The Moderating Effect of Privacy and Personalization in Mobile Banking: A Structural Equation Modeling Analysis

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Abstract
Over the last decade, bank industry has made a significant investment on mobile banking (MB) as an innovative tool with an expectation that MB services are being frequently used and increasing customer satisfaction. While the focus has been on increasing MB adoption, banking research shows more value is generated with frequent and continued usage of MB services, an area that has been given little attention. We develop a research model that integrates privacy and personalization with satisfaction and technology acceptance model (TAM) factors to address this gap. Using a sample of 486 MB customers from a US local bank, our regression results reveal that perceived usefulness and perceived ease of use are significant predictors of satisfaction, which lead to continued usage of MB. However, the interaction effects used in our model show statistical significance for privacy while not for personalization. Limitations and practical implications are discussed.

Keywords
Mobile banking (MB), perceived usefulness, perceived ease of use, privacy, personalization, adoption, continued usage intention of MB, TAM, and ECM.

Introduction
Mobile banking (MB) is considered a strategic service by banks today to build customer loyalty and increase customer retention. A study by Bain&Co shows meteoric rise of MB, with roughly 35% of bank interactions in U.S., and 30% of bank interactions globally are conducted through MB, a surge of 19% from 2013 (Ahmad et al. 2014). MB has, thus, become a dominant mean for consumers to interact with their banks. MB refers to the use of a mobile device (e.g. smartphone or tablets) to perform interactions with banks, such as checking balance, transferring funds, and others. Today, more bank interactions are handled through MB than ATM or bank branches due to the tremendous economic benefits. Digital transactions cost about 17 cents each, compared with 85 cents for ATM transaction and $4 for a branch
transaction (Fiserv, 2014). Banking industry has responded with big investments in mobile-IT to increase MB adoption and sustained usage because “high-intensity” users tend to be 1.7 times more profitable for the banks (WSJ, 2014). Both adoption and continued usage of MB increase with higher levels of interactivity, ease-of-use, customer satisfaction and other factors (Yu & Fang, 2009).

Academic research has mainly focused more on MB adoption (Riquelme & Rios, 2010; Koenig-Lewis et al. 2010; and Lin, 2011), rather than on the continued usage of mobile banking (CUMB). However, banking research shows more economic value for CUMB. Payoffs are higher when customers interact frequently and stay connected with the bank, as they purchase more services, thereby generating more revenue for banks (Fiserv, 2014 & Ahmad et al. 2014). The focus of this research is on the determinants of CUMB. Five factors were found as key contributors for continued acceptance of MB - 1) usefulness, 2) easily accessible, 3) highly secure 4) familiarity and 5) easy to use - by a banking industry study (Fiserv, 2012). Usefulness and ease of use have been widely used in MB adoption research through the use of technology acceptance model or TAM (Chung & Kwon, 2009; Sun & Jeyaraj, 2013). Usefulness and easy to use are critical for MB adoption. Bank consumers like easy login, intuitive layouts, navigation and quick response times with shorter learning curve all possible with MB. In addition to usefulness and easy to use, we also explore two factors privacy and personalization on CUMB.

Privacy is about individual rights to protect personal information from service providers. Consumers have cited privacy as major reason for not using mobile payment systems (Ahmad et al. 2014) For example, 51 percent of healthcare executives found data privacy as the biggest barrier to EMR adoption, according to a survey of 144 executives and managers in the healthcare industry in 23 countries (Klotz, 2015). Privacy fears affect consumer behavior when using mobile devices with real-time tracking features (Keith et al. 2013) and are major inhibitor in their acceptance by consumers (Xu et al. 2011). Recently, Federal Trade Commission (FTC) has issued a warning calling for better privacy protection for mobile device users with a primary focus on banking & financial data1. Banks that address privacy concerns with better communication and awareness will have higher MB usage (Fiserv, 2014). Therefore, it is important to include privacy effects on CUMB.

Personalization involves customizing the user interface and graphics to each users’ need. Research shows that apps with personalization capability increase customer satisfaction, loyalty, continued usage and a higher return on investment for the banks (Fiserv Report, 2012). Personalized MB applications require use of customer profiles, customer preferences, prior usage data of MB service and social media data. This information is collected explicitly by asking the user or implicitly by monitoring users’ behavior (Kobsa, 2002). Personalization increases adoption and sustain continued usage of IT (Park, 2014). However, information collection process can restrain usage of IT (Dhar & Varshney 2011) and this creates conflict between personalization and privacy. This personalization-privacy paradox is prominent in mobile application industry due to a one-on-one relationship between the device and user. Mobile location-tracking services are great resource for personalized service but privacy restrictions limit sharing personal information with third parties (Sutanto et al. 2013). This suggest both personalization and privacy could have an impact on CUMB.

Consumer satisfaction, as mentioned in extant research, plays a key role on CUMB. A FICO survey of U.S. bank customers in 2014 found 82% of MB users are satisfied with their bank compared to 71% of non-MB users.2 Satisfaction is a critical determinant of CUMB due to consumers’ sensitivity towards switching cost (Hsu, 2014). Consumers that are satisfied with existing MB services do not switch to competing services according to the rational decision making perspective (Kim & Gupta, 2009) or satisfaction has a positive impact on continued usage of mobile users (Hsu, 2014). Similarly, another study found MB usage was positively related to satisfaction which in-turn was positively related to customer loyalty (Masrek et al. 2012).

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In this study, we examine CUMB by integrating factors from the TAM (Davis, 1989) with Park’s model (2014) and add the privacy and personalization as moderating factors. Our model was tested with 486 MB-users from a local bank, found that usefulness and ease-of-use are significantly related to user satisfaction, which in turn influences continued usage of MB. Although privacy was found to have a moderating effect, personalization was not. The rest of this paper is structured as follows; related work in section two, research model and hypotheses development in section three, research method in section four, data analysis and results in section five, discussion in section six, and limitations and conclusion in section seven.

Related Work

Mobile banking (MB) adoption has been given a considerable attention in prior research (Wang et al. 2006; Koenig-Lewis et al. 2010; Riquelme & Rios, 2010; Shen et al. 2010 & Lin, 2011) while MB post-adoption (or continued usage intention) has been overlooked. However, several studies which have investigated post-adoption in other mobile contexts have been reviewed here (Table 1).

<table>
<thead>
<tr>
<th>Authors</th>
<th>Theoretical Lens</th>
<th>Impacting Factors</th>
<th>Target IS</th>
<th>Sample Analyzed</th>
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<tbody>
<tr>
<td>Hong et al. (2006)</td>
<td>Expectation confirmation model (ECM) and Technology acceptance model (TAM)</td>
<td>Perceived usefulness, perceived ease of use, and satisfaction</td>
<td>Mobile internet</td>
<td>1,826 participants</td>
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<tr>
<td>Thong et al. (2006)</td>
<td>ECM and TAM</td>
<td>Perceived usefulness, perceived ease of use, perceived enjoyment, and satisfaction</td>
<td>Mobile internet</td>
<td>811 participants</td>
</tr>
<tr>
<td>Kang et al. (2009)</td>
<td>ECM</td>
<td>Past use, perceived usefulness, perceived enjoyment, satisfaction, self-image congruity, and regret</td>
<td>Social network service</td>
<td>349 participants</td>
</tr>
<tr>
<td>Yu &amp; Fang (2009)</td>
<td>None</td>
<td>Security, interactivity, relative advantage, ease of use, interface creativity, and satisfaction</td>
<td>Mobile banking</td>
<td>458 participants</td>
</tr>
<tr>
<td>Boakye et al. (2012)</td>
<td>Expectation confirmation theory and TAM</td>
<td>Perceived usefulness, perceived ease of use, and satisfaction</td>
<td>Internet-enabled mobile phone service</td>
<td>189 participants</td>
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</table>
Table 1. Summary of Prior Work on Continued IS Usage Intention

A summarized review of prior research presented in Table 1 reveals that CUMB has not been studied by the research community. Considering the importance of this factor, as discussed in our introduction, our research model will study the effect of perceived usefulness, perceived ease of use, privacy, personalization, on satisfaction to observe its impact on CUMB. In addition, Sutanto et al. (2013) addressed personalization-privacy paradox for IS usage, which they referred to as “a personalized, privacy-safe application” solution to increase satisfaction for Smartphone users. Our study contributes to MB domain by examining the affect of privacy and personalization on the satisfaction and CUMB. These factors were used in our study because they:

1. were highlighted by many IS researchers (Davis, 1989; Wang et al. 2006; Hong et al. 2006; Jahangir & Begum, 2008; Chang et al. 2011 & Tong et al. 2012), hence, they are well-established and reliable indicators,
2. were used specifically to predict satisfaction and IS continued usage (Davis, 1989; Hong et al. 2006; Chang et al. 2011 & Tong et al. 2012), which make them a better fit in our conceptual model, and
3. can further our understanding about CUMB. Privacy and personalization are related to MB customers, who also strive for a personalized experience, while safeguarding their personal information.
Research Model and Hypotheses Development

In this section, we have develop a research model to explain the relationship between various factors that affect CUMB, specifically the moderating role of privacy and personalization, and provides a rationale for our hypothesis.

Research Model

Figure 1 explains our research model which integrates two factors—perceived usefulness and perceived ease of use—from the TAM model (Davis, 1989) with two factors—satisfaction and personalization—from the Park model (2014). Park model’s switching cost factor is replaced with privacy factor, as the latter was determined as playing a more crucial role on satisfaction (Chang et al. 2011). Drawing on prior research, we state that both privacy and personalization can play a positive moderating role on satisfaction, which in turn serves as a mediating factor to CUMB (Bansal et al. 2008 & Thongpapanl & Ashraf, 2011). Thus, our research model has perceived usefulness and perceived ease of use as independent variables, while privacy and personalization as independent and moderating variables, and satisfaction and continued MB usage intention as dependent variables.

Perceived Usefulness (PU) and Perceived Ease of Use (PEU)

In MB context, perceived usefulness assesses to what extent MB can improve conducting banking services, while perceived ease of use assesses to what extent MB can be perceived as user friendly (Davis, 1989). TAM is based on the theory of reasoned action (TRA) (Davis et al. 1989) and is often used by IS researchers to determine behavioral intention and actual use based on PU and PEU (Taylor & Todd, 1995). These two factors found to play a major role in determining satisfaction in contexts similar to MB. Bhattacherjee (2001) suggested that there is a positive relationship between perceived usefulness and satisfaction in online banking whereas Hong et al. (2006) suggested that there is a positive relationship between perceived ease of use and satisfaction in mobile internet. In the context of online university, Joo
et al. (2011) found both perceived usefulness and perceived ease of use are positively related to satisfaction. Also, there was empirical support of these relationships in the work of Lee & Park (2008). Thus, we hypothesize that:

**H1:** Perceived usefulness is positively related to customer satisfaction.

**H2:** Perceived ease of use is positively related to customer satisfaction.

### The Moderating Role of Privacy

Privacy is defined as “the ability of the individual to control when, how, and to what extent his or her personal information is communicated to others” (Hong & Thong, 2013). Privacy could be an important influencer on IT usage. Mobile users usually show their privacy concerns when interacting with online products or services (Sutanto et al. 2013), thus, privacy could be perceived as an important factor to satisfaction of MB users. Several contexts similar to MB demonstrate the relationship between privacy and satisfaction, for example online gaming (Chang et al. 2011) and online store (Dharmesti & Nugroho, 2013). It was found that privacy can indirectly influence post-adoption of mobile banking (Yu & Fang, 2009). This indicates associating MB with a good privacy can generate trust and satisfaction, which in turn leads to continued usage of MB (Zhou, 2012). However, privacy was shown to be a moderating factor in a number of other milieus, including but not limited to e-commerce and health (Bansal et al. 2008). Thus, we believe that privacy can be a predictor and a moderator to MB satisfaction:

**H3:** Privacy is positively related to customer satisfaction.

**H3.1:** The higher level of privacy, the greater positive relationship between perceived usefulness and customer satisfaction.

**H3.2:** The higher level of privacy, the greater positive relationship between perceived ease of use and customer satisfaction.

### The Moderating Role of Personalization

Personalization considers providing tailored services to MB users based on their behaviors and preferences (Xu, et al. 2011). MB personalized services can increase efficiency and effectiveness of interaction with MB services, hence, they could lead to higher satisfaction among MB users. In the related prior research, personalized services found to determine the level of satisfaction among Internet banking users (Tong et al. 2012). Additionally, personalization was found to significantly moderate customer satisfaction in online retailing environment (Thongpapanl & Ashraf, 2011). According to Wang & Groth (2014), service personalization can moderate customer satisfaction in employee-customer relationship setting. Therefore, we believe that personalization can be a predictor and a moderator to MB satisfaction:

**H4:** Personalization is positively related to customer satisfaction.

**H4.1:** The higher level of personalization, the greater positive relationship between perceived usefulness and customer satisfaction.

**H4.2:** The higher level of personalization, the greater positive relationship between perceived ease of use and customer satisfaction.

### Customer Satisfaction and Continued Usage Intention of Mobile Banking (CUMB)

Bailey & Pearson (1983) defined customer satisfaction as “Satisfaction in a given situation is the sum of one’s feelings or attitudes toward a variety of factors affecting that situation” while Bhattacharjee (2001) defined continued MB usage intention as the intent to continue using MB after the initial acceptance. Although this definition is for online banking, it could be extended to mobile banking since both are similar in providing the user with online channel to conduct banking transactions. Reasonably speaking, when customers are content and satisfied with MB, they will have a high tendency to continue using it. According to Delone & Mclean (2003) and Petter et al. (2013), customer satisfaction can play a major role in determining IS usage intention and even it can mediate the relationship between perceived usefulness
and perceived ease of use and IS usage intention (Hong et al. 2006). Also, Bhattacharjee (2001) predicted that customer satisfaction leads to continued IS usage in online banking, which is analogous to mobile banking. As MB is perceived to be IS, we hypothesize that:

**H5:** Customer satisfaction is positively related to CUMB.

## Research Method

### Study Sample

Our data were collected from a local bank's customers in the U.S. via an online survey. A 7-point, Likert-type scale was implemented to measure the survey items with a range of 1, "strongly disagree" to 7, "strongly agree". After approval from our campus IRB office, an invitation was sent by the bank to about 5,839 customers using online banking services. Survey participation was voluntary with an incentive from the bank to donate $1,000 to a charity organization for completing the survey. This survey remained open for a month and two follow-up reminders were sent by the bank. Our data collection approach proved successful as 939 customers responded (16% response rate). No identifying information were collected and survey data was kept confidential and secure, as per our IRB guidelines. Due to critical missing data, our sample got reduced to 851 valid respondents. We included both users and non-users of MB, but our research analysis focuses on MB users only (486 participants).

### Survey Design

The survey items were assessed for content validity first by subject matter experts, and later for face validity through an online pilot survey with 130 internal bank customers. Pilot survey respondents were asked to comment on clarity and understandability of the questions at the end of survey. Pilot study helped us revise the survey making it more clear and understandable before this final survey was sent to all online customers of the bank (excluding any internal customers used in pilot).

### Items Adaption and Analysis

Our survey constructs and items (Table 1) were adapted from literature in a comparable area. Perceived usefulness and perceived ease of use were adapted from Davis (1989). These two factors showed to have a composite reliability of 0.94 and 0.89, respectively. Privacy was adapted from Hong & Thong (2013) and personalization was adapted from Xu et al. (2011). Privacy and personalization showed to have a composite reliability of 0.88 and 0.93, respectively. Customer satisfaction was adapted from Fornell et al. (1996) and Thong et al. (2006). Continued MB usage intention was adapted from Bhattacharjee (2001) and Hong et al. (2006). Satisfaction and continued IT usage intention showed to have a composite reliability of 0.92 and 0.85, respectively.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Item</th>
<th>Citation</th>
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<tbody>
<tr>
<td>Perceived Usefulness</td>
<td>PU1: Overall, I find mobile banking to be useful.</td>
<td>Davis, 1989</td>
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<td>PU2: Using mobile banking improves my performance in conducting</td>
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<td></td>
<td>financial transactions.</td>
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<td></td>
<td>PU3: Using mobile banking enables me to process financial transactions</td>
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<td>quickly.</td>
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<td></td>
<td>PU4: Using mobile banking enhances my productivity with financial</td>
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<tr>
<td></td>
<td>transactions.</td>
<td></td>
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<tr>
<td>Perceived Ease of Use</td>
<td>PEU1: Overall, I find mobile banking to be easy to use.</td>
<td>Davis, 1989</td>
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<td>PEU2: Mobile banking is easy for doing what I want to do.</td>
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<td>PEU3: My interactions with mobile banking are clear and understandable.</td>
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<td></td>
<td>PEU4: Interaction with mobile banking app is flexible (on any device).</td>
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<td></td>
<td>PEU5: It is easy to become skillful at using mobile banking.</td>
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Effect of Privacy and Personalization on MB Continuance

Privacy
PY1: I am concerned that when I give personal information to mobile banking for some reason, the bank would use the information for other reasons.
PY2: I am concerned that my information could be breached when using mobile banking.
PY3: I am concerned that my information could be shared or sold when using mobile banking.

Personalization
PR1: Mobile banking provides me with personalized services tailored to my needs.
PR2: Mobile banking provides me with more relevant information tailored to my preferences.
PR3: Mobile banking provides me with more convenient services that I like.

Customer Satisfaction
CS1: Overall, I am satisfied with my mobile banking experience.
CS2: Mobile banking experience meets my expectations.

Continued Usage Intention of MB
CUMB1: I intend to continue using mobile banking services in the future.
CUMB2: I intend to continue to use Enterprise Bank’s mobile banking rather than seek out other banks for a better mobile experience.
CUMB3: I intend to increase my use of various services provided by mobile banking in the future.

Table 2. Construct Operationalization

Table 2 below summarizes the demographic characteristics of our sample. The inconsistency of sample size between columns can be noticed. For example, we have 486 valid respondents filling out questions related to our construct items but not all those respondents filled their demographic information; thus, Table 2 shows only 466 as MB-users. Participants’ demographic information were analyzed; most of the respondents were full-time employed and females with 48.7% and 54.2%, respectively. Also, most of them are college degree educated (32.6%) and aged between 56 and 65 (27.8%).
Data Analysis and Results

Data were analyzed for convergent validity and discriminant validity to determine whether the items are reflecting their relevant constructs and the independence of these constructs. Table 3 shows factor loading for each item, communality, composite reliability (CR), average variance extracted (AVE), internal consistency (Cronbach's alpha) and variance inflation factor (VIF) for every factor. All item loadings are good (0.6 or greater) on their corresponding factor. This suggests that the items are relevant, non-redundant and form independent constructs. Communality for each item is greater than 0.5 which denotes that items share common features except for CUMB3 which was 0.5. All CRs and AVEs are greater than 0.7 and 0.5, respectively, which indicates a good convergent validity (Zhou, 2013). Alpha values are greater than 0.7 for all factors; they are also associated with a total Cronbach's alpha of 0.914. In general, all our factors demonstrate good reliability (Zhou, 2013). VIF for all factors is smaller than 5 which indicates there is no collinearity between variables.
Effect of Privacy and Personalization on MB Continuance

Table 4. Quality Criteria

Table 4 lists the means, standard deviations, the square root of AVEs in bold and factor correlations. It is notable that the square root of AVE for each factor has considerably a greater value than other correlation coefficients of the same factor. Hence, discriminant validity was acceptable (Fornell & Larcker, 1981).

Using SmartPLS, which is immune to violation of normality assumption (Ram et al. 2013), our model hypotheses were tested with path coefficients of the Partial Least Squares (PLS) model. We have two independent variables: perceived usefulness (PU), perceived ease of use (PEU), privacy (PY) and personalization (PR), two moderating variables: privacy and personalization, and two dependent variables: customer satisfaction (CS) and continued usage intention of MB (CUMB). Figure 1 visualizes all hypotheses with items loadings, path coefficients and variance explained in our model.
Table 5 shows that perceived usefulness (β=0.274, p<0.05) and perceived ease of use (β=0.582, p<0.01) are significant predictors of customer satisfaction while privacy (β=0.027, p>0.05) and personalization (β=0.002, p>0.05) are not significant in the regression model. Thus, H1 and H2 are supported while H3 and H4 are not. For interaction effects, privacy was found significantly moderating both perceived usefulness (β=0.109, p<0.05) and perceived ease of use (β=0.095, p<0.05) whereas personalization was not found to have any significant effect. Thus, H3.1 and H3.2 are both supported but H4.1 and H4.2 are both not supported. Privacy showed a negative sign because we haven’t reversed the question code. However, customer satisfaction is positively related to continued usage of MB (β=0.677, p<0.01), thus, H5 is supported.

Table 6. Regression Analysis
Discussion

Our results indicate that perceived usefulness and perceived ease of use are more important than privacy and personalization as determinants of customer satisfaction. However, privacy is found to significantly moderate the relationship between perceived usefulness and satisfaction and between perceived ease of use and satisfaction. In addition, satisfaction is considered a predictor of CUMB.

Our findings of perceived usefulness and perceived ease of use are consistent with prior research. According Lee & Park (2008) and Joo et al. (2011), satisfaction is positively related to both perceived usefulness and perceived ease of use. However, our data indicated that privacy is not related to satisfaction; this relationship was supported in the work of Tomovska–Misoska et al. (2014) and Alawneh et al. (2013) while not supported in the work of Dharmesti & Nugroho (2013) and Chang et al (2011). Also, our analysis suggests that personalization does not affect satisfaction; this relationship is confirmed by Thongpapanl & Ashraf’s (2011) and Wang & Groth’s (2014) findings but opposed by Park’s (2014) findings. Our conclusion regarding CUMB supports the findings of Bhattacherjee (2001) and Hong et al. (2006) who also found a positive relationship between satisfaction and continued IS usage intention.

Customers who perceive that the current services provided by MB can improve their productivity and performance (usefulness) and can increase their flexibility and agility (easiness), they show a higher level of satisfaction, which means that they have a higher tendency to continue using MB in the future. Our concern about the relationship between usefulness, ease of use, privacy, and personalization and CUMB is central to our discourse, but in general, satisfaction is heavily weighted among customers as it can have a huge impact on their loyalty and retention (Fornell et al. 1996). However, privacy may increase the relationship between usefulness and satisfaction and between easiness and satisfaction. This indicates that enhancing the privacy level by making customers less concerned about breaching and sharing issues can lead to a higher satisfaction level.

We can attribute several reasons from our finding on why privacy and personalization are not significant. First, although privacy is well addressed and investigated in MB, some customers are still concerned about their information accessed or shared by a third party. Second, the surveyed customers have not provided with any options to personalize their MB experience. Third, both of privacy and personalization may not have given a considerable attention by the customers. In other words, their focus was on efficient and flexible performance of their banking interactions without giving much thought to the aspects of privacy and personalization. Lastly, this situation could be considered as a personalization-privacy paradox (Sutanto et al. 2013); as customers push for more privacy, they will be provided with less personalized services, hence, it is a trade-off case.

Conclusion

Following are some limitations of our study. First, it has examined only the impact of four variables but the IS domain is rich with relevant factors that may be regarded as determinants of continued usage of MB. Second, although we have a good sample size, it was obtained from one bank and in a single time (cross-sectional sample), which gives us a limited scope to interpret our results. This interpretation could be extended to other US mid-sized banks with similar customers, however, the findings may not be generalizable to all bank customers. Thus, we recommend further research in this area by including several banks to enhance the generalizability of the results. Third, this study suggests association between the investigated variables and does not claim to propose a causal relationship. This can be addressed in future research through cause-effect design or longitudinal research as it might have the capability to leverage the knowledge and understanding of this phenomenon and to provide deeper insights. Fourth, the survey is considered a self-reported data, which sometime conveys unnoticed bias. For example, some customers may be pleased with the bank services or personnel and hence, gave them highest ratings.

In the light of our findings, banks should address personalization with better data collection and analytics on consumers while respecting the privacy concerns raised by the customers, while at same time look for better and easy ways for them to complete financial transactions. This will improve their MB services and increase trust and confidence of the customers in MB. Contributions from our study are two-fold. First, it reveals the effect of privacy and personalization on continued usage in MB. Second, it unfolds practical implications for banks on how to improve their MB services for increased customer loyalty and usage which nets more profits to the banks, as indicated by the banking industry studies (Ahmad et al. 2014).
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