

Customer churn analysis: Churn determinants and mediation effects of partial defection in the Korean mobile telecommunications service industry

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Abstract

Retaining customers is one of the most critical challenges in the maturing mobile telecommunications service industry. Using customer transaction and billing data, this study investigates determinants of customer churn in the Korean mobile telecommunications service market. Results indicate that call quality-related factors influence customer churn; however, customers participating in membership card programs are also more likely to churn, which raises questions about program effectiveness. Furthermore, heavy users also tend to churn. In order to analyze partial and total defection, this study defines changes in a customer's status from active use (using the service on a regular basis) to non-use (deciding not to use it temporarily without having churned yet) or suspended (being suspended by the service provider) as partial defection and from active use to churn as total defection. Thus, mediating effects of a customer's partial defection on the relationship between the churn determinants and total defection are analyzed and their implications are discussed. Results indicate that some churn determinants influence customer churn, either directly or indirectly through a customer's status change, or both; therefore, a customer's status change explains the relationship between churn determinants and the probability of churn.

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1. Introduction

Managing customer churn is of great concern to global telecommunications service companies and it is becoming a more serious problem as the market matures. The annual churn rate ranges from 20% to 40% in most of the global mobile telecommunications service companies (Berson, Smith, & Therling, 1999; Madden, Savage, & Coble-Neal, 1999; Parks Associates, 2003; Kim, Park, & Jeong, 2004). Customer churn adversely affects these companies because they stand to lose a great deal of price premium, decreasing profit levels and a

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possible loss of referrals from continuing service customers (Reichheld & Sasser, 1990). Furthermore, the cost of acquiring a new customer can substantially exceed the cost of retaining an existing customer (Siber, 1997).

In a highly competitive and maturing mobile telecommunications service market, a defensive marketing strategy is becoming more important. Instead of attempting to entice new customers or lure subscribers away from competitors, defensive marketing is concerned with reducing customer exit and brand switching (Fornell & Wernerfelt, 1987). Reichheld (1996) estimated that, with an increase in customer retention rates of just 5%, the average net present value of a customer increases by 35% for software companies and 95% for advertising agencies. Therefore, in order to be successful in the maturing market, the strategic focus of a company ought to shift from acquiring customers to retaining customers by reducing customer churn.

In order to better manage customer churn, companies need to fully understand a customer's behavioral churn path and the factors pertaining to the customer churn; however, these problems have not been fully addressed in the literature.

First, previous studies mainly focused on finding a few specific factors (e.g., customer dissatisfaction, customer loyalty, etc.) pertaining to customer churn rather than investigating and empirically testing a comprehensive model encompassing relationships among various constructs, such as customer dissatisfaction, switching costs, service usage and other customer-related variables. For example, Keaveney (1995) only examined why customers switch their services and classified the reasons into eight general categories. Bolton (1998) investigated the role of customer satisfaction in a dynamic model estimating the customer's duration with the service carrier. Bolton, Kannan, and Bramlett (2000) found that members in loyalty reward programs overlook a negative evaluation of the company vis-à-vis its competitors in their repatronage decisions. Gerpott, Rams, and Schindler (2001) analyzed a two-stage model where overall customer satisfaction has a significant impact on customer loyalty, which in turn influences customers' intentions to terminate their contractual relationship. Lee, Shin, and Park (2003) found some determinants of customer churn in the Korean broadband Internet access service market. Kim et al. (2004) investigated the adjustment effect of switching barriers on customer satisfaction and customer loyalty.

Secondly, due to the proprietary nature of actual customer data, much of the research has dealt with consumer survey data asking consumers' perceptions of service experiences and intention to remain. However, the survey data rather than the actual customer transaction or billing data may not fully represent the customer's actual future repatronage decision. Furthermore, due to cost concerns, most survey-based studies use a small sample of less than a thousand customer records (Keaveney, 1995; Bolton et al., 2000; Gerpott et al., 2001; Lee et al., 2003; Kim et al., 2004), which may undermine the reliability and validity of analysis results.

In fact, there are several studies that are based on large-scale actual customer transaction and billing data. However, their objectives mainly focus on predictive accuracy rather than descriptive explanation. For example, detailed call data is used to predict the probability of customer churn (Mozer, Wolniewicz, Grimes, Johnson, & Kaushansky, 2000; Ng and Liu, 2000; Wei and Chiu, 2002); a subscriber's remaining tenure with the company is estimated using internal company databases (Drew, Mani, Betz, & Datta, 2001) and brand switching and adoption probabilities are forecasted using commercial databases (Weerahandi & Moitra, 1995). However, there are at least two exceptions, both of which use survival analysis to test hypotheses about churn predictors. One is a study by Bolton (1998) where actual customer transaction and survey data is used to analyze customer churn behavior in the cellular service market. Another is a customer attribution study where Poel and Larivière (2004) analyzed an in-house data warehouse in the European financial service market.

Compared with the previous studies, this paper has two distinct research objectives. The first objective is to develop a comprehensive churn model and empirically test it using a large sample of actual customer transaction and billing data, which is directly related to actual customer churn decisions. Identifying customer churn determinants, such as core service failures, customer complaints, loyalty programs, service usage, etc., may help managers improve company operations in terms of their marketing strategy, specifically customer churn prevention programs.

The second objective is to identify both partial and total defection in a subscription-based telecommunications service industry. The majority of previous studies have focused on discovering the direct effect of independent variables on customer churn; however, this study is motivated by the idea that customer status may act as a *mediator* between churn determinants and customer churn, indicating that a customer's status

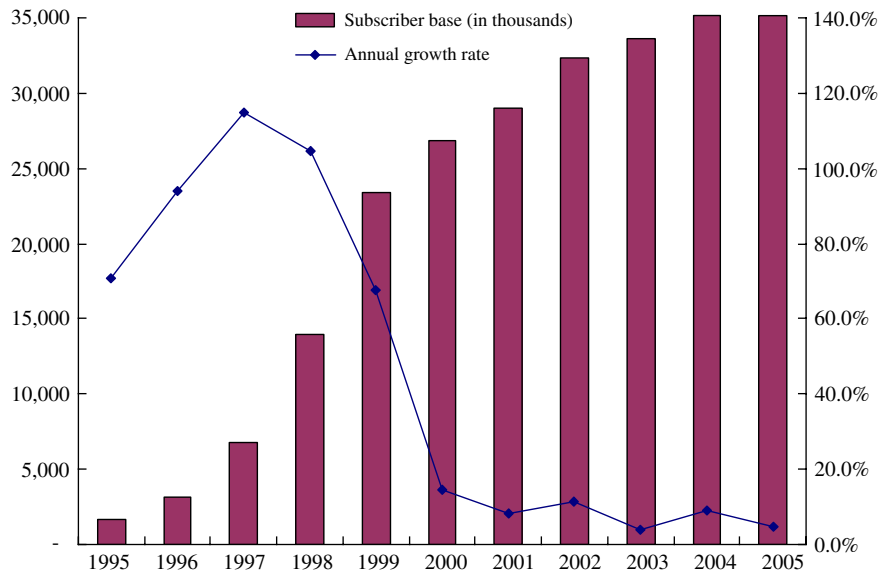


Fig. 1. Subscriber base and annual growth rate in the Korean mobile telecommunications service market.

change is an early signal of total customer churn. Some churn determinants are expected to affect customer status and their impacts on both customer status and customer churn are analyzed. From a managerial standpoint, understanding the mediating role of customer status would mean that companies will be able to manage churn better, which would not have been obvious in the previous models.

This paper is organized as follows. In Section 2, a research model and hypotheses are developed regarding the factors pertaining to customer churn. The empirical method is described in Section 3 and the results of the analysis are discussed in Section 4. Finally, the implications of the study and areas for further research are presented in Section 5.

2. A research model

2.1. The South Korean mobile telecommunications service market

With the launch of analogue cellular service in 1984 and digital service in 1995, the South Korean mobile telecommunications service market grew substantially. By 2004, the number of subscribers was over 36 million and the penetration rate was about 75%¹ (see Fig. 1). As the market has matured, however, competition among mobile service providers has intensified in order to maintain their subscriber bases.

The churn rate in the South Korean mobile telecommunications service market was 16.9% in 2003, which was comparable with the churn rate in the USA (Parks Associates, 2003). However, the introduction of mobile number portability in 2004 has allowed mobile subscribers to switch operators without having to change numbers and thus the customer churn rate increased to 20.0% by the end of 2004.

2.2. Customer churn determinants

The following paragraphs provide a motivation for including specific customer churn determinants considered in this study. Fig. 2 presents four major constructs hypothesized to affect customer churn and the mediation effects of customer status that indirectly affect customer churn.²

¹For reference, South Korea had a population of more than 48 million people as of 2004.

²Specific hypotheses on customer-related variables are ignored because there are few studies that explain the causality between the customer-related factors and customer churn.

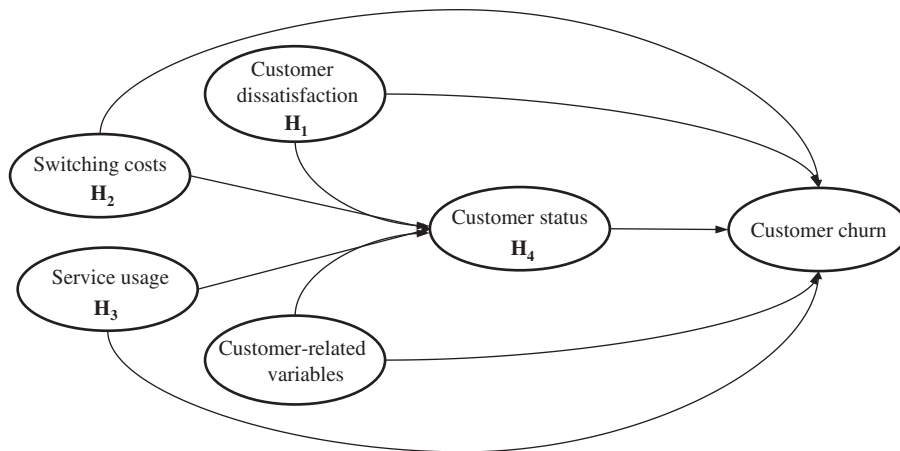


Fig. 2. A conceptual model for customer churn with mediation effects.

2.2.1. H1: customer dissatisfaction

Previous research suggests that network quality and call quality are key drivers of customer satisfaction/dissatisfaction in the mobile communications services market (Gerpott et al., 2001; Lee et al., 2001; Kim & Yoon, 2004; Kim et al., 2004).³ Keaveney's (1995) critical incident study of 835 customer-switching behaviors in service industries demonstrated that 44% switched their service providers because of core service failures. In addition, service failures have been "triggers" that accelerate a customer's decision to discontinue the service provider-customer relationship (Bolton, 1998; Bolton et al., 2000; Kim, 2000; Mozer et al., 2000). Therefore, some technical dimensions of service quality, such as the amount of call drops and call failures⁴ may be related to customer churn.

H1a: call drop rates are positively associated with the customer churn probability.

H1b: call failure rates are positively associated with the customer churn probability.

Though many factors are related to a customer complaint behavior, dissatisfaction with a service or a product is found to be positively related to the complainant's behavior (Day & Landon, 1977; Bearden & Teel, 1983). In fact, complaining customers can take private and/or public actions. For example, personal actions include no further purchase and negative word-of-mouth; public actions include redress-seeking efforts toward the provider/seller and appeals to third-party consumer affairs bodies (Day & Landon, 1977). That is, complaints lead to switching or customer churn. On the other hand, Fornell and Wernerfelt (1987) argued that well-managed complaint management programs can lower the total marketing expenditure by substantially reducing customer churn. However, it should be noted that this is true only if a sufficiently large proportion of the complainants can be persuaded to remain as customers by the complaint management programs. If the customer complaint management programs in major service providers are not effective, customer complaints may lead to customer churn. This is in line with some other empirical studies (Solnick & Hemenway, 1992; Keaveney, 1995) linking customer complaints and switching.

H1c: the number of complaints is positively associated with the probability of customer churn.

2.2.2. H2: switching costs

Customers want to maintain relationships with service providers for one of two reasons: constraints (they "have to" stay in the relationship) or loyalty (they "want to" stay in the relationship) (Bendapudi & Berry, 1997). Switching costs are the factors that act as constraints preventing customers from freely switching to

³ Among other factors, satisfaction with handsets and value-added services are also key drivers of customer satisfaction/dissatisfaction; however, they are not considered in the model because they were unavailable in the dataset.

⁴ Call drops denote percentage of abnormally terminated calls; and call failures mean the percentage of calls that are not initiated due to interference or poor coverage. In fact, Korean Ministry of Information and Communication (MIC) uses these two measures to evaluate the quality of major telecommunications services (Choi, 2001).

other service providers. In the mobile telecommunications service industry, loyalty points and membership card programs are the major components of switching costs, because all the membership benefits and accumulated points may be lost when service contracts are terminated or customers switch their service providers.

In a study of 306 subscribers in the Korean mobile service market, Kim et al. (2004) found that among factors constituting switching costs, loss of loyalty points has both a direct effect and an adjustment effect on customer loyalty. Because current loyalty points are forfeited as they switch, even dissatisfied customers may show a high level of “false” loyalty (Gerpott et al., 2001).

H2a: accumulated loyalty points are negatively associated with the customer churn probability.

The goal of membership card programs is to increase the rate of customer retention by providing benefits to their members. If the benefit is not available from other providers, it works as a switching barrier from the perspective of customer retention. Additionally, as Bolton et al. (2000) argued, members in loyalty reward programs may overlook or discount negative evaluations of the company against competitors in terms of product, quality and price. Therefore such membership card programs establish switching costs for customers and thus they may inhibit customer churn.

H2b: loyalty program membership is negatively associated with customer churn probability.

2.2.3. H3: service usage

Service usage patterns can be described as three commonly used measures, minutes of use, frequency of use and total number of distinct receivers contacted by the subscriber (Wei & Chiu, 2002). In effect, the level of service usage, which is measured by the monthly charge, is one of the most popular behavioral predictors of defection in the previous research (Buckinx & Poel, 2005). Mozer et al. (2000) conjectured that monthly charges and usage amounts are linked to churn. However, it is still unclear as to whether the relationship between service usage and customer churn is truly positive or negative. In this paper, the current billed amount is hypothesized to be related to customer churn, although the relationship is unclear.

H3a: monthly billed amounts are associated with the probability of customer churn.

However, among those users who are in their teens or early twenties, some cannot afford to pay their bills. Therefore, with unpaid balances and failures to pay their bill on time,⁵ customers are more likely to change their service, either voluntarily or involuntarily.

H3b: unpaid balances are positively associated with the probability of customer churn.

H3c: the number of unpaid monthly bills is positively associated with the probability of customer churn.

2.2.4. H4: customer status

Some customers do not suddenly churn from a service provider. In fact, they either decide not to use it on a temporary basis or are suspended by the service provider due to payment problems; i.e., they exhibit a status change in an internal company customer database. For the purpose of this study, more than a hundred different kinds of customer status are grouped into three categories: active use, non-use and suspended.⁶

H4: customers with a non-use or suspended status are considered more likely to churn than customers with an active use status.

2.3. Mediation effects of customer status

Mediating variables in path analysis account for the relationship between explanatory factors and dependent variables; in other words, they explain how and why certain effects of explanatory factors occur (Baron & Kenny, 1986). This study conjectures that a customer's status change may explain the relationship between the churn determinants and the probability of churn, therefore, some churn determinants may influence customer churn, either directly or indirectly through a customer status change, or both.

⁵The payment delinquency is often measured by the number of unpaid monthly bills. This refers to the number of times in which a customer did not pay his/her monthly bills in time.

⁶*Active use* means that a customer uses the service on a regular basis; *non-use* means that a customer decides not to use it, but has not churned yet; *suspended* means that a customer's service is suspended by the service provider because of payment problems.

Buckinx and Poel (2005) discovered partial defection in the non-contractual setting (e.g., retail sector).⁷ They assume that partial defection may lead to total defection in the long run, however, they were unable to verify the assumption, because in a non-contractual setting it is not clear when customers defect completely.

Regarding partial and total defection, this study defines a customer's status change from active use to non-use or suspended as partial defection and from active use to churn as total defection. As argued in the previous section, this study considers customer status as a *mediator* between churn determinants and customer churn. In other words, the mediation effects of the partial defection on the relationship between churn determinants and total defection are analyzed. Therefore, it is hypothesized that the relationship between factors influencing customer churn and actual customer churn will be mediated by a customer's status change.

H1a': the effect of call drop rates on customer churn is mediated by a customer's status change.

H1b': the effect of call failure rates on customer churn is mediated by a customer's status change.

H1c': the effect of the number of complaints on customer churn is mediated by a customer's status change.

H2a': the effect of accumulated loyalty points on customer churn is mediated by a customer's status change.

H2b': the effect of loyalty program membership on customer churn is mediated by a customer's status change.

H3a': the effect of monthly billed amounts on customer churn is mediated by a customer's status change.

H3b': the effect of unpaid balances on customer churn is mediated by a customer's status change.

H3c': the effect of the number of unpaid monthly bills on customer churn is mediated by a customer's status change.

3. Empirical methods

3.1. Sample

For the empirical analysis, 10,000 random samples were drawn from the database of one of the leading mobile telecommunications service providers in South Korea. The accounts had to be active from September 2001 to November 2001, meaning that they were active for at least 3 months so as to be included in the sample. For those accounts, an 8-month time window was set up for convenience; therefore, all accounts were tracked for an 8-month period, from September 2001 through April 2002.

For the purpose of analysis, "churn" was defined as the event in which a subscription was terminated by the end of April 2002; therefore, in this analysis, churn happened during the period from December 2001 to April 2002. For churned accounts, 3-month, 2-month and 1-month prior data was collected before the actual termination. For the retained accounts, the most recent last 3 months of data was collected, which was from February 2002 to April 2002. This data collection method is similar to the method used in the study conducted by Daskalaki, Kopanas, Goudara, and Avouris (2003).

Following the collection method, subscribers' usage and billing data was summarized over the 3-month period and personal profiles were added. The available data in a sample consists of behavioral information at the level of the individual customer and customer demographics; such as billed amounts, accumulated loyalty points, call quality-related indicators, handset-related information, calling plans, gender, etc. After the necessary data cleaning process, a sample of total 5789 records (5137 retained, 652 churned) of private users was finally obtained.⁸

⁷Buckinx and Poel (2005) classify a customer as a partially defective one if one of the following conditions is not fulfilled: (1) frequency of purchases is above average and (2) ratio of the standard deviation of the interpurchase time to the mean interpurchase time is below average.

⁸Following Lee et al. (2001), only private users were included in the sample, because business users have different characteristics, that is, it is the firm, not the individual who chooses the service provider and pays the bill.

Table 1
Categorical variables and descriptions

Variable name	Level	Description
<i>Switching costs</i>		
Membership card	A	Offering premium benefits, restricted to heavy-users
	B	Offering minimum benefits, open to any members
	Non-members	Offering no benefits
<i>Customer related variables</i>		
Customer grade	A	The highest level based on usage level and tenure
	B	The second level based on usage level and tenure
	Default	The lowest level based on usage level and tenure
Calling plans	A	Designed for brand card members with special calling plans
	B	Offering optional calling plans such as pre-specified calling area discount, designated receiver discount, or night/weekend discount
	C	Designed for only teens and young adults with a lower monthly fee and higher airtime rate
	Standard	Offering standard calling plans
Gender	Male	Male subscriber
	Female	Female subscriber
Payment method	Direct payment	Authorized direct payment from a bank account or a credit card
	Non-direct payment	Other payment methods
Handset capability	Internet capable	Capable to provide mobile internet access services
	Internet incapable	Incapable to provide mobile internet access services
Handset manufacturer	LG	LG Electronics, Inc.
	Motorola	Motorola, Inc.
	Samsung	Samsung Electronics, Inc.
	Others	Other handset manufacturers

3.2. Measurement of variables

For the dependent variables, a binary variable was used where 1 denotes “churn” and 0 denotes “retention”. For each account, another multinomial variable was used to indicate the customer status: active use, non-use, or suspended. There were both categorical and continuous independent variables. Table 1 shows the names of categorical variables and their descriptions. Table 2 shows the names of continuous variables and their descriptions. Table 3 shows summary descriptive statistics for continuous variables in the model. With few exceptions, correlations between variables are very low. The largest is between billed amounts and loyalty points ($r = 0.26$), which indicate that multicollinearity is not an issue (see Table A1 in the Appendix A).

4. Results of the analysis

4.1. Model estimation

In order to analyze the mediation effects of customer status, three logistic regressions are adopted.⁹ First, a multinomial logistic regression model on independent variables was used to accommodate the multinomial nature of customer status: a customer on active use status was used as a referent or a baseline outcome and

⁹According to Baron and Kenny (1986), to test for mediation, one should estimate the three following regression equations: (1) regressing the mediator on the independent variables, $M = aX$, (2) regressing the dependent variable on the independent variables, $Y = cX$

Table 2
Continuous variables and descriptions

Variable name	Description
<i>Customer dissatisfaction</i>	
Call drop rate	Proportion of call drops a customer experiences out of the total number of call trials
Call failure rate	Proportion of call failures a customer experiences out of the total number of call trials
Number of complaints	Number of times a customer makes complaints to customer service center regarding problems with billing, call coverage, membership cards, etc
<i>Switching costs</i>	
Loyalty points	Amount of credits customers earned, which are redeemable for a wide variety of goods and services, such as retail gifts and coupons
<i>Service usage</i>	
Billed amounts	Amount of monthly charge
Unpaid balances	Total unpaid balances
Number of unpaid monthly bills	Number of times in which a customer did not pay his/her monthly bills in time

Table 3
Summary of descriptive statistics^a

Variable	Total	Customer churn		Customer status		
		Retention	Churn	Active use	Non-use	Suspended
Number of accounts	5789	5137	652	5634	94	61
Call drop rate (%)	1.0	1.0	1.4	1.0	1.2	1.4
Call failure rate (%)	5.3	5.2	5.4	4.5	4.6	5.3
Number of complaints	0.005	0.004	0.018	0.000	0.005	0.043
Loyalty points (in 1000 points)	7.6	7.6	7.2	6.1	7.2	7.6
Billed amounts (in \$ USD)	28.9	28.1	35.1	28.5	38.7	52.3
Unpaid balances (in \$ USD)	3.5	3.9	0.4	2.6	18.7	60.0
Number of unpaid monthly bills	0.4	0.4	0.5	0.4	1.1	2.5

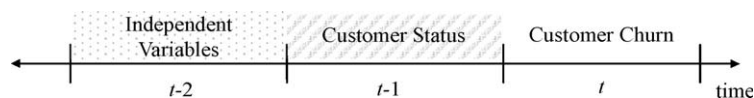
^aNote 1. Values in the table are means for the variables in the sample, except in the row of the number of accounts. Note 2. All numbers are from 2002 (1 USD = 1200 KRW).

logit functions were formed comparing customers on non-use status (Model 1a) and customers on suspended status (Model 1b), to the customers on active use status.¹⁰ Secondly, a binary logistic regression model on independent variables (Model 2) was used to model and analyze the customer churn. Thirdly, a binary logistic

(footnote continued)

and (3) regressing the dependent variable on both the independent variables and the mediator, $Y = bM + c'X$. Full mediation holds if $a \neq 0$, $b \neq 0$, $c \neq 0$, $c' = 0$; partial mediation holds if $a \neq 0$, $b \neq 0$, $c \neq 0$, $c' \neq 0$ ($|c| > |c'|$); no mediation holds if $a = 0$ or $b = 0$.

¹⁰It should be noted that customer status as a dependent variable was measured 1 month prior to end period of observation window; and independent variables were measured 2 months prior to it.



Customer churn can take place anytime between the first day and the last day of a specific month (say t). To explain customer churn, it is natural that we use explanatory variables that are measured at least 1 month prior ($t-1$) to the specific month (t), because it is equally possible for a subscriber to leave on the very first day of a month. Accordingly, among other explanatory variables, customer status is measured 1 month prior ($t-1$) to the end of observation window (t). On the other hand, analyzing mediation effects of a customer's status change, the customer status is regressed on other explanatory variables. Therefore, these exploratory variables ought to be measured 1 month prior ($t-2$) to the month that the customer status is measured ($t-1$).

Table 4
Results of logistic regression

Independent variables		Dependent variables			
		Customer status		Customer churning behavior	
		Model 1a	Model 1b	Model 2	Model 3
Call drop rate		0.544 (0.333)	0.204 (0.561)	0.535** (0.158)	0.530** (0.161)
Call failure rate		−0.156 (0.182)	−0.048 (0.224)	0.042 (0.059)	0.052 (0.060)
Number of complaints		0.910** (0.359)	−7.492 (100.8)	0.562* (0.291)	0.538* (0.323)
Loyalty points		−0.036 (0.024)	−0.114** (0.039)	−0.038** (0.010)	−0.034** (0.010)
Membership card	A	0.065	0.730	0.971**	0.984**
	B	(0.526)	(0.680)	(0.210)	(0.214)
	(Non-members)	−0.078 (0.262)	0.051 (0.331)	0.347** (0.100)	0.371** (0.102)
Billed amounts		0.097** (0.044)	0.162** (0.049)	0.150** (0.021)	0.140** (0.022)
Unpaid balances		0.079** (0.021)	0.096** (0.020)	−0.246** (0.073)	−0.306** (0.080)
Number of unpaid monthly bills		0.103** (0.043)	0.226** (0.041)	0.006 (0.025)	−0.009 (0.026)
Customer status	Non-use				1.455** (0.349)
	Suspended (<i>Active use</i>)				2.689** (0.238)
Gender	Female (<i>Male</i>)	0.441** (0.220)	0.462 (0.287)	0.273** (0.088)	0.244** (0.090)
Customer grade	A	0.125 (0.374)	−0.227 (0.524)	−0.382** (0.170)	−0.383** (0.174)
	B (<i>Default</i>)	0.190 (0.269)	0.206 (0.344)	0.206* (0.109)	0.216* (0.111)
Payment method	Direct payment	0.371 (0.354)	−0.629* (0.322)	−0.156 (0.130)	−0.174 (0.133)
	(<i>Non-direct payment</i>)				
Calling plans	A	0.381 (0.413)	−0.013 (0.473)	−0.151 (0.189)	−0.202 (0.196)
	B	0.196 (0.285)	−0.043 (0.373)	−0.234** (0.113)	−0.260** (0.116)
	C (<i>Standard</i>)	0.613** (0.291)	0.116 (0.365)	0.582** (0.112)	0.566** (0.114)
Handset capability	Internet capable (<i>Internet incapable</i>)	−0.470* (0.258)	0.225 (0.406)	−0.383** (0.105)	−0.363** (0.107)
Handset manufacturer	LG	−0.396 (0.437)	−0.466 (0.666)	−0.192 (0.160)	−0.175 (0.164)
	Motorola	−0.338 (0.368)	0.077 (0.499)	−0.119 (0.138)	−0.093 (0.140)
	Samsung				
	(<i>Others</i>)	−0.250 (0.257)	0.187 (0.369)	−0.485** (0.105)	−0.502** (0.107)
−2 log likelihood chi-square		179.4 (40 d.f.)**		268.1 (20 d.f.)**	407.7 (22 d.f.)**

Note 1. * $p < 0.1$, ** $p < 0.05$.

Note 2. For categorical variables, the referent (or default outcome) is written in *italic* in parenthesis.

Note 3. Values in the results of logistic regression are beta coefficients and numbers in parenthesis are standard deviations.

Note 4. Call drop rate and call failure rate are in percentages.

Note 5. Billed amounts and unpaid balances are in \$ USD.

Note 6. Loyalty points are in 1000 points.

Table 5
Hypothesis test results: customer churn determinants

Dependent variable	Independent variable	Hypothesis	Result
Customer churn	Call drop rate	H1a	Accept
	Call failure rate	H1b	Reject
	Number of complaints	H1c	Accept
	Loyalty points	H2a	Accept
	Membership card	H2b	Reject
	Billed amounts	H3a	Accept
	Unpaid balances	H3b	Reject
	Number of unpaid monthly bills	H3c	Reject
	Customer status	H4	Accept

regression model on both independent variables and customer status (Model 3) was used to analyze customer churn.

The parameters of logistic response functions were estimated with the maximum likelihood method. Table 4 shows the estimation results for the three equations. The likelihood ratio test indicates that these models fit the data very well. To be specific, the regression equation on customer status (Model 1a, 1b) was very significant, with χ^2 statistic of 179.4 (p -value < 0.01) with 40 degrees of freedom. The regression equations on customer churn (Model 2 and Model 3) were also very significant; with χ^2 statistic of 268.1 (p -value < 0.01) with 20 degrees of freedom and with χ^2 statistic of 407.7 (p -value < 0.01) with 22 degrees of freedom, respectively.

4.2. Hypothesis tests: customer churn determinants

Based on the results of a logistic regression for Model 3, which includes all relevant independent variables, the following shows hypothesis test results for customer churn determinants (see Table 5).

The test of hypothesis 1a and 1b reveals that the call drop rate has a significant impact on the probability of churn,¹¹ however, the call failure rate does not. As noted in Kim et al.'s (2004) study, this result confirms the rationale that mobile service providers have traditionally emphasized the importance of service quality, particularly call-related quality in new services. Also, the test of hypothesis 1c indicates that the number of complaints is positively related to the probability of churn.

The test of hypothesis 2a shows that loyalty points have a significant negative impact on the probability of churn: the more loyalty points customers have accumulated, the less likely they are to churn. Contrary to hypothesis 2b, however, a membership card has a negative influence on the probability of churn. Furthermore, customers with membership card A (*premium* card) are in fact more likely to churn than those with membership card B (*regular* card). This is true when customers with membership cards A or B are compared to non-members. This result indicates that customers with more privileged benefits are more likely to churn. This relates to the effectiveness of membership card programs, which will be discussed in a later section.

The test of hypothesis 3a shows that the billed amount is found to be positively related to the probability of churn, indicating that heavy users are more likely to churn. However, contrary to hypothesis 3b and 3c, the unpaid balance is negatively related to the probability of churn and the number of unpaid monthly bills is not related to the probability of churn.

The test of hypothesis 4 reveals that customer status has a significant impact on the probability of churn. The customer's status change from active use to either non-use or suspended increases the odds of churn by 14.7 and 4.5 times, respectively.

¹¹To be specific, if a customer's call drop rate increases by 1%, then his/her odds of churn increase by 1.7 times. The change of the odds can be calculated by $\exp^{0.530}$ (also called *odds ratio*), where 0.530 is the estimated coefficient for the call drop rate of Model 3 in Table 4. According to Hosmer and Lemeshow (2000), it should be noted that the odds of the outcome being present among individuals with $x = 1$ is defined as $\pi(x)/[1 - \pi(x)]|_{x=1}$, where π is a probability of churn and x is an independent variable. Similarly, the odds of the outcome being present among individuals with $x = 0$ is defined as $\pi(x)/[1 - \pi(x)]|_{x=0}$. Therefore, the odds ratio is defined as the ratio of the odds for $x = 1$ to the odds for $x = 0$ and is computed from the equation $\left(\pi(x)/[1 - \pi(x)]|_{x=1} / \pi(x)/[1 - \pi(x)]|_{x=0}\right)$.

Table 6
Testing for mediation effects

Variable	Hypothesis	Result	Mediation effects
Call drop rate	H1a'	Reject	No mediation
Call failure rate	H1b'	Reject	No mediation
Number of complaints	H1c'	Accept	Partial mediation
Loyalty points	H2a'	Accept	Partial mediation
Membership card	H2b'	Reject	No mediation
Billed amounts	H3a'	Accept	Partial mediation
Unpaid balances	H3b'	Reject	No mediation
Number of unpaid monthly bills	H3c'	Reject	No mediation
Gender			Partial mediation
Calling plans			Partial mediation
Handset Internet capability			Partial mediation

4.3. Mediation effects of customer status

In order to test the mediation effects of customer status, a procedure developed by Baron and Kenny (1986) is applied. Results in this study indicate that the customer status acts as a partial mediator between some churn determinants and customer churn. Specifically several churn determinants are found to be significantly mediated by customer status. Table 6 shows the results of the analysis and hypothesis test results.

The effects of the following variables on the probability of customer churn are partially mediated by the customer's status change: number of complaints, loyalty points, billed amounts, gender, calling plan C and handset Internet capability. They affect the probability of customer churn both directly and indirectly through a customer's status change. Among other factors, the mediating effects of the number of complaints and loyalty points are discussed below.

The number of complaints was found to increase the probability of churn directly and also the probability of non-use, which subsequently increases the probability of churn. From a service failure recovery perspective, this can be interpreted in two different ways. First, the company's current customer complaint management programs may not be adequately designed and implemented, thus, complaining customers are leaving rather than staying. Secondly, rather than immediately churning, at least some complainants are found to change their status into non-use beforehand. This finding provides a service provider with additional information that some complaining customers are churning through their status changes into non-use, therefore, the service provider can focus on and actively appease, those who have become non-users and at the same time, especially those who have complained to its customer service center.

Loyalty point rewards have a negative impact on both the probability of churn and the probability of being suspended, which also in turn increases the probability of churn. Considering that loyalty points are accumulated based on both usage level and account tenure, this result implies that as customers gain more service experience in terms of usage intensity and longevity, they are less likely to churn voluntarily. Furthermore, they are also less likely to be churned involuntarily in the sense that they may not be suspended by the service provider because these experienced customers are less likely to be troubled with payment problems.

5. Discussion

5.1. Customer dissatisfaction

This analysis shows that call drop experiences lead to direct customer churn. This result is in line with a previous study that customer churn intention in the Australian Internet Service Provider (ISP) market is significantly influenced by the reliability of service, including aspects such as call drop rate and connection

speed (Madden et al., 1999). It is also associated with Kim et al.'s (2004) finding in the Korean mobile service market that call quality is the most important direct determinant of customer satisfaction and also with the results of Bolton's (1998) study that customers who experienced dissatisfaction with billing, service, equipment, or other transactions tend to quickly churn. However, the result also highlights the fact that call failure experiences do not necessarily lead to customer churn. It can be conjectured that while call failures are attributable to many events (e.g., interference, handset malfunction, etc.), call drops are mostly attributable to the mobile service provider. Therefore, call failure is not necessarily as much a determining churn factor as call drop.

As emphasized in Solnick and Hemenway (1992), studies on complaint behavior usually rely on consumer recollections rather than actual complaints. However, this study is based on actual customer complaint information from a company-internal database. Also, the significant effect of the number of the complaints on customer churn hints that either complaints registered to customer service centers are not adequately handled or some complaints cannot be addressed immediately. Since it usually takes a long time to fix problems such as call quality deterioration or service coverage those complainants who are unable to tolerate long waiting times may leave.¹²

5.2. *Switching costs*

Results indicate that the number of loyalty points accumulated by each customer works as a very effective switching barrier. However, this result needs to be interpreted with caution, because it can also be argued that churn leads to fewer points in that customers who expect to churn, cash in their loyalty points beforehand.¹³ Hence this suggests that customer loyalty points need to be studied over several months during the observation window, so that whether the low number of loyalty points has been at that level for months or reduced rapidly a couple of months prior to the end of the observation period can be checked. If the latter holds true, the inhibiting effect of loyalty points on customer churn is yet to be verified. However, if the former holds, then the present interpretation is supported. In fact, only a few cashed in their loyalty points during the observation period in the sample.¹⁴ Considering the fact that it is rare for those who churn to use up their accumulated loyalty points, it is highly probable that loyalty points act as a switching cost.

Results also revealed that current membership card programs in the company studied are not effective in reducing the churn rate. In fact, the churn rate of the members of the membership card programs is even higher than that of non-members. This result, however, needs to be interpreted with caution. Customer heterogeneity in disposition to churn when applying for membership cards was not effectively controlled in the analysis. Therefore, the relationship between membership card programs and the high level of churn may be caused by the possibility that those who voluntarily apply for membership cards are more deal-prone. It has been argued that customers who are more sensitive to promotion (or deal-prone) are less brand-loyal and less store-loyal (Bawa & Schoemaker, 1987). This theory is reinforced by the fact that most membership card members are teenagers or adults in their early twenties who are usually characterized as more deal-prone.

However, the effectiveness of membership card programs is yet to be determined. Apart from the fact that the proportion of membership card subscribers in the analysis was quite low, variables such as account tenure and the subscriber's age, which are expected to be related to both membership card programs and customer

¹²It can also be argued that customer dissatisfaction influences customer churn either directly or indirectly through customer complaints. In other words, the customer complaint may mediate the relationship between customer dissatisfaction and customer churn. Accordingly, a mediation analysis of customer complaints was conducted; however, no significant mediating effects were found; therefore, the mediating effect of customer complaints is dropped in the current model. Correlation coefficients between call drop/failure rate and customer complaints are found to be only meager ($r = -0.01$); this further reinforces the weak relationship between customer dissatisfaction and complaining behavior in the current sample. One reason for this low correlation is that current measures for customer dissatisfaction include only core service-related dissatisfaction (excluding dissatisfaction with billing, membership card programs and rate plans).

¹³One of the reviewers raised this point.

¹⁴To be specific, there were only 9 (4 churners and 5 retainers) in a sample of 6442 records.

churn, were not available in the dataset. Therefore, careful research design and analysis coupled with the necessary process of controlling for other factors would be required in future studies.¹⁵

5.3. Service usage

The finding that heavy users are more likely to churn is in line with Madden et al.'s 1999 argument that customers with a high amount of expenditure are more price-sensitive and likely to churn for even a small discount as their usage level grows. Also, it is suggested that heavy users with accumulated service experiences may explore more advanced new services, such as mobile internet, location-based and entertainment services, beyond what their current service provider can offer.

Results also show that non-paying customers are not likely to churn directly. They can be suspended by the provider if the number of unpaid monthly bills exceeds a pre-specified limit. Furthermore, they cannot churn either voluntarily or involuntarily unless they pay off a significant portion of their unpaid balances. Therefore, even the non-paying customers among churners can have lower unpaid balances because they must have already cleared off their debts to some extent. It also demonstrates that the effect of the number of unpaid monthly bills on the probability of churn can be better understood with the consideration of its indirect effect through a customer's status change.

To reduce the scenario in which the unpaid balance increases the possibility of becoming non-users or being suspended, a number of managerial actions can be imposed. First, customers with bad credit can be screened out when they apply for service. Some companies use credit scoring models to make their screening decision. Secondly, some usage threshold can be set up for certain customers so that their billed amounts do not exceed what they can afford to pay. By taking these actions, customer churn can be managed better.

5.4. Customer-related factors

Among other customer-related churn factors, of special interest is that the functional capability of a customer's handset has a significant impact on the probability of churn. The more obsolete a customer's handset is, the more likely he/she is to churn. As mobile telecommunications service companies accelerate the rate of development and launch new services, more advanced features (e.g., mobile games, music/video download, mobile banking services, etc.) become available in the market, however, customers with outdated handsets cannot use the latest features and thus have motivation to change handsets.

There are many reasons why the event of changing handsets can lead to customer churn. First, when looking for new handsets, customers are likely to consider various models, some of which are compatible only with particular mobile service providers. Thus, a strong preference for a particular handset may limit the kind of mobile service providers that the customer can choose, or may lead the customer to churn if the handset is not supported by the current service provider. Secondly, various benefits (e.g., handset subsidy, free voice minutes, etc.) could encourage customers to switch to other service providers when they are about to replace their handsets. This is further reinforced by the fact that retailers have incentives to encourage customers to switch to other carriers because they can receive a commission based on the new customers' billed amounts.

6. Conclusions and implications

This study investigated factors leading to customer churn using a sample of 5789 actual customer transactions and billing data. In addition, the mediating effects of customer status between churn

¹⁵Much scholarly work has been done on switching costs, arguing that they adjust or moderate the relationship between customer satisfaction/dissatisfaction and customer loyalty (Fornell, 1992; Jones & Sasser, 1995; Bolton et al., 2000; Lee et al., 2001; Kim et al., 2004). Following Sharma, Durand, and Gur-Arie (1981) moderated regression analysis (MRA), the moderating effects of loyalty points and membership cards on the relationship between call drop/failure rate and customer churn were originally considered in the model; however, results indicated no significant moderating effects. Therefore, in the main models, the moderating effects of switching costs are ignored; only their direct effects on customer churn are included.

determinants and customer churn were analyzed. The following section summarizes the result, discusses implications and suggests areas for further study.

First, this study developed and tested a customer churn model based on a large number of transaction and billing data. This actual data-based approach addressed the managerial problems that may arise from the discrepancy between customers' perception or intention and their actual behavior in the market. For example, previous research based on customer survey responses suggests that for membership card program subscribers, the negative effects of dissatisfaction with the service provider are adjusted, thus they remain loyal customers. However, this study using a company-internal database found that the membership card program subscribers, in fact, are more likely to churn. This raises questions about such a program's effectiveness, which is discussed in later paragraphs.

Secondly, this study not only confirmed some findings of previous studies regarding explanatory churn factors, but also identified new ones. As in line with the previous result, call quality, loyalty points and service usage level are found to be among the major factors influencing customer churn in the mobile telephony market. On the other hand, specific factors such as functional capability of handsets, membership card programs and customer status were significant factors newly found in this study.

Regarding the functional capability of handsets, [Gerpott et al.'s \(2001\)](#) study of the German mobile service market showed that a customer's desire for a new handset did not have any significant effect on customer retention. On the other hand, the result in this study shows that low functional capability of handsets leads to customer churn. The difference could be explained by the availability of handset subsidies: In June 2000, handset subsidies were banned in Korea, but they were still available in Germany. From that fact, it can be inferred that the handset subsidy ban in the Korean mobile market increased the customers' actual cost (e.g., the price of purchasing new handsets). Therefore, the cost for a new handset worked as a switching barrier in the Korean mobile telephony market. However, if a subscriber's handset is quite old and lacks much needed functional capability, the switching barrier from the money spent on his/her current handset can be reduced significantly; thus he/she would purchase a new handset and that event might trigger a decision to churn. In fact, the present analysis shows that customers with less desirable handsets are more likely to churn.

Thirdly, despite the incomplete nature of the data, the result implies that membership card programs may not increase customers' switching costs. Considering the fact that most competing mobile service providers offer similar types of benefits (discounts, coupons, etc.) through their own membership card programs, customers may have few incentives to maintain a contractual relationship with the current service provider simply because of the benefits that the current membership card program offers.

In addition, it can be argued that the benefits from current membership card programs are not fully responsive to the level of customers' service usage or duration. For example, service providers issue only two or three kinds of membership cards and the benefits are almost equivalent regardless of service usage level, therefore, effectiveness of the membership program is not justified. The same concerns are shared among managers in the company where samples were collected. They believe that membership programs do not achieve the original objective and the programs need to be overhauled.

Comparing the effects of two types of switching costs on customer churn, it can be suggested that current membership card programs should be redesigned following the characteristics of the loyalty point reward programs. This is justified by the result that loyalty points rather than membership card programs work as a switching cost. For example, two major characteristics of loyalty point reward programs are: (1) the points are gained according to customer usage level, (2) the points are deducted following a customer's redemption of fringe benefits via the membership card. Therefore, membership card programs need to be transformed from the current almost unlimited fringe service provision program into a point-based fringe benefit provision program where customers' points are gained or deducted according to their usage level and point redemption level, respectively. This is in line with a [Dowling and Uncles' \(1997\)](#) reward scheme where a customer's motivation to make the next purchase is maximized.

Fourthly, partial and total defection were examined by identifying the mediation effects of customer status. Failure to consider a customer's status change is likely to cause researchers or corporate executives to ignore

the impact of indirect effects of churn determinants on customer churn and eventually to mishandle the customer churn. Factors such as number of complaints, loyalty point rewards, billed amounts, gender, calling plans and handset Internet capability influence the probability of churn both directly and indirectly and thus have partial mediation effects.

Of special interest is a management program that is designed to handle customer complaints. The result of partial mediation of the customer complaints indicates that the effectiveness of the customer complaint management program can be measured in two different ways: one is to evaluate the extent to which the number of complaints lead to customer churn. Another is to measure the extent to which the number of complaints influence a customer's status change from active use to non-user (or other possible customer status), which is positively related to customer churn. Either measure can provide a checkpoint of whether the current customer complaint management program prevents customer churn in the way in which it was designed. Accordingly, it can be argued that if an effective service failure recovery program is implemented, the number of complaints registered to the customer service center may decrease the probability of both the direct customer churn and the customer's status change into non-use. Thus the company can eventually reduce the customer churn.

Despite this analysis, there are some areas that warrant further study. First, data for some variables, such as account tenure (also called customer duration) and each subscriber's age, were not available; and customers' perceived values on service satisfaction were not included in the data either. Therefore, a better model can be developed by including these variables. In particular, the account tenure will be a very important variable explaining customer churn.

Secondly, the 8-month data collection period for this study was relatively short. An additional longitudinal study (i.e., panel data analysis) with a longer period of data collection and time-series data is necessary. Such a study would help researchers and managers to not only better estimate the expected tenure but also develop the current churn model further into a lifetime customer value model (Jain & Singh, 2002) where the economic impact of churn factors can be estimated.

Finally, the impact of membership card programs needs to be further evaluated. Surprisingly, the analysis showed that members in the programs are more likely to churn than non-members. In fact, the program may increase customers' experiences and expose them to other competitors (Bolton et al., 2000). On the other hand, people who decide to join the program may be the group with a higher propensity to churn than the average population. That is, self-selection bias may exist in the sample, therefore, careful research design and analysis are needed to evaluate the impact of the programs on customer churn.

Appendix A. See Table A1 for correlations of key variables ($N = 5789$)

Table A1
Correlations of key variables ($N = 5789$)^a

Variable	1	2	3	4	5	6	7	8
1 Call drop rate								
2 Call failure rate	.09							
3 Number of complaints	-.01	-.01						
4 Loyalty points	.03	-.02	.00					
5 Billed amounts	.08	-.06	.01	.26				
6 Unpaid balances	.01	-.03	.00	.01	.22			
7 Number of unpaid monthly bills	.03	-.02	.00	.06	.16	.18		
8 Gender	-.04	.02	.00	.03	-.15	-.05	-.07	
9 Churn	.06	.01	.05	-.02	.10	-.04	.01	-.06

^aNote 1. For the gender, male is coded 1 and female 0. For the churn, churner is coded 1 and non-churner 0.

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