-aanbieder in Nederland. Onze belangrijkste bijdrage aan de adoptieliteratuur was dat we zowel direct marketing communicatie als massamarketing communicatie hebben onderzocht, en dat we daarbij onderscheid hebben gemaakt tussen marketing communicatie met betrekking tot het merk en marketing communicatie die specifiek betrekking heeft op de nieuwe dienst, van zowel de betrokken provider als concurrerende aanbieders. We hadden hierbij de beschikking over een grote steekproef uit de klantendatabase van de mobiele provider over een periode van 25 maanden, nadat de nieuwe dienst voor het eerst op de markt geïntroduceerd was. Hierbij was bekend of, en zo ja, wanneer een klant zich voor de nieuwe dienst aanmeldde. Vervolgens werd geanalyseerd in welke mate deze adoptie timing afhing van de marketing communicatie over de tijd en van andere verklarende variabelen zoals klantkenmerken en relatiekenmerken. We hebben hiervoor een split-hazard duurmodel gebruikt, dat rekening houdt met het feit dat een deel van de klanten de nieuwe dienst waarschijnlijk nooit zal adopteren, deels afhankelijk van de klant- en relatiekenmerken. Zeker voor nieuwe high-tech producten zoals mobiele diensten zal dit van toepassing zijn. Het split-hazard model liet een betere ‘fit’ zien dan een model dat hier geen rekening mee hield.

Onze bevindingen laten zien dat direct marketing communicatie de adoptietijd voor individuele klanten verkort en dat dit effect veel belangrijker is dan dat van massamarketing communicatie. Hoewel we slechts het effect van één type direct marketing uiting hebben gemeten in de specifieke context van een nieuwe mobiele dienst, is dit een van de eerste onderzoeken die de invloed van direct marketing op adoptiegedrag meet in combinatie met de effecten van massamarketing. Ook uitingen van massamarketing bleken de adoptietijd van individuele klanten te verkorten. Echter, massamarketing communicatie die direct betrekking had op de nieuwe dienst, had een groter effect op de adoptie timing van die nieuwe dienst dan massamarketing communicatie die alleen betrekking had op het merk van de aanbieder. Dit resultaat suggereert dat massamarketing communicatie die niet specifiek op een nieuw product of dienst is gericht, toch het adoptieproces kan versnellen, mogelijk vanwege een verbetering van de attitudes ten aanzien van het merk. Massamarketing communicatie die het merk van concurrerende aanbieders promoot, bleek de adoptietijd juist te verlengen. Ook dit suggereert een invloed van merkattitudes op adoptiegedrag. Wanneer concurrerende aanbieders een soortgelijke nieuwe dienst promoten via massamarketing, heeft dit juist een positieve invloed op de adoptie van de nieuwe dienst onder klanten van de betrokken aanbieder. Dit *market-making effect* van min of meer generieke reclame was al wel bekend in de diffusieliteratuur, maar was tot nu toe nooit aangetoond in een individuele adoptie context. Marketing communicatie van concurrenten is veelal buiten beschouwing gelaten in de adoptieliteratuur. Ons onderzoek heeft aangetoond dat ook concurrerende massamarketing een significant invloed kan hebben op adoptietiming en dat de richting van het effect deels afhangt van het feit of er naar de nieuwe dienst verwezen wordt of alleen naar het concurrerende merk. Onze bevindingen kunnen van belang zijn voor ondernemingen die nieuwe mobiele diensten introduceren. Zo blijkt dat direct marketing activiteiten een zeer belangrijk instrument zijn om bestaande klanten de nieuwe dienst te laten adopteren. Massamarketing kan nog wel een rol spelen voor nieuwe klanten, hoewel het ook klanten van concurrenten kan overhalen de nieuwe dienst bij hun eigen aanbieder te adopteren. Op marktniveau zouden concurrerende aanbieders van elkaars massamarketing communicatie kunnen profiteren door tegelijkertijd een nieuwe dienst te introduceren.

Ook heeft dit onderzoek bijgedragen aan de *customer management* literatuur door de interactie-effecten tussen relatiekenmerken en marketing uitingen te bekijken. Tot nu toe werd de adoptie van nieuwe producten vaak buiten beschouwing gelaten bij het verhogen van de klantwaarde. Onze resultaten laten zien dat massamarketing communicatie gerelateerd aan de nieuwe dienst een grotere invloed heeft op loyale klanten. Dit geldt ook voor soortgelijke marketing uitingen van concurrerende aanbieders. Hieruit blijkt dat loyale klanten erg waardevol kunnen zijn als het gaat om de adoptie van nieuwe diensten, omdat zij sneller over te halen zijn via massamarketing. Bovendien zullen zij marketing communicatie voor soortgelijke diensten van concurrenten eerder beschouwen als generieke reclame, zodat zij gestimuleerd worden de dienst bij hun eigen aanbieder te adopteren.

In hoofdstuk 3 hebben we een crossnationaal onderzoek gedaan over drie landen, waarin we de effecten hebben bekeken van consumentkarakteristieken op de adoptiekans van vijf mobiele diensten, alsmede de modererende effecten van culturele dimensies en karakteristieken van mobiele diensten. We hebben de culturele dimensies van Hofstede gebruikt om verschillen in adoptiegedrag tussen landen te verklaren, bovenop de effecten van consumentkarakteristieken, productcategorie variabelen en merkgerelateerde variabelen. Hoewel veel innovatiediffusie onderzoeken de invloed van culturele waarden onderzocht hebben, is er nog weinig gedaan op het niveau van individuele adoptiebeslissingen. De data werden verkregen van een marktonderzoeksbureau dat een consumentenonderzoek had verricht onder mobiele telefoongebruikers in de Verenigde Staten, Japan en Duitsland. Dit bevatte onder andere de zelfgerapporteerde adoptie van vijf mobiele diensten: SMS, MMS, e-mail, downloads en voicemail.

Met behulp van een *multivariate probit* model met latente variabelen hebben we aangetoond dat consumentkarakteristieken zoals leeftijd en innovativiteit, en productcategorie variabelen zoals gebruiksintensiteit en ervaring met de productcategorie, consistente effecten op individuele adoptiekansen hebben over de drie landen heen. Echter, onze resultaten lieten ook zien dat geslacht alleen consistente effecten op adoptie had in Japan, het land dat het hoogste scoort op *masculiniteit*. Dit resultaat bevestigt de theorie dat de verschillen in consumentengedrag tussen mannen en vrouwen groter zijn in landen met een hoge masculiniteit, hoewel dit nooit was aangetoond in een individuele adoptie setting. We vonden ook een consistent positief effect van de gevoeligheid voor normatieve invloeden in de Verenigde Staten, een land dat erg individualistisch is, terwijl we geen effect vonden in het collectivistische Japan. Dit verschil schrijven we toe aan de prominentere *value expressive influence* in individualistische landen, dat wil zeggen, deze consumenten hechten er meer waarde aan om zich te onderscheiden van de massa door de adoptie van nieuwe diensten dan consumenten in collectivistische landen. Telecombedrijven die nieuwe mobiele diensten willen introduceren in meerdere landen zullen rekening moeten houden met deze modererende effecten van culturele waarden. Concreet betekent dit dat zij in hun communicatie moeten differentiëren tussen mannen en vrouwen in landen met een hoge masculiniteit en dat zij meer gebruik moeten maken van *value-expressive* aspecten van de nieuwe diensten in individualistische landen. Hoewel ons onderzoek slecht drie landen omvat, duiden de consistente resultaten voor de meeste effecten erop dat aanbieders van nieuwe mobiele diensten zich in eerste instantie altijd moeten richten op de jonge, innovatieve en relatief ervaren consument.

Door vijf mobiele diensten in het onderzoek te betrekken konden we de effecten op de adoptiekansen van elk van de diensten vergelijken. De van nature meer innovatieve consument had een hogere kans om een van de innovatieve diensten te adopteren en consumenten met een hogere entertainment behoefte hadden meer kans op het adopteren van mobiele diensten met een hedonisch karakter, hoewel deze resultaten niet altijd even consistent bleken. Ook de factorstructuren, die de onderliggende motivaties en mogelijke samenhang tussen de adoptiebeslissingen met betrekking tot de vijf mobiele diensten moesten weergeven, konden niet eenduidig worden geïnterpreteerd in termen van productkarakteristieken. Er is dus nader onderzoek nodig naar de invloed van de karakteristieken van mobiele diensten op adoptiekansen.

In Hoofdstuk 4 richtten we ons op de volgende fase in het adoptieproces: het gebruik na adoptie. We hebben hier de relatie onderzocht tussen adoptie timing en het gebruik in de eerste 12 maanden na adoptie van een nieuwe mobiele dienst gebaseerd op de GPRS-technologie door consumenten. Met onze longitudinale aanpak konden we nieuwe inzichten verkrijgen in de veranderingen in gebruiksniveaus over de tijd, hetgeen nog niet eerder was gedaan in een onderzoek naar individueel adoptiegedrag. Adoptie timing, als belangrijkste verklarende variabele voor het gebruik van de nieuw dienst, hebben we beschouwd als een endogene variabele. Klantkenmerken en relatiekenmerken deden dienst als verklarende variabelen voor zowel adoptie timing als gebruik na adoptie (in aantal gedownloade kilobytes per maand).

Met behulp van een *random effects* tobit model met endogene adoptietijd konden we vaststellen dat de eerste adopters aanvankelijk minder gebruikten dan de latere adopters, hetgeen we toeschrijven aan de hoge verwachtingen van de latere adopters. Echter, na verloop van tijd neemt het gebruik van de latere adopters af, mogelijk omdat de nieuwe dienst niet volledig aan hun hoge verwachtingen voldoet. Dit patroon konden we niet terugvinden bij de eerste adopters: hun gebruiksniveau bleef min of meer stabiel over de tijd of nam zelfs toe. Deze verschillen in gebruikspatronen tussen eerdere en latere adopters ondersteunen en versterken eerdere bevindingen dat latere adopters een grotere kans hebben om het gebruik van een nieuw product te beëindigen, hoewel we dit stopgedrag niet specifiek hebben onderzocht. Aanbieders van nieuwe diensten moeten er dus rekening mee houden dat een aanvankelijk hoog gebruiksniveau van latere adopters geen garantie voor een constant gebruik in de toekomst is. Aan de andere kant zullen de eerdere adopters aanvankelijk misschien minder van de nieuwe dienst gebruikmaken, maar desondanks kunnen zij op de langere termijn erg waardevol zijn, omdat zij een grotere kans hebben om het gebruik in de toekomst voort te zetten. Behalve de effecten van adoptie timing vonden we ook belangrijke effecten van relatiekenmerken op het gebruik na adoptie, die in de adoptieliteratuur nauwelijks onder de aandacht zijn gebracht. Het gebruik van andere diensten in de productcategorie en de tijd dat men bij de huidige aanbieder zit bleken een positief effect te hebben op het gebruik van de nieuwe dienst. Bovendien lijken de veelgebruikers in de productcategorie en de loyale klanten hun gebruik van de nieuwe dienst te verhogen over de tijd, wat het belang van relatiekenmerken voor het gebruik van nieuwe diensten nog eens benadrukt.

Met het onderzoeken van verschillende aspecten van het individuele adoptieproces van nieuwe mobiele diensten hebben we bijgedragen aan zowel de adoptieliteratuur als de customer management literatuur. We hebben een breed scala aan antecedenten van adoptie bekeken, waarvan marketing communicatie (Hoofdstuk 2) en – als modererende variabelen – culturele waarden (Hoofdstuk 3) de belangrijkste waren, aangezien de kennis over deze effecten beperkt was. Ook hebben we de volgende stap in het adoptieproces onderzocht, te weten gebruik na adoptie (Hoofdstuk 4), dat tot nu toe nog weinig aandacht heeft gehad in de adoptieliteratuur. Tezamen vormen deze drie onderzoeken een completer beeld van het adoptieproces als geheel (zie het theoretisch raamwerk in Figuur 1.1). Het exploratieve karakter van enkele delen van ons onderzoek kan richting geven aan toekomstig onderzoek op dit gebied.

Hoewel dit proefschrift geschreven is vanuit adoptieperspectief, zijn er vele raakvlakken met het gebied van customer management. In de hoofdstukken 2 en 4 hebben we gebruik gemaakt van transactiedata uit de klantendatabase van een telecomaanbieder. Beide onderzoeken lieten zien dat relatiekenmerken een significante invloed kunnen hebben op het adoptiegedrag van consumenten en dat de loyale en ervaren consument erg waardevol kan zijn voor een aanbieders van nieuwe diensten. Dit ondersteunt eerdere bevindingen in de customer management literatuur dat loyale klanten winstgevender zijn.

Het feit dat we ons alleen gericht hebben op nieuwe mobiele diensten zou als een beperking kunnen worden opgevat, omdat de telecomsector een zeer specifieke technologische markt is met vele innovaties en vaak ook met hevige concurrentie tussen de aanbieders. Desondanks bood het dynamische karakter van deze markt ons de mogelijkheid om grote steekproeven voor ons onderzoek te gebruiken binnen een relatief korte tijdsperiode. De nieuwe diensten die worden geïntroduceerd zijn relatief homogeen tussen aanbieders en landen, zodat we de effecten van concurrerende marketing uitingen en adoptiegedrag in verschillende landen konden onderzoeken. In hoeverre onze resultaten gegeneraliseerd kunnen worden voor andere diensten zal nader onderzocht moeten worden, ook al vinden we theoretische ondersteuning voor veel van onze hypotheses.

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MODELING CONSUMER ADOPTION AND USAGE OF VALUE-ADDED MOBILE SERVICES

In recent years, the mobile telecom market has been very dynamic in terms of innovations. Mobile service providers continuously invest in new technologies and introduce many new mobile services for consumers, such as MMS and web services. However, adoption rates are often not very high, which makes it difficult for firms to get return on their technology investments. In this thesis we investigate the individual consumer adoption of new mobile services and consider a range of antecedents and possible moderators. Most importantly, we study the effects of different types of marketing communications on individual adoption timing, and the moderating effect of cultural values on adoption behavior across countries. In addition, we consider the next step in the adoption process: postadoption usage, which has received little attention in the adoption literature so far. In a longitudinal study, we investigate the effect of adoption timing on consumer usage patterns after the adoption of a new mobile service. By taking customer and relationship characteristics into consideration in each study, we also contribute to the customer management literature. We show that relationship characteristics can have a significant impact on customer adoption behavior and that a loyal and experienced customer can be a valuable asset to companies that introduce a new service.

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