Elsevier Editorial System(tm) for The Journal of High Technology Management Research
Manuscript Draft

Manuscript Number: HITECH-D-19-00019R1

Title: Who is tech savvy? Exploring the adoption of smartphones and tablets: an empirical investigation

Article Type: Original Article/Research

Keywords: Smartphone adoption, tablet adoption, family business, old, young, combined technology

Corresponding Author: Dr. Emmanuel Apergis, Ph.D.

Corresponding Author's Institution: Kent University

First Author: Emmanuel Apergis, Ph.D.

Order of Authors: Emmanuel Apergis, Ph.D.

Abstract: The present analysis performs a Multinomial Probit Model in order to observe which mobile technology qualifies across individuals. The findings indicate that individuals in family businesses prefer to combine both tablets and smartphones in their purchases, rather than separately. Younger individuals report an adoption preference towards smartphones, while older individuals are inclined towards tablets. The theoretical contributions encompass both the technology acceptance model (TAM) and the social cognitive theory (SCT). Individuals working in a family business exhibit a curious behaviour and they are becoming early adopters. TAM helps explain this behaviour as they tend to try new novelties exploring the potential usefulness they might derive; these technological advancements allow them to connect with customers and partners. By contrast, SCT helps gain a better understanding on young and old individuals' behaviour. The younger generations seem to be easily influenced by their peers with a tendency to technologies which are fun and allow them to build connections. Older individuals are equally influenced by their peers, with the difference that their social circle being more mature (e.g., business owners, professionals). This combined with the complexity of the technology orients them into adopting tablets more easily than smartphones.

***Title Page (WITH Author Details)**

Who is tech savvy? Exploring the adoption of smartphones and tablets: an empirical investigation

Emmanuel Apergis, University of Huddersfield, *E.Apergis@hud.ac.uk*

*BLINDED Manuscript (No Author Details)
Click here to view linked References

Who is tech savvy? Exploring the adoption of smartphones and tablets: an empirical investigation

Abstract: The present analysis performs a Multinomial Probit Model in order to observe which mobile technology qualifies across individuals. The findings indicate that individuals in family businesses prefer to combine both tablets and smartphones in their purchases, rather than separately. Younger individuals report an adoption preference towards smartphones, while older individuals are inclined towards tablets. The theoretical contributions encompass both the technology acceptance model (TAM) and the social cognitive theory (SCT). Individuals working in a family business exhibit a curious behaviour and they are becoming early adopters. TAM helps explain this behaviour as they tend to try new novelties exploring the potential usefulness they might derive; these technological advancements allow them to connect with customers and partners. By contrast, SCT helps gain a better understanding on young and old individuals' behaviour. The younger generations seem to be easily influenced by their peers with a tendency to technologies which are fun and allow them to build connections. Older individuals are equally influenced by their peers, with the difference that their social circle being more mature (e.g., business owners, professionals). This combined with the complexity of the technology orients them into adopting tablets more easily than smartphones.

Keywords: Smartphone adoption, tablet adoption, family business, combined technology

Introduction

Smartphones are considered an essential everyday device, alongside tablets designed for making on-the-spot purchases, checking e-mails, surfing entries, entertainment and even monitoring businesses usually through an Enterprise Resource Planning (ERP) software. Since mobile technology has infiltrated almost every aspect of our daily lives, mobile shopping has become widespread (in browsing and purchasing products and services online from multiple retailers at any time and place with wi-fi access) (Yang and Kim, 2012; Holmes et al., 2013; Groß, 2015). Prior research findings from Lee et al. (2017) indicate that tablets act as substitutes to smartphones, while Santandreu and Shurden (2017) argue in favour of their synergistic effect.

In this analysis, however, it is shown that there is a population group which prefers to adopt two technologies (smartphones and tablets), which happen to work in conjunction rather than separately. These are family businesses. It is important to study how the market (including specific population groups) behaves in technology purchases. The effectiveness of traditional marketing instruments has declined, while social interactions between consumers have increased (Sethuraman et al., 2011), thus the opportunities to exploit these interactions offer new avenues for disseminating products.

The research contributes to the body of knowledge regarding the adoption and use of smartphones and tablets. By gaining an understanding of human behaviour this can shape how the Internet of Things (IoT) will evolve (Johnsson and Magnusson, 2017). Moreover, the research aims to influence product and marketing managers in targeting specific population segments first. Should not be a priority the satisfaction of the needs for the demographic group that really demands them the most? Market researchers have begun to understand the

importance of mobile devices in conducting surveys for market analysis (Wells, 2015; Brosnan et al., 2017) and family businesses tend to explore new technologies faster than others and adopt them easily. Probably this is attributed to novelty seeking (Hirschman, 1980). Adopters are curious, stimulation-seeking, venturesome, and cognitive individuals (Olson et al., 1984). The adoption of combined technologies is important because complementary products have noted to increase consumer utility (Gupta et al., 1999).

The present research contributes to TAM (the product innovation literature) by suggesting that family business are savvy technological adopters, as well as on marketing literature. Without directing tablets and smartphone products to the proper population groups, marketing managers will not manage to share technology with the group that actually needs or demands this technology. Retailers should be very aware of family businesses as early adopters of products which are complimentary. Technology improvements in power battery management and nanomaterials will significantly improve mobile devices, memory and computational capabilities (Byoung-Dai et al., 2013). The TAM has two independent variables. Perceived ease of use and usefulness combine the effect of behavioural intention. By drawing attention on family businesses this work contributes to how TAM can be extended into exploring specific occupations in influencing the channels of technology adoptions alone or in conjunction. The conjunction and complementarity of technological devices adopted have certainly been neglected in the literature. The same can be argued for the Unified Theory of Acceptance and Use of technology known as UTAUT (Venkatesh et al., 2003).

This paper also contributes to the social contagion theory (SCT) (Bandura, 1989; Van den Bulte and Stremersch, 2004) and the new product diffusion. Social influence affects the adoption of products (Godes, 2011), which has implications in the marketing theory and specifically in the social network theory within marketing. The results show an age effect and

imply that contagiousness is dependent on family businesses to diffuse innovation and products. In order to discover new methods to reach the consumer, it is important first to pinpoint the consumer who will adopt the product first and later spread it through her network. Family businesses appear to be that linking knot.

The remainder of the paper is structured as follows: Initially, it begins with a discussion and an overview of the literature. Next, the data are described and then the variables are presented before estimation. Data are extracted from the Innovation Panel survey in the UK and a discussion comes afterwards on how the main variable is developed through the data management method (smartphone – tablet – smartphone & tablet – neither). Next, comes the elaboration on the econometric model on utility, where the analytic approach includes Jackknife resampling in order to decide whether a linear or a non-linear model is specified correctly. In the section that follows, an overview of the results is provided, addressing research questions. Finally, a discussion on the main findings and study limitations are offered in the end.

Literature review

Technology adoption

The adoption of technology is affected by peers and social influence (Kulviwat et al., 2009; Risselada et al., 2014). According to Frambach et al. (1998), it seemed that not only the social network, but also the supplier of the innovation has had a strong influence on the adopter's decision. Suppliers target a specific group, communicate to create awareness and influence perception in order to minimize financial and operational risks (Framback and Schillewaert, 2002). According to research from Hallikainen et al. (2018), mobile devices are a highly significant predictor of lead usefulness in a work-related context among senior managers and entrepreneurs. In general, females and males are found to differ in their

decision-making process related to technology adoption and use (Venkatesh and Morris, 200) with males demonstrating higher ranks of confidence in using new technology compared to females (Elliott and Hall, 2005). In line with prior research from Zhao et al. (2018), the analysis in this work is expecting age to play an active role in the use of mobile services. The younger generation, also referred to as the generation Y (millennials), is the first generation growing up within a digital environment compared to more matured users (Bolton et al., 2013). Typically, they are more exposed to new technologies and easier to absorb the new technological advancements with minimum effort.

The TAM describes perceived usefulness on the context to which a system adds to the user's job performance (Davis, 1989). It is proposed that the TAM should be viewed in relevance to current technological developments (Koufaris, 2002). Consumers just do not spend more expecting features, but also for prestige and better quality (Lichtenstein et al., 1993). Most of the consumers of new technology are aged between 18 and 34 (Tai and Tam, 1997). Above 55 years old in a cultural context (in Finland) only the two thirds actively engaged in internet activities (Vuori and Holmlund-Rytkonen, 2005). Carpenter and Buday (2007) find that old people refrain from adopting (buying) new technologies because they lack interest and motivation, it is costly for them and are physically limited due to ageing. The existing literature is thriving with technology acceptance theories, such as the TAM (Davies, 1989), Ajzen's (1991) Theory of Planned Behaviour (TPB), Roger's and Shoemaker's (1971) Diffusion of Innovation (DoI), Venkatesh's et al.'s (2003) the Unified Theory of Acceptance and Use of Technology (UTAUT) and its extended version (UTAUT2) from Venkatesh et al. (2012). Studies by Anshari et al. (2016) and Ameen and Willis (2016) document that the behaviour of individuals in relations to smartphones varies by gender and age. Possessing stylish products allows younger individuals relative to matured users to look and feel different without risking significant discomfort, satisfying the counter-conformity

motivation (Nail, 1986). The social cognitive theory (SCT), developed by Bandura (1989), highlights that an individual's behavioural intention is a function of not only behavioural, but also of cognitive personal and environmental factors. These environmental factors refer to the immediate cultural milieu encompassed by social groups, social relationships and interactions, plus the social norms and peer influence. The SCT is the umbrella theory for covering individual and group psychological behaviours (Pincus, 2004). Contrary to the technology acceptance theories, the perceived ease of use is not significant for SCT (Boateng et al., 2016) with Ratten & Ratten (2007) drawing the academic attention towards the social cognitive theory as the best explanation we have for youth early adoption of technological innovations.

Tablets

Early tablet versions have been existed since the 60s (and in popular movies) but have not been widely advocated due to their lack of user-friendliness until Microsoft introduced the detachable keyboard in 2002 (Ozok, 2008). Khuhro et al. (2016) eulogise the Global System for Mobile (GSM) communication in tablets as a stepping stone in the IT revolution:

"[...] tablet devices have internet connectivity through Wi-Fi or GSM technology. GSM has an added advantage of providing mobile connectivity everywhere. Latest tablets have moved to 4G technology".

Tablets seem to be substitutes for personal computers, as well as for smartphones, with the affinity to spur purchases from a wider diversity of products (Xu et al., 2016). Tablet computers have begun to be adopted by clinicians in medical wards (Ducey and Coovert, 2016), while tablet computers can help and engage older adults to familiarise themselves with new technologies and increase their digital literacy (Tsai et al., 2017). Tablet users often seek relaxation, information seeking, fashion items and work-related issues as instrumental issues

for tablet use, while social connection anytime and anywhere, large screens and ease-of-use are intrinsic motives (Leung and Zhang, 2016). A tablet may be the best media device to use to spend time alone and enjoy a moment of solitude to release stress with fun seeking-oriented activities (Leung, 2015). Negative experiences mainly concern the tablet's features of short battery life and lack of screen brightness (Ifenthaler and Schweinbenz, 2013).

Smartphones

Smartphones, also, enable consumers to acquire information from non-store sources, while shopping at traditional retail shops (Bhatnagar and Papatla, 2019). As Cochrane and Bateman (2010) put it in their own words:

"Smartphones have matured into feature-rich miniature multimedia computers, including features such as HSPA connectivity (3.6 Mb/s and higher wireless mobile broadband connectivity), built in virtual or physical keyboards for easy text entry a high resolution [...] camera, a GPS, high capacity memory storage [...], high resolution touchscreen user interfaces, and a wide variety of preinstalled and downloadable applications that integrate with Web 2.0 social software".

A large screen, compared to a small screen, is likely to lead to higher smartphone adoption, which in turn positively influences perceived ease of use, thus, attributing to the device both hedonic and utilitarian attributes (Kim and Sundar, 2014). Smartphones can be viewed from the perspective of college students as task-oriented and entertainment-oriented devices at the same time (Chun et al., 2012). Social influence extends the Technology Adoption Model (TAM) since it adds up a positive user image (Chun et al., 2012). Smartphones are also adopted by healthcare professionals (Wu et al., 2010).

Method

Data

Data have been extracted from the Understanding Society Innovation Panel database. This survey is a sample of 1,500 households used by researchers as a test-bed for developing new areas of research. In the present research, only the 9th wave of the Innovation Panel has been included since this is the only wave with available data for smartphones and tablets.

During the questionnaire, the respondent has been asked the following question: "Which of the following devices do you use to connect to the internet?" and the individual has to select all that apply from a list which includes: (1) desktop computer, (2) laptop, (3) smartphone, (4) tablet, (5) feature phone / non-touchscreen mobile phone, (6) e-book reader (e.g. Kindle), (7) smartwatch and (8) other. At this point, the selected choices are carefully chosen to touch the strongest interest in this analysis. More specifically, the study is interested in individuals who have chosen both a smartphone and a tablet. To do this, intervention into the variable is essential in order to convert it from numerical into a string. Once this is performed successfully, the process follows with concatenating the string variables of "tablet" and "smartphone". This allows joining these two characters together from end to end. If the strings had not been converted into strings, then a mismatch error would have surfaced. After the decomposition, the string characters are transformed again into numerics. As a result, a new variable is formed which includes individuals who are having simultaneously "a smartphone and a tablet", individuals who are having only "a smartphone", individuals who are having only "a tablet", and individuals who are having "neither a smartphone, nor a tablet" (Table 1 and Figure 1).

[Insert Table 1 about here]

[Insert Figure 1 about here]

The main independent variables encountered in the questionnaire with the four following questions. First, "what is your legal marital status?" Individuals have to select from a list

which is consisted of: (1) single and never married or never in a legally recognised Civil Partnership, (2) married, (3) a civil partner in a legally recognised civil partnership, (4) separated, but legally married, (5) divorced, (6) widowed, (7) separated from civil partner, (8) spontaneous: a former civil partner, the civil partnership legally dissolved and, finally, (9) a surviving civil partner (partner has died). From the above, only those who are married and who are not are needed. Secondly, the next question seeks to know: "Which of these best [options] describes your current employment situation?" and the individual selects from twelve options: (1) self-employed, (2) in paid employment (full or part-time), (3) unemployed, (4) retired, (5) on maternity leave, (6) looking after family or home, (7) full-time student, (8) long-term sick or disabled, (9) on a government training scheme, (10) in family business, (11) working in an apprenticeship, and (12) doing something else. From the list above, the present strategy cares about those working in the family business, which a dummy variable is formed. Now, one corresponds for "working in a family business" and zero for "not working in a family business". Thirdly, a gender variable is required, a variable reporting the individuals' age, which is also in square in order to fit it in a quadratic equation. A detailed description of the variable statistics can be found in Table A1 in the Appendix.

Procedural analysis

In our estimation strategy, the analysis fits a Multinomial Probit (MNP) model for a categorical dependent variable with outcomes that have no natural ordering and have to choose among several discrete variables. The actual values taken by the dependent variable are irrelevant. The stochastic error terms are assumed to be independent, normal and random distributions. The latent variable for the jth alternative, $j = 1, \dots, 4$, is:

$$h_{ij} = a_j x_i + \xi_{ij} \quad (1)$$

where x_i contains the observed independent variables for the ith decision maker, coefficients a_j and ξ are the error terms. The latent variable k is chosen over the alternatives $j-1$ and is given by:

$$y_{ij'} = h_{ij} - h_{ik} \tag{2}$$

$$= z_i(a_j - a_k) + \xi_{ij} - \xi_{ik}$$

$$= z_i\beta_{j'} + \varepsilon_{ij}$$

The probability that subject i chooses outcome k is:

$$\Pr(y_i = k) = \Pr(y_i \leq 0, \dots, y_{ij-1} \leq 0) \tag{3}$$

$$= \Pr(\varepsilon_{ij} \leq -z_i\beta_j, \dots, \varepsilon_{ij-1} \leq -z_i\beta_{j-1} = \frac{1}{2\pi^{\frac{j-1}{2}}|\Sigma|^{\frac{1}{2}}} \int_{-\infty}^{-z_i\beta_1} \dots \int_{-\infty}^{-z_i\beta_{j-1}} e^{-\frac{1}{2}z'\Sigma^{-1}} dz$$

where

$$\Sigma = \begin{bmatrix} 2 & 1 & \dots & 1 \\ 1 & 2 & \dots & 1 \\ \vdots & \vdots & \ddots & \vdots \\ 1 & 1 & \dots & 2 \end{bmatrix} \tag{4}$$

through the Dunnett's (1989) modification of the exchangeable correlation structure, the multidimensional integral is reduced to one dimension. After the reduction is complete, the Gaussian quadrature is used to approximate the integral in a $\lambda - point$ quadrature formula:

$$\Pr(y_i = k) \approx \frac{1}{2}\sum_{\lambda=1}^{\lambda} w_\lambda \left\{ \prod_{j=1}^{j-1} \Phi\left(-\sqrt[2]{2\mu_k} - z_i\beta_j\right) + \prod_{j=1}^{j-1} \Phi\left(\sqrt[2]{2\mu_k} - z_i\beta_j\right) \right\} \tag{5}$$

where w_λ and μ_k are respectively the weights and roots of the Laguerre polynomial of order λ. Here, 15 Gaussian quadrature points are specified in approximating the likelihood. In addition, the variance-covariance matrix (VCE) is specified corresponding to the parameter

estimates performing the Jackknife estimation (Quennouille, 1949; 1956). If the modelling has not specified the Jackknife estimation, then the standard approach will display errors based on variance estimates given by the standard inverse of the negative Hessian known as the second derivative matrix. The Jackknife specification allows us to calculate the standard errors on this replication method applying the t distribution in the coefficients table. When $\widehat{\omega}$ is the observed value of the statistic calculated from the original dataset, then $\widehat{\omega}_{(\theta)}$ is the statistic value computed, leaving the θth observation out. The θth pseudovalue (Tukey, 1958) is given by:

$$\widehat{\omega}_{\theta}^{*} = \widehat{\omega}_{(\theta)} + \Theta\{\widehat{\omega} - \widehat{\omega}_{(\theta)}\} \tag{6}$$

while the standard errors are estimated as:

$$\hat{s}_{z} = \left\{\frac{1}{\Theta(\Theta-1)}\right\}^{\frac{1}{2}} \sum_{\theta=1}^{\Theta} (\widehat{\omega}_{\theta}^{*} - \overline{\omega}^{*})^{2} \tag{7}$$

where the Jackknife estimate is given by:

$$\overline{\omega}^{*} = \frac{1}{\Theta} \sum_{\theta=1}^{\Theta} \widehat{\omega}_{\theta}^{*} \tag{8}$$

and the multinomial Probit is run on an estimation sample for 1866 Jackknife replications.

Basically, pseudovalues are leave-one-out (Jackknife) estimates of a parameter of interest. Basically, it leaves out each observation from the dataset, calculates the estimate and then finds the average of the calculations. The analysis uses the Jackknife resampling method because it is relevantly useful for variance and bias estimations when the sample is small. In our case, the size of the sample consists of 1,866 observations.

Empirical results

After running the multinomial Probit regression with Jackknife resampling, the findings report the estimated results in Table 2. Notice that there is a 100% success in Jackknife replications for the linear model, but not for the quadrative one (99.46% success rate is not satisfactory), which is rejected for misspecification.

[Insert Table 2 about here]

The results from model (1) indicate a positive opportunity cost. This implies that people will choose that mode of technology (smartphone and tablet combined) over not having a smartphone and a tablet. The coefficient is 8.086 (p-value < 0.01). For married individuals the coefficient is also positive at 0.398 (p-value < 0.01), while for males the opportunity cost is negative at -0.139 (p-value < 0.10). In a similar manner, the age coefficient is also negative at -0.044 (p < 0.01). A significant difference is detected when people tend to choose smartphones as a means of technology over no technology at all. Here, only age reports significant results with -0.043 (p-value < 0.01) opportunity cost. The tablet technology mode reports a positive sign for married individuals 0.229 (p-value < 0.05) and an expected negative coefficient for males -0.340 (p-value < 0.01).

Overall, despite that the scores are important only for model (1), the general indication of these findings is that family businesses have a positive opportunity cost to select both tablet and smartphone technology in their employment compared to selecting only the tablet technology or the smartphone technology alone. The reason for this preference may be attributed to the needs of the business. At this point, it is deemed important to look further into the results below in order to gain a deeper understanding of the analysis.

[Insert Figure 2 about here]

Figure 2 depicts the predictive margins of age for the linear variable in black and the quadrative variable in red. An early investigation might trick the reader to suspect that the

quadratic offers a better specification, but this is not the case here. Firstly, by bringing the predictive margins next to the age histogram, this permits a direct comparison and inspection on whether the predictive margins are influenced by the distribution of variable "age". That would imply that the more observations for the distribution of age data available, the higher the probability is. By having them both together, it can safely be said that this is not the case here. Notice that the inclusion of the Jackknife resampling is important since the independent variable is not normally distributed, but is following the distribution of a different kernel. See the fat left tail of the age population histogram.

[Insert Figure 3 about here]

Predictive margins of age with confidence interval at 95% significant level (Figure 3) report that married individuals are more likely to adopt (purchase) smartphone and tablet technology at the same time. It is noteworthy that the predictive probability of adoption remains steady until the threshold age of 44, and then it begins to decline for both marital statuses. Looking at the probability of smartphone adoption, non-married individuals are more likely to adopt it, compared to married individuals. The trend here is also declining with age. Now, for the probability in adopting a tablet only (excluding smartphones) both married and non-married individuals report similar results, but this time, as age increases, the probability of adopting a tablet is rising as well. Here it can be assumed that a tablet is a business highly needed on the field, while younger individuals are content with devices which demand little calculative capacity.

[Insert Figure 4 about here]

Predictive margins of age with a confidence interval at the 95% significant level (Figure 4) depict that both males and females behave similarly when the dependent variable is a simultaneous adopter of smartphone and tablet technology at the same time. The probability

of a purchase is higher and steady for aged individuals until 44 years old, which is the threshold age. After that, the probability decreases. A declining pattern is observed for smartphone users as they grow older as well. Here males have a marginally higher probability of purchasing smartphones. For tablets now, the reader can observe that younger individuals are not equally interested in tablet PCs. Instead, as individuals grow older, gradually they begin to realise their importance and are more likely to make the purchase (to adopt it). Finally, it is evident that females are more likely to purchase a mobile tablet PC, compared to males.

Discussion

Bettiga & Lamberti (2017) make a call for a renewed attention of technology adoption process. With new innovations coming to the fore, the main findings aim to discover the choices individuals make when purchasing mobile device technology and specifically: smartphones, tablets or both, when the reference category is the option "neither of them". With reference to the last option, the decision to adopt and use of smartphones and tablets at the same time is strongly significant for family businesses. This can mostly be explained by TAM, which is usually utilized in the pre-adoption stage (Bhattacherjee, 2001) and its perceived usefulness for early adopters (Dutot, 2015). Technological innovations involve a new concept, a new idea, a different object, or an optimized process and allow individuals to learn about them and explore them further (Cantisani, 2006). For that reason, it is assumed that technological innovations are adopted differently by individuals depending on their capacity to exhibit how efficient is their learning (Rycroft, 2006). Entrepreneurs have seen as more likely to be able to use innovative breakthroughs as they focus on risk taking and proactive technologies (Ratten, 2012). This behaviour can possibly be explained by the level of self-efficacy or confidence in using the new technology as outlined by Jimenez et al. (2019). The confidence an individual has with using the technology (Ozturk et al., 2016) lies

in the ability to distinguish in which activity they are good at or capable of doing and at which they are mostly experienced (Faqih & Jaradat, 2015). This is not different from the individual's willingness to adopt a new product or a new idea based on individuals experience. But it is different from the Agarwal & Prasad (1998)'s approach according to which some personalities will enfold towards innovation and these will respond positively towards the acquisition of new knowledge or technologies once they appear in existence. Family businesses are often entrepreneurs occupying a niche market they acquired through novelty seeking and venturesome behaviour.

Adopting a new technology is also higher for married individuals, lesser for males, compared to females, while this relationship declines with age. This implies that younger individuals influence each other by adopting both smartphones and tablets. This is best explained by SCT. Running a Multinomial Probit model helps to identify the opportunity costs and explore a linear and a curvilinear specification with age. Furthermore, Jackknife resampling facilitates the identification of the appropriate specification, which here is the linear model. The findings documented that males, married households and females are more likely to purchase a tablet, while younger ones are more inclined to purchase a smartphone. As noted above, individuals happen very often to learn from their social group and their interactions (Chan & Lu, 2004), thus constituting repositories of behaviour, action and knowledge on how to eventually utilise a new technology (LaRose & Eastin, 2004).

By taking into consideration that individuals are complex and volatile (Kock, 2004), it can be assumed that decision making in adopting a new technological breakthrough is also achieved by following the actions of other people (Celsi et al., 1993) and through this exposure people emulate their behaviour. Individuals imitate other people by sharing consumption habits (Herr et al., 1991). For Kim & Baek (2018) the intensity of use of a given technology is linked to the user's lifestyle, while according to Chemingui & Ben Lallouna

(2013), this is an effect of the perceived entertainment possibly derived in the future. This can be claimed for young individuals, but not so for the older generations, since human's adoptive nature is dependent on task complexity (Bolt et al., 2001).

Recapping, for family businesses, the suggested perceived value or utility can influence the perceived ease of use and continue to do so found in TAM (Tseng & Chiang, 2013). Young individuals tend to prefer purchasing (adopting) smartphones up to the threshold of 44 years, where the trend declines, because of the social interactions among their friends and contacts which influence them found in SCT. However, 44 years old is the threshold for older individuals to begin adopting (purchasing) tablets. This can equally be explained by SCT, but since their social circle is more mature (often from the same generation they are) their level of complexity in the technologies they adopt is a crucial factor.

Managerial Implications

Advertisements or media exposure can raise the awareness of products and services (Rice & Bennett, 1998), with youth especially being influenced more easily by advertisement consumption (O'Bannon, 2001). By directing advertisement communication more effectively, individuals will have the opportunity to receive the products they want more easily. It is easily derived from this research that entrepreneurs or early adopters are influenced mainly by the new gadgets, because these are novel technologies. Directing new product communication is, thus, more likely for them to begin adopting it. Because most entrepreneurs are mature individuals, their social circle is more likely to be also mature. As a result, when entrepreneurs or family business first get the new product, are more likely to influence similar individuals (of the same age as they are) and this is the reason older people easily adopt tablets over smartphones, because these are also tools for the entrepreneurs with,

however, low levels of complexity. Now, young people are influenced by media, they need to get entertained within their own social circle, and have fun with their peers, so their choice of new technologies is focused around communicating with them, something that is more easily achieved with smartphones.

Limitations and future research

Although the model provides several interesting strengths, it also offers weaknesses on the variety of variables used. Note that if the model was overburdened, then estimations would have been impossible. Keeping the model parsimonious allows the exploration of the true effects of the independent variables as opportunity costs. Despite the adopters of combined smartphones and tablets, adopters of simultaneously tablets and smartphones have not been used in a conjoint analysis prior to this paper. This work suggests using the new concatenated variable introduced here as an independent, rather than as a dependent variable.

The model has limitations that need to be accounted for in future studies. First, the research was conducted without including variables of TAM or SCT used in the literature. The aim was not to extend the theory, but to draw the attention on (firstly) family businesses and the age factor, on (secondly) the combined technology adopted, and, (finally), exploring potential non-linearities. Future studies should add these factors to the model to gain a more comprehensive picture of technology adoption. The designers of Internet-based devices (channels) for shopping have to also consider, on the top of customer needs, cultural differences for small businesses on adopting new technologies (Barnes et al., 2007).

Conclusion

The present study showed the importance of family business into purchasing or adopting complementary technologies according to the Information Systems, Marketing and Entrepreneurship literature.

References

Agarwal, R., & Prasad, J. (1998). A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology. *Information Systems Research, 9*(2), 204-215.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Process, 50*(2), 179-211.

Ameen, N. A., & Willis, R. (2016). The Use of Mobile Phones to Support Women's Entrepreneurship in the Arab Countries. *International Journal of Gender and Entrepreneurship, 8*(4), 424-445.

Anshari, M., Alas, Y., Hardaker, G., Jaidin, J. H., Smith M., & Ahad, A. D. (2016). Smartphone Habit and Behavior in Brunei: Personalization, Gender, and Generation Gap. *Computers in Human Behavior, 64*, 719-727.

Bandura, A. (1989). Human Agency in Social Cognitive Theory. *American Psychologist, 44*(9), 1175-1184.

Barnes, S. J., Bauer, H. H., Neumann, M. M., & Huber, F. (2007). Segmenting Cyberspace: A Customer Typology for the Internet. *European Journal of Marketing, 41*(1/2), 71-93.

Bettiga, D., & Lamberti, L. (2017). Exploring the Adoption Process of Personal Technologies: A Cognitive-Affective Approach. *The Journal of High Technology Management Research, 28*(2), 179-187.

Bhatnagar, A., & Papatla, P. (2019). Do Habits Influence the Types of Information that Smartphone Shoppers Seek? *Journal of Business Research, 94*, 89-98.

Bhattacherjee, A. (2001). Understanding Information Systems Continuance: An Expectation-Confirmation Model. *MIS Quarterly, 25*(3), 351-370.

Boateng, H., Adam, D. R., Okoe, A. F., & Anning-Dorson, T. (2016). Assessing the Determinants of Internet Banking Adoption Intentions: A Social Cognitive Theory Perspective. *Computers in Human Behavior, 65*, 468-478.

Bolt, M. A., Killough, L. N., & Koh, H. C. (2001). Testing the Interaction Effects of Task Complexity in Computer Training Using the Social Cognitive Model. *Decision Sciences, 32*(1), 1-20.

Bolton, R. N., Parasuraman, A., Hoefnagels, A., Migchels, N., Kabadayi, S., Gruber, T., . . . Solnet, D. (2013). Understanding Generation Y and their Use of Social Media: A Review and Research Agenda. *Journal of Service Management, 24*(3), 245-267.

Brosnan, K., Grun, B., & Dolnicar, S. (2017). PC, Phone or Tablet? Use, Preference and Completion Rates for Web Surveys. *International Journal of Market Research, 59*(1), 35-55.

Cantisani, A. (2006). Technological Innovation Process Revisited. *Technovation, 26*(11), 1294-1301.

Carpenter, B. D., & Buday, S. (2007). Computer Use among Older Adults in a Natural Occuring Retirement Community. *Computers in Human Behavior, 23*(6), 3012-3024.

Celsi, R. L., Rose, R. L., & Leigh, T. W. (1993). An Exploration of High-Risk Leisure Consumption through Skydiving. *Journal of Consumer Research, 20*(1), 1-23.

Chan, S. C., & Lu, M. (2004). Understanding Internet Banking Adoption and Use Behavior: A Hong Kong Perspective. *Journal of Global Information Management, 12*(3), 21-43.

Chemingui, H., & Ben Lallouna, H. (2013). Resistance, Motivations, Trust and Intention to Use Mobile Financial Services. *International Journal of Bank Marketing, 31*(7), 574-592.

Chun, H., Lee, H., & Kim, D. (2012). The Integrated Model of Smartphone Adoption: Hedonic and utilitarian Value Perceptions of Smartphones among Korean College Students. *Cyberpsychology, Behavior, and Social Networking, 15*(9), 473-479.

Cochrane, T., & Bateman, R. (2010). Smartphones give you Wings: Pedagogical Affordances of Mobile Web 2.0. *Australasian Journal of Educational Technology, 26*(1), 1-14.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of two Theoretical Models. *Management Science, 35*(8), 982-1003.

Ducey, A. J., & Coovert, M. D. (2016). Predicting Tablet Computer Use: An Extended Technology Acceptance Model for Physicians. *Health Policy and Technology, 5*(3), 268-284.

Dunnett, C. W. (1989). Algorithm AS 251: Multivariate Normal Probability Integrals with Product Correlation Structure. *Journal of the Royal Statistical Society, 38*(3), 564-579.

Dutot, V. (2015). Factors Influencing Near Field Communication (NFC) Adoption: An Extended TAM Approach. *The Journal of High Technology Management Research, 26*(1), 45-57.

Elliott, K. M., & Hall, M. C. (2005). Assessing Consumers' Propensity to Embrace Self-Service Technologies: Are there Gender Differences? *Marketing Management Journal, 15*(2), 98-107.

Faqih, K. M., & Jaradat, M. I. (2015). Assessing the Moderating Effect of Gender Differences and Individualism-Collectivism at Individual-Level on the Adoption of Mobile Commerce Technology. *Journal of Retailing and Consumer Services, 22*, 37-52.

Frambach, R. T., & Schillewaert, N. (2002). Organizational Innovation Adoption: A Multi-Level Framework of Determinants and Opportunities for Future Research. *Journal of Business Research, 55*(2), 163-176.

Frambach, R. T., Barkema, H. G., Nooteboom, B., & Wedel, M. (1998). Adoption of a Service Innovation in the Business Market: An Empirical Test of Supply-Side Variables. *Journal of Business Research, 41*(2), 161-174.

Godes, D. (2011). Commentary - Invited Comment on "Opinion Leadership and Social Contagion in New Product Diffusion". *Marketing Science, 30*(2), 224-229.

Groß, M. (2015). Exploring the Acceptance of Technology for Mobile Shopping: An Empirical Investigation among Smartphone Users. *The International Review of Retail, Distribution and Consumer Research, 25*(3), 215-235.

Gupta, S., Jain, D. C., & Sawhney, M. S. (1999). Modeling the Evolution of Markets with Indirect Network Externalities: An Application to Digital Television. *Marketing Science, 18*(3), 396-416.

Hallikainen, H., Alamaki, A., & Laukkanen, T. (2018). Lead Users of Business Mobile Services. *International Journal of Information management*, (Article in Press).

Herr, P. M., Kardes, F. R., & Kim, J. (1991). Effects of Word-of-mouth and Product-attribute Information on Persuasion. *Journal of Consumer Research, 17*(4), 454-462.

Hirschman, E. C. (1980). Innovativeness, Novelty Seeking, and Consumer Creativity. *Journal of Consumer Research, 7*(3), 283-295.

Holmes, A., Byrne, A., & Rowley, J. (2013). Mobile Shopping Behaviour: Insights into Attitudes, Shopping Process Involvement and Location. *International Journal of Retail & Distribution Management, 42*(1), 25-39.

Ifenthaler, D., & Schweinbenz, V. (2013). The Acceptance of Tablet-PCs in classroom instruction: The Teachers' Perspectives. *Computer in Human Behavior, 29*(3), 525-534.

Jimenez, N., San-Martin, S., & Puente, N. (2019). The Path to Mobile Shopping Compatibility. *The Journal of High Technology Management Research, 30*(1), 15-26.

Johnsson, B. A., & Magnusson, B. (2017). Towards End-User Development of Graphical User Interfaces for Internet of Things. *Future Generation Computer Systems*, (Article in Press).

Khuhro, R., Qureshi, Q., Humayon, A., Tahir, S., & Khan, A. (2016). Factors Affecting Adoption Behavior for Tablet Device among Computer Users in Pakistan. *Management Science Letters, 6*(12), 723-734.

Kim, K. J., & Sundar, S. S. (2014). Does Screen Size Matter for Smartphones? Utilitarian and Hedonic Effects of Screen Size on Smartphone Adoption. *Cyberpsychology, Behavior, and Social Networking, 17*(7), 466-473.

Kim, S., & Baek, T. H. (2018). Examining the Antecedents and Consequences of Mobile App Engagement. *Telematics and Informatics, 35*(1), 148-158.

Kock, N. (2004). The Psychobiological Model: Towards a New Theory of Computer-Mediated Communication Based on Darwinian Evolution. *Organization Science, 15*(3), 327-348.

Koufaris, M. (2002). Applying the Technology Acceptance Model and Flow Theory to Online Consumer Behavior. *Information Systems Research, 13*(2), 205-223.

Kulviwat, S., Bruner II, G. C., & Al-Shuridah, O. (2009). The Role of Social Influence on Adoption of High Tech Innovations: The Moderating Effect of Public/Private Consumption. *Journal of Business Research, 62*(7), 706-712.

LaRose, R., & Eastin, M. S. (2004). A Social Cognitive Theory of Internet Uses and Gratifications: Toward a New Model of Media Attendance. *Journal of Broadcasting & Electronic Media, 48*(3), 358-377.

Lee, B. D., Lim, K. H., & Kim, N. (2014). Development of Energy-Aware Mobile Applications Based on Resource Outsourcing. *International Journal of Software Engineering and Knowledge Engineering, 24*(8), 1225-1243.

Lee, S., Lee, S., & Chan-Olmsted, S. (2017). An Empirical Analysis of Tablet PC Diffusion. *Telematics and Informatics, 34*(2), 518-527.

Leung, L. (2015). Using Tablet in Solitude for Stress Reduction: An Examination of Desire for Aloneness, Leisure Boredom, Tablet Activities, and Location of Use. *Computers inHuman Behavior, 48*, 382-391.

Leung, L., & Zhang, R. (2016). Predicting Tablet Use: A Study of Gratifications-Sought, Leisure Boredom, and Multitasking. *telematics and Informatics, 33*(2), 331-341.

Lichtenstein, D. R., Ridgway, N. M., & Netemeyer, R. G. (1993). Price Perceptions and Consumer Shopping Behavior: A Field Study. *Journal of Marketing Research, 30*(2), 234-245.

Nail, P. R. (1986). Toward an Integration of some Models and Theories of Social Response. *Psychological Bulletin, 100*(2), 190-206.

Olson, K., Camp, C., & Fuller, D. (1984). Curiosity and Need for Cognition. *Psychological Reports, 54*(1), 71-74.

Ozok, A. A., Benson, D., Chakraborty, J., & Norcio, A. F. (2008). A Comparative Study between Tablet and Laptop PCs: User satisfaction and Preferences. *International Journal of Human-Computer Interaction, 24*(3), 329-352.

Ozturk, A. B., Bilgihan, A., Nusair, K., & Okumus, F. (2016). What Keeps the Mobile Hotel Booking Users Loyal? Investigating the Roles of Self-Efficacy, Compatibility, Perceived Ease of Use, and Perceived Convenience. *International Journal of Information Management, 36*(6), 1350-1359.

Pincus, J. (2004). The Consequences of Unmet Needs: The Evolving Role of Motivation in Consumer Research. *Journal of Consumer Behaviour, 3*(4), 375-387.

Quenouille, M. H. (1949). Problems in Plane Sampling. *The Annals of Mathematical Statistics, 20*(3), 355-375.

Quenouille, M. H. (1956). Notes on Bias in Estimation. *Biometrika, 43*(3/4), 353-360.

Ratten, V. (2012). Entrepreneurial and Ethical Adoption Behaviour of Cloud Computing. *The Journal of High Technology Management Research, 23*(2), 155-164.

Ratten, V., & Ratten , H. (2007). Social Cognitive Theory in Technological Innovations. *European Journal of Innovation Management, 10*(1), 90-108.

Risselada, H., Verhoef, P. C., & Bijmolt, T. H. (2014). Dynamic Effects of Social Influence and Direct Marketing on the Adoption of High-Technology Products. *Journal of Marketing, 78*(2), 52-68.

Rogers, E. M., & Shoemaker, F. F. (1971). *Communication of Innovations: A Cross-Cultural Approach* (2nd ed.). New York: US: Free Press.

Rycroft, R. W. (2006). Time and Technological Innovation: Implications for Public Policy. *Technology in Society, 28*(3), 281-301.

Santandreu, J., & Shurden, M. C. (2017). Tablets Vs. Smart phones: The Battle of the Century. *Journal of Marketing Development & Competitiveness, 11*(4), 28-33.

Sethuraman, R., Tellis, G. J., & Briesch, R. A. (2011). How well does Advertising Work? Generalizations from Meta-Analysis of Brand Advertising Elasticities. *Journal of Marketing Research, 48*(3), 457-471.

Tai, S. H., & Tam, J. L. (1997). A Lifestyle Analysis of Female Consumers in greater China. *Psychology and Marketing, 14*(3), 287-307.

Tsai, H. Y., Shillair, R., & Cotten, S. R. (2017). Social Support and "Playing Around" An Examination of how Older Adults Acquire Digital Literacy and Tablet Computers. *Journal of Applied Gerontology, 36*(1), 29-55.

Tseng, F. M., & Chiang, H. Y. (2013). Exploring Consumers to Buy Innovative Products: Mobile Phone Upgrading Intention. *The Journal of High Technology Management Research, 24*(2), 77-87.

Tukey, J. (1958). Bias and Confidence in not Quite Large Samples. *Annals of Mathematical Statistics, 29*(2), 614-623.

Van den Bulte, C., & Stremersch, S. (2004). Social Contagion and Income Heterogeneity in New Product Diffusion: A Meta-Analytic Test. *Marketing Science, 23*(4), 530-544.

Venkatesh, V., & Morris, M. G. (2000). Why don't Men ever Stop to Ask for Directions? Gender, Social Influence, and their Role in Technology Acceptance and Usage Behavior. *MIS Quarterly, 24*(1), 115-139.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), 425-478.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly, 36*(1), 157-178.

Vuori, S., & Holmlund-Rytkonen, M. (2005). 55+ People as Internet Users. *Marketing Intelligence & Planning, 23*(1), 58-76.

Wells, T. (2015). What Market Researchers should Know about Mobile Surveys. *International Journal of Market Research, 57*(4), 521-532.

Wu, R. C., Morra, D., Quan, S., Lai, S., Zanjani, S., Abrans, H., & Rossos, P. G. (2010). The Use of Smartphones for Clinical Communication on Internal Medicin Wards. *Journal of Hospital Medicine, 5*(9), 553-559.

Xu, K., Chan, J., Ghose, A., & Han, S. P. (2016). Battle of the Channels: The Impact of Tablets on Digital Commerce. *Management Science, 63*(5), 1469-1492.

Yang, K., & Kim, H. Y. (2012). Mobile Shopping Motivation: An Application of Multiple Discriminant Analysis. *International Journal of Retail & Distribution Management, 40*(10), 778-789.

Zhao, Y., Ni, Q., & Zhou, R. (2018). What Factors Influence the Mobile health Service Adoption? A Meta-Analysis and the Moderating Role of Age. *International Journal of Information Management, 43*, 342-350.

Appendix

Table A1. Summary statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Married	1871	0.5446	0.498	0	1
Family Business	1874	0.0016	0.039	0	1
Male	1879	0.4561	0.498	0	1
Age	1878	47.969	17.347	16	91
$Age^{squared}$	1878	2601.8	1662.916	256	8281

Smartphone/Tablet	1879	14.021	4.535	11	22

Table 1. Main variables

	Frequency	Per cent	Cumulative
Smartphone & Tablet	980	52.16	52.16
Smartphone	394	20.97	73.12
Tablet	273	14.53	87.65
Neither	232	12.35	100.0
Total	1,879	100.0	

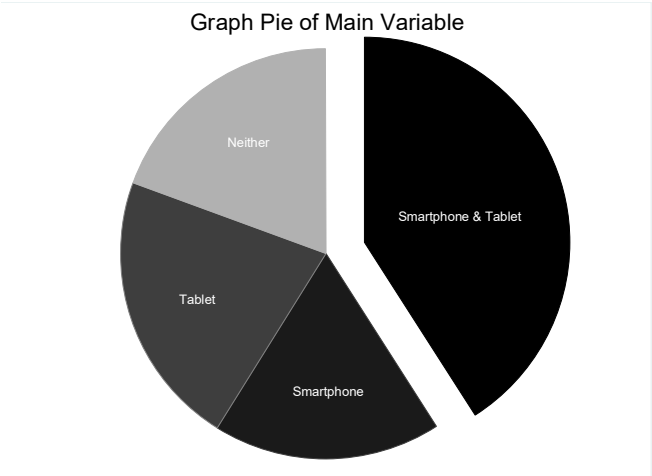

Figure 1.

Table 2. Multinomial Probit regressions with Jackknife s.e.

	Linear Model	Quadratic Model
	(1)	(2)
Smartphone & Tablet		
Family Business	8.086*** (1.610)	8.479 (116.448)
Married	0.398*** (0.084)	0.343*** (0.088)
Male	-0.139* (0.081)	-0.125 (0.080)
Age	-0.044*** (0.003)	0.007 (0.017)
$Age^{squared}$	-	-0.001*** (0.000)
Smartphone		
Family Business	-0.032 (0.334)	-0.018 (46.585)
Married	0.052 (0.091)	0.021 (46.585)
Male	-0.051 (0.088)	-0.039 (0.087)
Age	-0.043*** (0.003)	-0.004 (0.017)
$Age^{squared}$	-	-0.000** (0.000)
Tablet		
Family Business	-0.091 (0.221)	-0.023 (0.023)

Married	0.229** (0.093)	0.241** (0.095)
Male	-0.340*** (0.003)	-0.347*** (0.089)
Age	-0.002 (0.004)	-0.004 (0.018)
Age^{squared}	-	0.000 (0.000)
F(12, 1865) & F(12, 1855)	41.56	34.33
P	0.000	0.000
L1	-1,955.81	-1,946.43
N	1,866	1,866
Success rate of Jackknife replications	1866/1866	1856/1866[a]
Good Identification	yes	no

*p<0.1; **p<0.05;***p<0.01. [a]: Note that in model (2) one or more parameters could not be estimated in 10 Jackknife replicates. The standard error estimates include only complete replications.

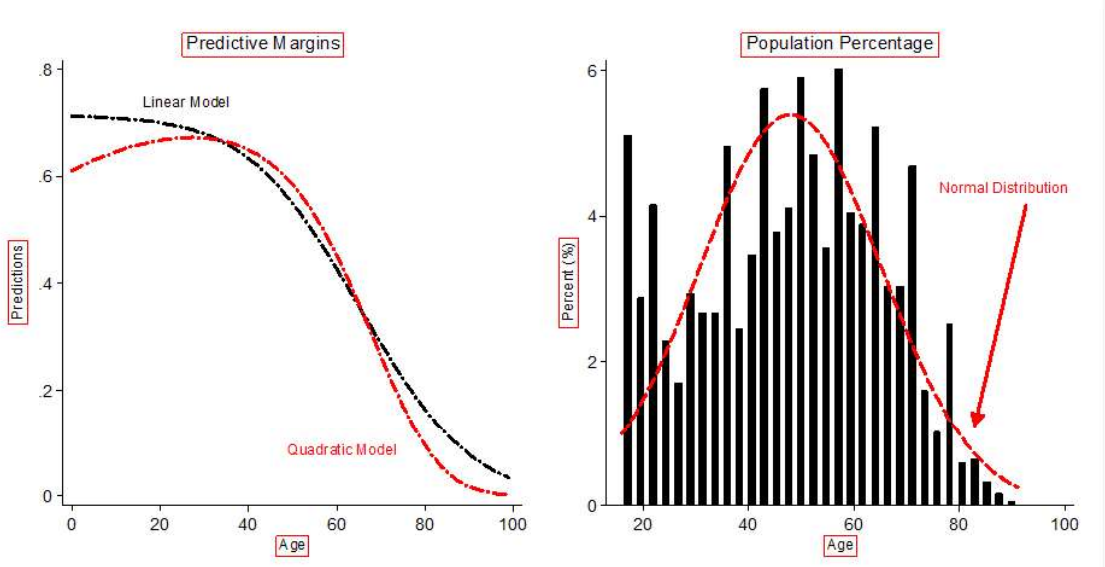

Figure 2.

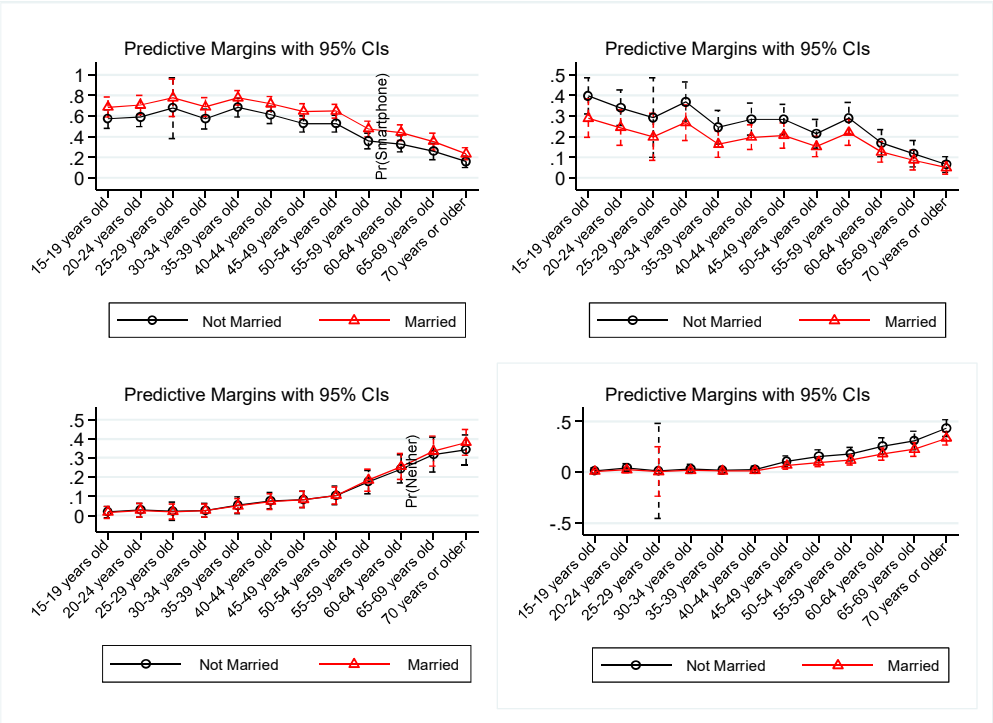

Figure 3.

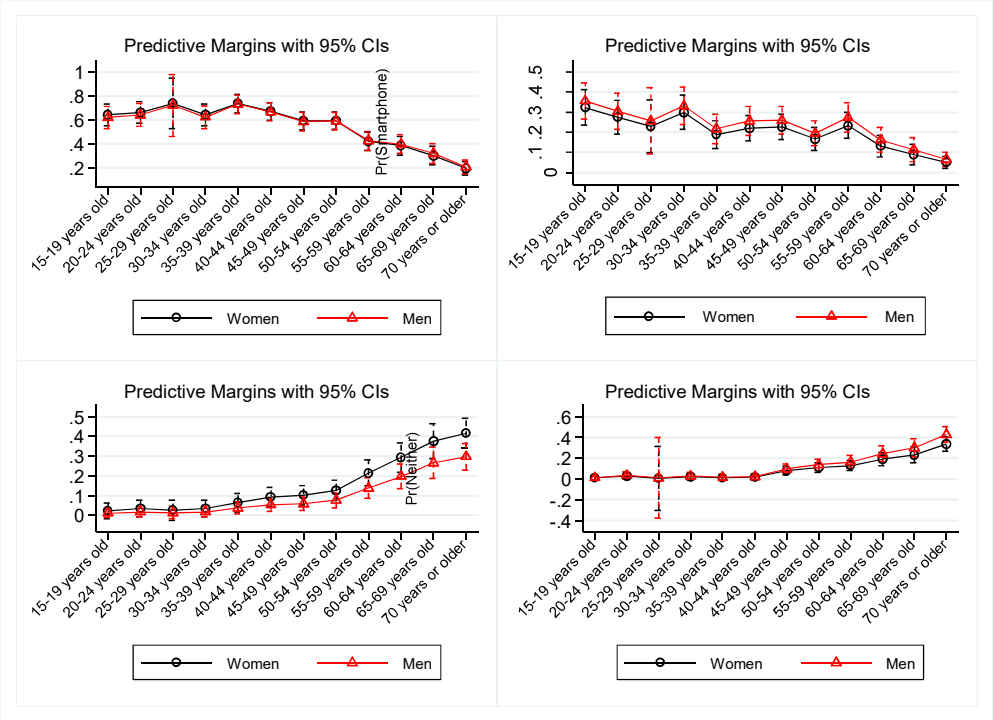

Figure 4.