Examining the factors that influence early adopters’ smartphone adoption: The case of college students

Sang Yup Lee*

Michigan State University, Telecommunications, Information Studies, and Media, Quello Center for Telecommunication Management and Law, 404 Wilson Rd., Room 406, Communication Arts & Sciences Building, East Lansing, MI 48824-1212, United States

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A B S T R A C T

The influence of early adopters on potential adopters’ decisions of whether or not to adopt a product is known to be critical. In this paper, we examine the factors that influence the adoption behavior of smartphone early adopters by looking at smartphone adoption behavior of college students, because a large portion of the early adopters of smartphones are college students. Our focus is on the effect of normative peer influence on a college student’s smartphone adoption. We also examine the influence of other factors such as self-innovativeness, self-efficacy, the decision maker’s attitudes towards a product, financial burden of using the product, familial influence, and other demographic factors (e.g., age and gender). College students’ adoption behavior is studied using logit and probit choice models developed based on random utility theory. The discrete choice models are empirically estimated using survey data. We find important influence of friends, financial burden, and other family members on the smartphone adoption of college students who adopted smartphones earlier than other students.

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1. Introduction

The influence of early adopters on potential adopters’ decisions about whether or not to adopt a product is critical (Rogers, 2003). Early adopters are known to have the highest degree of opinion leadership and help trigger a critical mass (Rogers, 2003). Due to the critical influence of early adopters on a product’s adoption in a community, it is important to understand what factors influence early adopters’ decisions about the adoption of a new product.

When it comes to electronic devices such as smartphones, tablet PCs, and video game consoles, college students tend to adopt those sorts of electronic devices earlier than do other demographic groups. Especially with respect to smartphones, market data show that college students are early adopters. According to a report by Pew Internet (Smith, 2011), 35% of adults in the U.S. owned a smartphone in 2011 and smartphone adoption rates vary depending on age. The report found that younger people tend to adopt a smartphone earlier than older people. For example, 52% of 18–29 year olds owned a smartphone in 2011 while only 24% of 50–64 year olds owned a smartphone in the same year. Furthermore, a report from eMarketer (2012) shows that 61% of college students owned a smartphone in 2011. This higher smartphone adoption rate among college students than among people in other age groups indicates that a large portion of the early adopters of smartphones are college students.

* Tel.: +1 517 285 5999.
E-mail address: leesan61@msu.edu

1 In the present study, a smartphone is defined as a mobile phone that offers advanced capabilities, often with PC-like functionality, and that is no longer limited to making voice calls. iPhone, Android phones, Blackberry phones, Palm Pre phones are examples of a smartphone.
In addition to the fact that college students tend to adopt smartphones earlier than other demographic groups, the fact that the factors that influence college students’ smartphone adoption are likely to influence their adoption behavior of other electronic devices (e.g., tablet PCs and video game consoles) in a similar way also makes it important to study college students’ smartphone adoption behavior.

Despite the importance of studying college students’ smartphone adoption behavior, to the best of our knowledge, no studies have examined such behavior. In this study, we examine the factors that influence smartphone adoption behavior of the college students who adopted a smartphone earlier than other college students. For this, we analyze smartphone adoption behavior of the college students who adopted smartphones in 2010. According to a report by Nielsen (2010), only 28% of mobile subscribers in the U.S. had smartphones in 2010 and many of these were college students. Thus, the college students who adopted smartphones in 2010 can be regarded as early adopters of smartphones.

In this study, we examine the influence of the factors that have been identified as important by prior studies in consumers’ product adoption behavior on college students’ smartphone adoption. Those factors include normative peer influence (Ajzen, 1991; Bearden et al., 1989; Ford and Ellis, 1980; Moschis, 1976), self-innovativeness (Hirschman, 1980), self-efficacy (Eastin and LaRose, 2000), decision maker’s attitudes towards a product (Ajzen, 1991), the financial burden for using a product, and other demographic factors (e.g., age and gender). In addition to these factors, we also look at familial influence, because it has been found that familial influence is an important factor in college students’ consumption behavior (Childers and Rao, 1992).

Among those factors, we specifically focus on the effect of normative peer influence on a student’s smartphone adoption, because students’ consumption behavior is well known to be easily and significantly influenced by their friends (Garnier and Stein, 2002; Maxwell, 2002; Thornberry and Krohn, 1997; Barry and Wentzel, 2006).

In order to measure the normative influence of friends who have smartphones on a college student’s smartphone adoption decision more accurately, we consider two different factors. The first factor is the number of close friends who have smartphones; the second is a student’s susceptibility to normative peer influence. We then create a new measure of normative peer influence on smartphone adoption by multiplying the first factor with the second factor.

In addition to normative peer influence, we also consider the influence of a college student’s financial affordability on the student’s smartphone adoption decision as another main explanatory variable. The influence of a college student’s financial affordability on her consumption behavior can be important, mainly because many college students are financially dependent on their parents. As financial factors, we include a student’s income (or the amount of money that a student has at her disposal in a month), whether the price of the smartphone is paid by the parents or the student, and whether the smartphone usage costs are paid by the parents or the student.

We study college students’ adoption behavior using logit and probit choice models. To construct the discrete choice models, random utility theory is used. The discrete choice models are empirically tested with survey data.

This paper is organized as follows. Section 2 reviews prior studies of the topic and hypotheses are developed. In Section 3, the discrete choice model is developed. Section 4 explains how data were collected. Section 5 provides the results. Section 6 discusses the results.

2. Literature review and hypotheses

2.1. Studies about normative interpersonal influence on choice behavior

In this subsection, we first review the studies about the effects of normative interpersonal influence on an individual’s behavior, because the variable is of our main interest. Then, related hypotheses are developed.

There have been a variety of studies that emphasize the importance of interpersonal influence (also called peer influence, in the present study, both terms are used interchangeably) on an individual’s behavior. One of the theories frequently used when studying interpersonal influence on an individual’s behavior is the theory of planned behavior (Ajzen, 1991). Among the three explanatory variables of the theory (i.e., attitudes, subjective norms, and perceived behavior control), the ‘subjective norms’ variable is related to normative interpersonal influence. According to the theory, ‘subjective norms’ refers to the perceived social pressure to perform or not to perform the behavior in question.

In addition to the theory of planned behavior, other scholars (e.g., Bearden et al., 1989; Ford and Ellis, 1980; Moschis, 1976) also stressed the importance of interpersonal influence in consumers’ purchasing behavior.

Burnkrant and Cousineau (1975) defined normative influence as influence that affects a person’s tendency to conform to the expectations of others. Moreover, normative influence is divided into value-expressive influence and utilitarian influence (Bearden and Etzel, 1982). Value-expressive influence occurs when a person has a desire to enhance his or her self-image via an identification process with others. On the other hand, utilitarian influence occurs when a person tries to comply with the expectations of others to obtain rewards or avoid punishments.

According to Bearden and Etzel (1982), the level of others’ influence on a person’s consumption behavior varies depending on whether a good is publicly consumed or it is privately consumed. That is, a consumer is more influenced by others when she uses a good publicly. A mobile phone is a publicly-used good. Hence it is likely that people are influenced by others when they buy a mobile phone and use it.
Another important factor that should be considered when studying interpersonal influence on an individual’s behavior is the individual’s susceptibility to interpersonal influence. Because different people have different levels of susceptibility to interpersonal influence, the extent to which they are influenced by their friends or family members varies.

Bearden et al. (1989, p.474) defined consumers’ susceptibility to interpersonal influence as “the need to identify or enhance one’s image with significant others through the acquisition and use of products and brands, the willingness to conform to the expectations of others regarding purchase decisions, and/or the tendency to learn about products and services by observing others and/or seeking information from others“. It can be inferred from this definition that a person who is more susceptible to interpersonal influence is in more need or has a greater willingness to buy/use a certain product or brand in order to conform to others’ expectations. It has been found that individuals differ in their susceptibilities to interpersonal influence depending on different personal characteristics such as self-esteem and intelligence (e.g., Cox and Bauer, 1964; McGuire, 1968).

Bearden et al. (1989) developed a scale that measures a person’s susceptibility to normative influence. The scale was created based on the concept of interpersonal influence defined by Deutsch and Gerard (1955), and Bearden and Etzel (1982). That scale is intended to measure two different types of normative influence: utilitarian and value-expressive normative influence.

2.1.1. Studies about interpersonal influence among college students

Because the present study’s focus is on college students’ behavior, we also review the literature about peer influence on the behaviors of adolescents and youths. The term, ‘peer influence’, is commonly used to designate interpersonal influence among adolescents and youths. Many studies have found that the behaviors of people of this age are easily and significantly influenced by their close friends (e.g., Garnier and Stein, 2002; Maxwell, 2002; Thornberry and Krohn, 1997; Barry and Wentzel, 2006).

A few studies have examined peer influence on adolescents’ and youths’ consumption behavior. Mascarénhas and Higby (1993) studied peer influence on teens’ apparel shopping behavior. Mangleburg et al. (2004) studied whether shopping with friends influences teens’ attitudes towards retail stores and shopping behavior. They also examined how the different levels of susceptibility to peer influence can change teens’ shopping behavior. They argued that by shopping with friends, an adolescent can create favorable images among those friends because she can buy what others like and can thus obtain rewards or avoid punishments from others by meeting their expectations. This argument is consistent with other studies (e.g., Bearden and Etzel, 1982; Deutsch and Gerard, 1955). Childers and Rao (1992) examined the different influences of peers and family members on a college student’s consumption behavior depending on the types of products being consumed – private or public, luxury or necessity. Meanwhile, the number of friends who exhibit the same behavior has also been identified as an important factor that influences an adolescent’s behavior (Akers et al., 1979).

2.1.2. Hypotheses

Based on the theories and studies reviewed in the preceding subsections, we developed the following hypotheses.

**H1.** A student’s smartphone adoption is positively influenced by the smartphone adoption of the student’s friends.

**H1.1.** A student’s smartphone adoption is positively influenced by the number of the student’s friends who have adopted smartphones.

**H1.2.** A student’s smartphone adoption is positively influenced by the student’s susceptibility to peer influence.

2.2. Studies about familial influence on the behavior of adolescents and youths

The influence of family and parents on the behavior of an adolescent or youth is also critical. Several studies found important familial influence on the behavior of this age group: e.g., substance abuse (Glynn, 1981), cigarette smoking (Chassin et al., 1986; Wang et al., 1995), sexual activity (Pick and Palos, 1995). A few studies have also looked at the effects of familial influence on a young person’s consumption behavior. As mentioned above, Childers and Rao (1992) studied the influences of family members on a college student’s consumption behavior depending on the types of products being consumed. They found that students are more vulnerable to familial influence when choosing privately-used goods than when choosing publicly-used goods. Moreover, they claimed that adolescents and youths are likely to be susceptible to familial influence on their consumption decisions because they are primarily dependent on their parents for financial support. Moschis (1985) acknowledged the importance of family communication in the formation of the consumption attitudes of adolescents. Due to its importance, the number of family members who use a smartphone is also included in our model as an explanatory variable.

2.3. Studies about the influence of a consumer’s innovativeness on her buying behavior

In addition to the factors mentioned in the preceding subsections, a consumer’s innovativeness has also been identified as an important personal trait that influences that person’s intention to adopt a new product or technology (Hirschman, 1980). Hirschman viewed a person’s innovative traits as her desire to seek out novelty and creativity. This can be interpreted as meaning that a person with a high level of innovativeness is likely to gain higher utility from having or using a new product and service.
This construct of innovativeness has been applied to explain consumers’ adoption behavior related to a variety of products and services and it has been confirmed that more innovative consumers tend to adopt new products or switch to new products earlier than do less innovative consumers. For example, Lassar et al. (2005) found that there was a positive relationship between a person’s innovativeness and the person’s adoption of internet banking services. Im et al. (2003) found a positive influence of a person’s general innovativeness on his adoption behavior, as measured by the number of certain products he owned at the time of the study. Yang (2005) found that there was a positive relationship between a consumer’s innovativeness and her adoption of mobile-commerce services. Regarding a consumer’s intention to switch from the current services or products to new ones, Wood and Swait (2002) found that more innovative consumers tend to switch from current familiar products or services to new ones earlier than do less innovative consumers.

2.4. Studies about the choice and use of mobile phones

There have been a few studies which have looked at the choice of mobile phones and their use. In his book, Rogers (2003) briefly mentioned why a cell phone has been successfully adopted by consumers. He attributed its successful adoption to cell phones’ relative advantages over wireline phones (e.g., mobility), cell phones’ compatibility with the existing telephone systems, simplicity of use, trialability, and observability. Kwon and Chidambaram (2000) studied consumers’ cell phone use using the technology acceptance model (TAM). Rice and Katz (2003) studied digital divide problems in mobile phone adoption and use through comparison with those in the Internet adoption and use.

Although there have been a few studies about the use of cell phones, to the best of our knowledge, there has been no study that looked at what factors influence a person’s choice of a smartphone, specifically, using the economic utility theory and econometric models.

3. Choice model

This section develops a discrete choice model based on random utility theory to test the hypotheses developed in Section 2.1.2. In our model, it is assumed that a person uses only one phone, either a smartphone or a non-smartphone. If the utility (or satisfaction) a person gains from using a smartphone is larger than or equal to zero, then the person uses a smartphone. On the other hand, when a person’s utility obtained from using a smartphone is less than zero, there are two possible situations; either (1) the person has not yet bought a smartphone (i.e., the person has been using a non-smartphone) or (2) the person previously used a smartphone but she has switched back to a non-smartphone because she did not obtain utility larger than zero by using a smartphone. Logit and probit estimation methods are used to see how the factors reviewed in Section 2 influence an individual’s utility from using a smartphone.

3.1. Utility function

That the factors reviewed in Section 2 influence a person’s consumption behavior means that those factors influence a person’s utility (i.e., satisfaction) that she obtains from buying a product. Thus, the utility function, which is used to study a person’s smartphone adoption, can be constructed as in Eq. (1). Here, in addition to the variables reviewed in Section 2, we also include other factors that can influence a person’s product adoption behavior as control variables. Those control variables are a person’s attitudes towards a product (e.g., Ajzen, 1991), self-efficacy (Eastin and LaRose, 2000), and a person’s financial burden for consuming a product.

Accordingly, the utility function is constructed as:

\[ U_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} + \epsilon_i \]  

where \( U_i \) is the utility that person \( i \) obtains from having a smartphone, \( x_{1i} \) is person \( i \)'s perceived normative influence of friends who have smartphones, \( x_{2i} \) is the number of family members who have a smartphone, \( x_{3i} \) is person \( i \)'s self-innovativeness, \( x_{4i} \) is person \( i \)'s attitudes towards a smartphone, \( x_{5i} \) is person \( i \)'s self-efficacy, and \( x_{6i} \) is person \( i \)'s burden for the costs required to use a smartphone.

3.2. Logit model

Because in a discrete choice model based on random utility theory, a person is assumed to adopt a product if her utility from adopting the product is positive, the probability of choosing a particular product in a logit model is equivalent to the probability of the person’s utility from using the product being positive. That is, \( P_i = \text{Prob} \left( U_i > 0 \right) \) is the probability of choosing a particular product in a logit model. Accordingly, \( P_i \) is a cumulative density function of a standard logistic distribution. Due to the symmetry of a logistic distribution, \( P_i = \frac{1}{1 + \exp \left( -\left( \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} \right) \right)} \). Finally, we have

\[ \ln \left( \frac{P_i}{1 - P_i} \right) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_4 x_{4i} + \beta_5 x_{5i} + \beta_6 x_{6i} \]

On the other hand, for a probit estimation method, the error term has a standard normal distribution.
4. Research methodology

4.1. Population and sample

The intended population of this study is college students in the U.S. This study uses a convenient sample, which suggests that it is possible that the sample of this study does not well represent the population. 151 College students in two introductory communications classes at a large Midwestern university participated in the survey. They received extra credits for their participations. The data in this study were collected via an online survey in 2010. The respondents were 40% female (60) and 60% male (90) students. Their average age was 20.3.

4.2. Measurements

4.2.1. Definitions of “smartphone and mobile phone”

Because there exist no clear definitions of smartphone and mobile phone, definitions of these terms are provided in our study. As mentioned in the introductory section, a smartphone is defined as a mobile phone that offers advanced capabilities, often with PC-like functionality, and that is no longer limited to making voice calls. iPhone, Android phones, Blackberry phones, Palm Pre phones are examples of smartphone. On the other hand, in our study, a mobile phone can be either a ‘voice and text message’-only cell phone or an internet-possible phone (such as a smartphone and a PDA).

4.2.2. Perceived normative peer influence ($x_1$)

Perceived normative peer influence ($x_1$) is composed of two factors – the number of friends who have a smartphone and a person’s susceptibility to interpersonal influence. $x_1$ is calculated by multiplying these two factors. The multiplication of these two factors was implemented based on existing studies that recognized the importance of the number of friends on a student’s behavior (Akers et al., 1979) and the importance of susceptibility to normative interpersonal influence (Bearden et al., 1989). Thus, it is expected that the combined measure, $x_1$, better represents a student’s perceived peer influence than do the separate variables.

In this study, a participant was asked to think first about five friends with whom he/she spends the most time and to provide the number of friends who have a smartphone among those five friends. A person’s susceptibility to normative interpersonal influence was measured with items developed by Bearden et al. (1989). The items were modified to measure a student’s susceptibility to peer influence regarding his mobile phone choice. Examples of those items are “It is important that my friends like the mobile phone I buy”, and “I like to know what mobile phone makes good impressions on my friends”.

4.2.3. Number of family members who use a smartphone ($x_2$)

The students were asked to answer how many of their family members use a smartphone (Family members were limited to parents and siblings).

4.2.4. Self-innovativeness ($x_3$)

A person’s self-innovativeness was measured with the items used in Lassar et al.’s study (2005). These items were 7-point Likert scale items ranging from 1 (strongly disagree) to 7 (strongly agree).

4.2.5. Attitudes towards a smartphone ($x_4$)

In this paper, a person’s attitudes towards a smartphone refer to the degree to which the person has a favorable or unfavorable evaluation of a smartphone. This definition is borrowed from Ajzen (1991). A person’s attitudes towards a smartphone were measured using the items developed by Shimp and Kavas (1984). These items were “To me, a smartphone would be useful/useless, of concern to me/of no concern to me, valuable/worthless, and wise use of money/waste of money”. The answers were ranged from 1 to 5.

Since a student’s attitudes towards a smartphone can change after using a smartphone, there can be a simultaneous relationship between a student’s smartphone adoption and her attitudes toward a smartphone. This simultaneous relationship between the dependent variable and an independent variable can cause biased estimates of the parameters of interest in the regression model. Thus, the model is also estimated by using a two stage least squares (2SLS) method. The ‘gender’ variable is used as an instrument variable.

4.2.6. Self-efficacy with respect to mobile phone use ($x_5$)

An individual’s self-efficacy regarding a technology refers to the person’s belief in her capabilities to use the technology (Eastin and LaRose, 2000). A student’s self-efficacy regarding a mobile phone use was measured with the items developed by Eastin and LaRose (2000). Originally, these items were developed to measure the degree of self-efficacy for internet use. Hence, they were modified to measure the level of self-efficacy of mobile phone use. Those were 7-point Likert scale items ranging from ‘strongly disagree’ (scored 1) to ‘strongly agree’ (scored 7). Because it is plausible that a person who has a

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2 The entire survey items of the measurements used in this study are listed in Appendix 1 at the end of this paper.
smartphone might feel more confident about using a mobile phone, which causes a simultaneity problem between the dependent variable and the self-efficacy variable, the model was also estimated by using a two stage least squares (2SLS) method. The gender variable was used as an instrument variable and satisfied the rank condition (p < .01).

4.2.7. Variables for a person’s financial burden for smartphone use ($x_6$)

To measure a person’s perceived burden for smartphone use, three different variables were used. One variable was measured by dividing the costs of using a smartphone with the student’s income. In the current study, for simplicity, the costs of using a smartphone were normalized to one. In addition, two more variables – who (i.e., the student or her parents) pays phone bill and who paid the phone price, were also included.

Because a large portion of college students do not have much income, the students in this study were asked to provide the amount of total money they spend in a week, excluding their rent, since many students live either in a dormitory or with their parents. In addition, as an alternative measure of the income of a student, the amount of a student’s discretionary fund per week was also measured. The students were also asked who paid the price of the phone that they have at the time of survey, i.e., themselves or their parents. They were also asked who pays their phone bills.

5. Results

5.1. Descriptive results

All the respondents said that they were using a mobile phone. 40% of the respondents (50) were using smartphones, whereas 60% (92) were not using smartphones. Approximately 70% of the respondents said that their parents were paying their phone bills while 16% were paying the bills themselves and 14% were paying with help from their parents. Meanwhile, about 49% of the respondents said that their parents had bought their phones, 43% had bought their phones themselves, and 8% had bought their phones with help from their parents.

The mean values and standard deviations of the main variables are reported in Table 1. For example, among five close friends of a respondent, about 2.5 friends had a smartphone and about 1.5 family members had a smartphone on average. The values of the reliability (Cronbach’s alpha) of the latent variables (i.e., susceptibility to peer influence, self-efficacy, self-innovativeness, and attitudes) are also reported in Table 1.

5.2. Impact of peer influence on smartphone adoption decision

The discrete choice model developed in Section 3 was estimated using logit and probit methods. The first part of this subsection provides the results of the estimation using the combined measure of perceived normative peer influence (i.e., the number of friends with smartphones times the susceptibility to peer influence), while the second part gives the results obtained by separating the number of friends from the susceptibility to peer influence in order to see the separate effects of those two factors on a student’s smartphone adoption.

In our study, we used a student’s weekly expenses and discretionary fund as indicators of the student’s financial status. Because the estimation results derived using the weekly expenses variable were similar to those derived using the discretionary fund variable, here we only report the results obtained using the weekly expenses.

5.2.1. Results of the estimation using the combined measure of perceived peer influence

This subsection provides the results of the estimation of the choice model using the combined measure of perceived normative peer influence on a student’s smartphone adoption (i.e., the number of friends with smartphones times the susceptibility to peer influence). The results from the logit and probit estimation methods are both reported in Table 2.

Because the differences in the coefficient values of the parameters between the logit and probit methods are small, here we only focus on the results of the logit method. We found that the effect of a student’s perceived normative peer influence on the student’s smartphone adoption is positive and statistically significant (p < .01). In the logit model, the coefficient value of the perceived peer influence variable is .184. The positive and statistically significant coefficient of the perceived peer

<table>
<thead>
<tr>
<th>Variables</th>
<th>FR#</th>
<th>FM#</th>
<th>WE</th>
<th>DF</th>
<th>SPI</th>
<th>SE</th>
<th>SI</th>
<th>ATT</th>
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<td>57.73</td>
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<td>49.11</td>
<td>13.68</td>
<td>1.24</td>
<td>1.11</td>
<td>1.22</td>
<td>0.91</td>
</tr>
<tr>
<td>Alpha</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>0.91</td>
<td>0.92</td>
<td>0.90</td>
<td>0.87</td>
</tr>
</tbody>
</table>

FR# = number of friends with smartphones, FM# = number of family members with smartphones, WE = weekly expenses, DF = discretionary fund a week, SPI = susceptibility to peer influence (rated 1–7), SE = self-efficacy (rated 1–7), SI = (general) self-innovativeness (rated 1–7), ATT = attitudes (rated 1–5).
influence variable supports Hypothesis 1 (i.e., $H_1$: A student’s smartphone adoption is positively influenced by the smartphone adoption of the student’s friends).

A marginal effect of an independent variable on the probability change of a person having a smartphone in a logit model is calculated as $p(1-p)b$, where $p$ is the current probability of a person buying a smartphone and $b$ is the coefficient value of the independent variable. For example, let us suppose that there is a person who is not sure whether or not to buy a smartphone (i.e., $p = .5$). When there is a unit increase in the person’s perceived interpersonal influence, the probability of the person buying a smartphone would increase by approximately $0.046 = 0.5(1-0.5)/0.184$. Thus, the new probability that the person would buy a smartphone is now $0.546 (0.5 + 0.046)$.

The number of family members who have a smartphone was found to be another important factor that influences a student’s smartphone adoption ($p < .001$). Furthermore, the variable’s coefficient value (1.016) is much larger than that of the perceived peer influence variable (.184), which might indicate that the influence of family members on a student’s smartphone adoption is larger than peer influence.

The coefficient value of the ‘attitudes towards a smartphone’ variable is also statistically significant ($p < .01$). Meanwhile, the coefficient values of the financial burden and self-innovativeness variables were found to be positive, but they are statistically marginally significant (i.e., the $p$-value of the financial burden is .127 and that of the self-innovativeness variable is .122).

The variables of who pays the phone bill and bought the phone were found to be statistically insignificant.

### 5.2.2. Separate effects of the number of friends with a smartphone and a student’s susceptibility to peer influence on the dependent variable

In order to study the separate effects of a person’s susceptibility to peer influence on the person’s smartphone adoption from the effects of the number of friends who have a smartphone, the combined measure of perceived peer influence was separated into two different variables – a variable for the number of friends who have a smartphone and a variable for a student’s susceptibility to peer influence. This model was also estimated using both the logit and probit methods. The results are reported in Table 3. Here, we only report the results of those two variables, because the results of the other variables are similar to those in Table 2.

The coefficient values of the number of friends who have a smartphone variable and susceptibility to peer influence variable both are positive and statistically significant. In the logit model, the coefficient value of the number of friends with a smartphone takes value of 1 when a bill is paid by both parents and a student, $PPI = \text{perceived peer influence, the number of friends with smartphones times susceptibility to peer influence, } FM# = \text{number of family members with smartphones, } WE = \text{weekly expenses, } BP2 = \text{(mobile phone) bill payer 2 (a dummy variable which takes value of 1 when a bill is paid by parents), } BP3 = \text{bill payer 3 (a dummy variable which takes value of 1 when a bill is paid by both parents and a student), } PPI = \text{phone payer 2 (a dummy variable which takes value of 1 a phone was bought by parents), } PP2 = \text{phone payer 3 (a dummy variable which takes value of 1 when a phone was bought by both parents and a student), } ATT = \text{attitudes (rated 1–5), } SE = \text{self-efficacy (rated 1–7), } SI = \text{(general) self-innovativeness (rated 1–7).}$
The smartphone variable is .362 and its p-value is .065, and the coefficient value of the susceptibility to peer influence variable is .581 and its p-value is .057. These results support Hypotheses H1.1 and H1.2 (i.e., H1.1. A student’s smartphone adoption is positively influenced by the number of the student’s friends who have adopted a smartphone. H1.2. A student’s smartphone adoption is positively influenced by the student’s susceptibility to peer influence.).

5.2.3. Results of a probit model with a 2SLS estimation method

As explained in Section 4.2, it was expected that a person’s self-efficacy of a mobile phone and her attitudes toward a smartphone were influenced by whether the person has a smartphone (i.e., those factors have a simultaneous relationship with the dependent variable). It is plausible that a person who uses a smartphone might be more confident about using a mobile phone than a person who uses a non-smartphone and that a person who has been using a smartphone might have more favorable evaluation of a smartphone than a person who has never used a smartphone. These simultaneous relationships between the dependent variable and independent variables can lead to biased estimates of the parameters of the regression model.

In order to address the simultaneity problem, the choice model was estimated by a two stage least squares method (2SLS). Because a logit method cannot be used for 2SLS in Stata (ver. 10), only the results of a probit method with 2SLS are reported. The results of the estimation with the simultaneous relationship between the self-efficacy variable and the dependent variable considered are reported in Table 4 and the results of the estimation with the simultaneous relationship between the attitudes variable and the dependent variable taken into account are reported in Table 5. We also tried to estimate the choice model by controlling for the simultaneous problems of both variables at the same time, but the log-likelihood function of the estimation was convex (i.e., had no maximum point), thus, we failed to do that.

When the simultaneous relationship between the dependent variable and the self-efficacy variable was taken into account, the p-values of some variables became different from those found when the relationship was not considered (i.e., the coefficient values of those variables in Table 2). For example, the p-values of the coefficient values of the number of family members, attitudes, and self-innovativeness variables became much larger when the simultaneity was considered. However, the p-value of the perceived peer influence variable remains the same (i.e., it is still less than .05). The results of the financial burden-related variables are omitted here due to their similarities to those in Table 2.

When the simultaneous relationship between the dependent variable and the attitudes variable was considered, the coefficient value of the attitudes variable became negative and it became statistically insignificant (p = .77). By contrast, the coefficient values of the self-efficacy and self-innovativeness variables became statistically more significant than when the simultaneous relationship was not considered. However, the p-values and coefficient values of the other variables did not change much compared to those found when the simultaneous relationship was not considered.

---

Table 4

<table>
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<th>Variables</th>
<th>Coef</th>
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<th>p-Value</th>
</tr>
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<tr>
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<td>.040</td>
<td>0.014</td>
</tr>
<tr>
<td>FM#</td>
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<td>.231</td>
<td>0.043</td>
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<td>SI</td>
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<td>0.780</td>
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<tr>
<td>Model fit (chi²)</td>
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<td></td>
<td>0.000</td>
</tr>
</tbody>
</table>

Instrument variable = gender.

Table 5

<table>
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<tr>
<th>Variables</th>
<th>Coef</th>
<th>SE</th>
<th>p-Value</th>
</tr>
</thead>
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<tr>
<td>PPI</td>
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<td>0.028</td>
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<tr>
<td>FM#</td>
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<tr>
<td>SE</td>
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<td>.152</td>
<td>0.087</td>
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<tr>
<td>SI</td>
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<td>.130</td>
<td>0.009</td>
</tr>
<tr>
<td>Model Fit (chi²)</td>
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<td></td>
<td>0.000</td>
</tr>
</tbody>
</table>

Instrument variable = gender.

---

3 Even though the p-value is slightly larger than .05, when considering the relatively small sample size (n = 151), the p-value can be regarded as significant.
6. Discussion

With the critical influence of early adopters on potential adopters’ decisions about whether or not to adopt a new product, in this study, we examined the factors that influence the smartphone adoption behavior of smartphone early adopters. For this, we specifically studied smartphone adoption behavior of the college students who adopted a smartphone earlier than other students, because a large portion of smartphone early adopters were college students.

In this study, we looked at several psychological and economic factors that have been identified as important in an individual’s adoption behavior. Those factors were normative peer influence, familial influence, self-innovativeness, attitudes towards a smartphone, self-efficacy regarding a mobile phone, and financial burden of using a phone.

One of the contributions of this paper is that we have incorporated psychological factors into an economic utility function and used that function to explain smartphone adoption behavior of college students. Another contribution is that we were able to create a new measure of peer influence on smartphone choice by multiplying the number of close friends who have a smartphone with the respondent’s susceptibility to peer influence.

Overall, the results of the discrete choice model are consistent with the predictions of the theories reviewed in Section 2. All of our models confirmed the strong impact of normative peer influence on a college student’s adoption of a smartphone. This result indicates that a college student behaves in a way that conforms to the expectations of her friends and that creates a favorable images among her friends. This finding is consistent with the claims made in previous studies (e.g., Burnkrant and Cousineau, 1975; Mangleburg et al., 2004).

In addition, the separate impacts of the number of a student’s friends who have smartphones and the student’s susceptibility to peer influence on the dependent variable are also positive and statistically significant. This finding means that a person who has more friends who have a smartphone is more likely to have a smartphone, even when the person’s susceptibility is controlled for, and vice versa.

We also found a positive and significant effect of familial influence on a student’s smartphone adoption. This finding is consistent with the findings of Childers and Rao (1992). In contrast to the finding of Childers and Rao (1992) that a student is more likely to be influence by family members for a privately-used product than for a publicly-used product, however, it turns out that the influence of family members on a student’s smartphone adoption is larger than that of friends, although a smartphone is a publicly-used product.

We also found that self-innovativeness is an important factor that influences a student’s smartphone adoption. This means that a student who perceives him/herself as being innovative is more likely to have a smartphone than a person who does not think of herself as innovative.

Looking at the impact of a student’s financial status on the student’s smartphone adoption, it turns out that a student’s financial burden for smartphone use, which was measured as 1 divided by’s weekly expenses, has a significant practical impact on the student’s smartphone adoption. The higher a person’s burden for the costs of using a smartphone is, the less likely there is that the person will buy a smartphone. This finding indicates that the relatively expensive price of a smartphone and its maintenance costs significantly influence students’ smartphone adoption, which might be due to college students’ low financial capability.

Finally let us look at the impact of self-efficacy regarding a mobile phone on a student’s smartphone adoption. It was found that the effect of a person’s self-efficacy about a mobile phone on a person’s smartphone choice was not statistically significant. This might indicate the existence of a ceiling effect of self-efficacy on the dependent variable. That is, because a mobile phone (including a smartphone) is not difficult to use, most students feel confident about using a mobile phone, whether or not they use a smartphone. This small difference of self-efficacy between smartphone users and non-smartphone users might have resulted in the insignificant coefficient value of the self-efficacy variable.

In conclusion, we found that the smartphone adoption behavior of a college student is highly likely to be influenced by her friends, financial status, and family members. The college students who adopted a smartphone earlier than other students tend to have more friends who have a smartphone, to be more susceptible to normative peer influence, and have more family members who have a smartphone than other students. Furthermore, we also found that the students who adopted a smartphone were more financially well off than other students who had not adopted a smartphone.

We should note that the results obtained from a particular sample might not be generalized to the population of this study (i.e., college students in the U.S.) because it is likely that the demographic and socio-economic characteristics of the students in our sample are different from those of other students in other schools and cities.

Finally, in this study, we only focused on the smartphone adoption behavior of college students who adopted a smartphone earlier than other students, they are 40% of our sample. In future studies, it might be interesting to examine the different smartphone adoption behaviors of students depending on when they adopt a smartphone (e.g., early adopters vs. late adopters). Furthermore, the factors that influence the early adopters of other electronic products such as tablet PCs and video game devices can be compared with the factors that influence the early adopters of smartphones.
Appendix 1

Survey items

1. Susceptibility to peer influence (Cronbach's alpha: 0.91)
   The following questions concern your mobile phone choice. Please respond to each of the statements using the 7-point scale that runs from “strongly agree” to “strongly disagree.”
   
   (1) It is important that my friends like the mobile phone I buy.
   - Strongly agree
   - Somewhat agree
   - Neither agree nor disagree
   - Somewhat disagree
   - Disagree
   - Strongly disagree

   (2) I like to know what mobile phone makes good impressions on my friends.

   (3) I achieve a sense of belonging by purchasing the same mobile phone that my friends purchase.

   (4) If I want to be like someone, I try to buy the same mobile phone that they buy.

   (5) I identify with my friends by purchasing the same mobile phone they purchase.

2. Self-efficacy regarding a mobile phone (Cronbach's alpha: 0.92)
   Next questions are addressing how confident you are about using a mobile phone. Please respond to each of the statements using the 7-point scale that runs from “strongly agree” to “strongly disagree”.

<table>
<thead>
<tr>
<th>How much do you agree or disagree?</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Somewhat agree</th>
<th>Neither</th>
<th>Somewhat disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
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<td>o</td>
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</tr>
</tbody>
</table>

3. Self-innovativeness (Cronbach alpha: 0.90)
   The following questions are about yourself with new products or sales. Please respond to each of the statements using the 7-point scale that runs from “strongly agree” to “strongly disagree”.
   
   (1) My friends think of me as a good source of information when it comes to new products or sales.
   - Strongly agree
   - Somewhat agree
   - Neither agree nor disagree
   - Somewhat disagree
   - Disagree
   - Strongly disagree

   (2) I like helping people by providing them with information about many kinds of products.

   (3) I like introducing new brands and products to my friends.

   (4) If someone asked where to get the best buy on several types of products, I could tell him or her where to shop.

   (5) People ask me for information about products, places to shop, or sales.

   (6) Think about a person who has information about a variety of products and likes to share this information with others. This person knows about new products, sales, stores, and so on, but does not necessarily feel like she or he is an expert on one particular product. How well would you say this description fits you?

   (1) The description does not fit me at all
   (7) The description fits me very well
4. Attitudes towards a smartphone (Cronbach alpha: 0.87)

The following questions are about your attitude for a smartphone. Please respond to each of items according to how you perceive a smartphone.

To me, a smartphone (or smartphone use) is...

useful o o o o o useless
of no concern to me o o o o o of concern to me
waste of time o o o o o wise use of time
valuable o o o o o worthless
waste of money o o o o o wise use of money

References


Smith, A., 2011. 35% of American adults own a smartphone: Pew Internet.


