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Age and Income Moderation on Adoption of Mobile Payments in Brazil

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Resumo

The objective of this work is to measure the effects of performance expectations, effort expectations, social influence, risk, and perceived cost in the intention of using mobile payment systems, and how Age and Income moderate these relationships, for a sample of 1742 Brazilian users. The research data were analyzed using the Partial Least Squares Structural Equation Model. All the proposed latent variables are significant, with Income moderating positively the performance expectation and negatively moderating the perceived cost and perceived risk. Age moderates positively performance expectation and negatively the cost perception. In this way, it is possible to generate segmented communication and engagement plans for users of different income and age to seek to maximize the intention of adopting use by companies operating in this market.

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ABSTRACT

The objective of this work is to measure the effects of performance expectations, effort expectations, social influence, risk, and perceived cost in the intention of using mobile payment systems, and how Age and Income moderate these relationships, for a sample of 1742 Brazilian users. The research data were analyzed using the Partial Least Squares Structural Equation Model. All the proposed latent variables are significant, with Income moderating positively the performance expectation and negatively moderating the perceived cost and perceived risk. Age moderates positively performance expectation and negatively the cost perception. In this way, it is possible to generate segmented communication and engagement plans for users of different income and age to seek to maximize the intention of adopting use by companies operating in this market.

Keywords: Mobile Payments; UTAUT; Technology Adoption

1 INTRODUCTION

The use of electronic payments methods is on a rise in Brazil. From 1994 to 2019, after the Plano Real, economic stability and income growth lead to a faster rate of use of banking services among the population. The growth of electronic payments methods in Brazil can be demonstrated by its adoption: as of 2018, the use of cards already surpassed the use of cash and checks in Brazil as per ABECS (2019).

Not only the use of payments by cards grew on the physical world. In Brazil we can observe among credit card owners, the use of these electronics payments' methods for online transactions. A survey carried by Brazilian association of Cards and Services Companies (ABECS) in 2019 demonstrated that for credit card owners in cities with more than 100.000 inhabitants, almost 80% do use it for online purchases in websites, marketplaces, and app stores and 63% do perform these using their mobile phones.

According to Dahlberg (2008), mobile payments differ from online payments made with smartphones when they are performed using either wireless or other communications technology that is specific to mobile devices. This type of payment method thus is leveraged by the conjunction of growth in the credit and debit cards combined with the now widely adopted smartphone.

According to Euromonitor (2017) mobile payments are expected to reach US$ 3 trillion in purchase volume by 2021 rising to 11% of all payments up from 5% in 2016.

1.1 OBJECTIVES

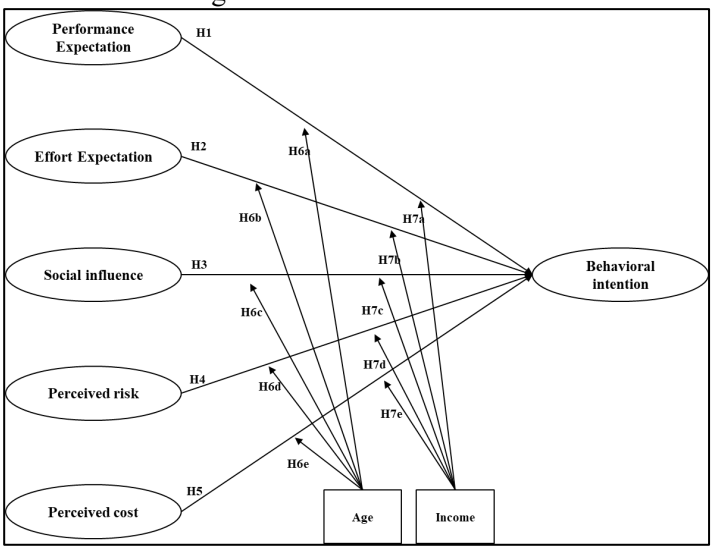
The main objective of this work is to measure how different types of consumers, classified by age and income, develop their adoption behavior regarding mobile payments in Brazil.

The study will use a theoretical model based on the UTAUT theory, adapted for use with mobile payments in Brazil by Abrahao *et al* (2016). This model is comprised by five main variables that will be studied against moderation of Age and Income to measure Behavioral Intention with the hypotheses to be found in Figure 1:

- **Performance Expectation**: How much consumers perceive the technology is useful for realization of their activities?
- **Effort Expectation**: What is the degree of easiness of use for the technology?

- **Social Influence**: What it the degree that others' opinions exert on user attitude towards technology?
- **Perceived Risks**: What are the perceived risks, either financial, social, psychologic, physical, or temporal related to the use of technology?
- **Perceived Costs**: What is the impact of potential acquisition, transaction, or subscription for using a technology?

Figure 1 - Theoretical Model



Source: Author, adapted from Abrahao *et al*. (2016).

2 LITERATURE REVIEW

The topic of mobile payments first gained momentum in 2000, when the first initiatives to make purchases of goods or contents via mobile devices, mainly mobile phones, was made possible by the introduction of functionalities such as mobile based internet banking as well as SMS based authorization methods. As per Dahlberg (2008) there were hundreds of initiatives on mobile payments in Europe in the early 2000s with most of these initiatives decommissioned as of 2007.

The defining characteristic of technology adoption models to be discussed in this document is that these models employ intention to use or actual use as the dependent variable and the role of different sets of determinant variables and/or moderators for the intention or actual use (VENKATESH, 2003).

Venkatesh and others worked to continually test and evolve the TAM model that later formed basis to the TAM2 model (VENKATESH; DAVIS, 2000) which had additional dimensions that went on to increase the rate of variance in user intentions.

Later Venkatesh (2003) proposed another evolution, based on characteristics of eight different technology adoption frameworks, that resulted in the creation of the United Theory of Acceptance and Use of Technology (UTAUT). The main benefit of the UTAUT model is to summarize the models into four determinants of usage and intention, to be moderated by up to four variables.

The moderating effects of Gender, Age and Income are also suggested by the research of Shafinah (2013) regarding to intention of use of mobile payments specifically. The moderating effects of Gender, Age and Income are part of the original UTAUT model, with its inclusion on this current research supported by robust evidence.

In conclusion the adapted UTAUT model was chosen for this study mainly due to its simpler structure, overall robustness, and original prevision for the existence of moderating variables, allowing for the focus on the potential findings for the mobile payments market in Brazil rather than directing the effort on using a less validated measurement instrument.

3 METHODOLOGY

Research was based on the scale used by Abrahao (2016) with adaptations on the text consisting in the provisioning of use examples for simplification purposes. The scale consists of questions that specifically measure each of the analytical model constructs. The questions were answered by the participants either via a 6-point Likert scale, for the construct questions, or via numerical and text-based scales for demographic data collection.

The questionnaire is composed by three main sections: a demographic description of the respondent, from where the information of Age and Income will be obtained, a second section with 23 questions regarding the constructs for adoption model as per Abrahao (2016) and a last section considering the demographic aspects of respondents, from which Age and Income are to be obtained.

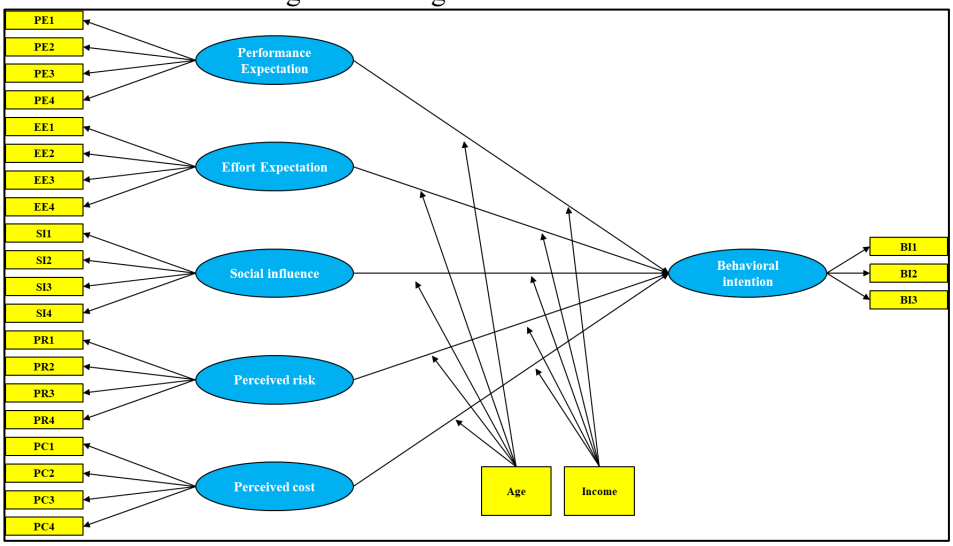
Data was collected via an online questionnaire, containing the research scale, and was rolled out through a sample of users of a payment methods company in Brazil. Sampling was non probabilistic per convenience. The invite to fill the questionary was sent to 100 thousand users of a Brazilian payments company and was available to fulfillment from July 6th, 2020 to July 29th, 2020. During this period, we were able to collect 1780 answers, of which after excluding invalid answers resulted in 1742 respondents.

4 DATA ANALYSIS

The valid sample was comprised of 46% female respondents and 39% male respondents, thus with a slight prominence of feminine respondents. There is a concentration of respondents in the Southeastern region of Brazil, most prominently in the São Paulo State with 48% of respondents. The least represented regions are the Northern and West-Center geographic regions. The age distribution consists mainly of respondents that are in the typical working age, which in Brazil typically falls from 16 to c. 60 years old. The average age for the sample is 34,6 years. The sample yielded respondents in all the proposed income brackets with 47% earning up to R$ 2.090,00 per month.

This study will use the SEM-PLS model to explore fit of a pre-defined set of hypotheses. Given the formative characteristics of the constructs PLS models are preferred. They have been widely used on Marketing research because of its innate ability to combine factors and composites that most truthfully represent consumer behavior (HENSELER, 2015). The reference model can be found in Figure 2.

Figure 2 - Original Structural model



Source: Author (2020).

The analysis followed a two-step approach (MALHOTRA *et al*, 2014). On the first step the questionnaire scale is validated for accuracy and given validity of said scale then the analysis proceeds to the structural modelling of construct variables.

Age and Income, the moderator variables, were dichotomized following the guidelines provided by Vieira (2009). Both variables were divided in two groups using the median value for each one as mid-point. The median of the Age variable is approximately 34 years and the Median for Income is an income up to approximately R$ 2090,00 per month.

For testing the relationships amongst studied variables, first the structural model was tested and validated and then each moderating effect was independently tested against said structural model (HAIR; RINGLE; SARSTEDT, 2013).

All analyses were made using the Smart PLS 3.3.2 software.

4.1 ANALYSIS RESULTS FOR ORIGINAL STRUCTURAL MODEL

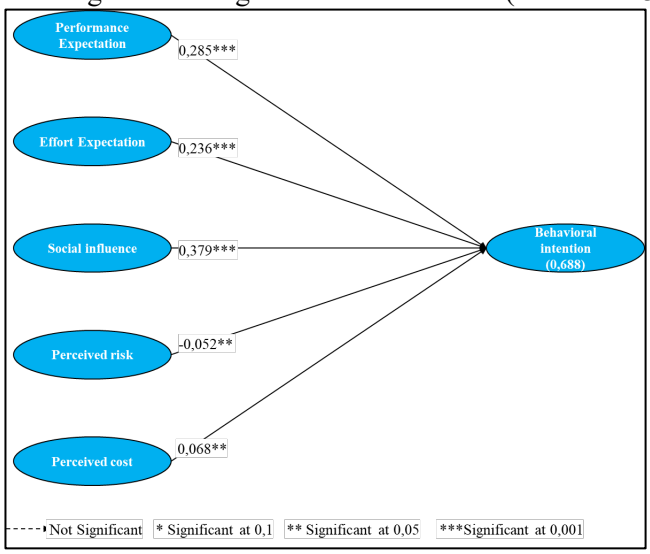
The theoretical path model was ran using the PLS method with Bootstrapping technique to test for the validity of the hypotheses. The bootstrapping consisted in the generation of 5.000 samples (HAIR, RINGLE & SARSTEDT, 2011) and the following results were then analyzed on a 5% significance level.

The Cronbach´s Alpha test for reliability was performed. For the results to be considered valid the results must be ideally larger than 0,7 (HAIR *et al*, 2009). Our model resulted in all values being above 0,8 which validates for reliability. For convergence validation the Average Variance Extracted (AVE) test was performed. The values must be above 0,5 for the validity to be achieved. All the constructs are above the 0,5-value threshold. The test for composite reliability resulted in all constructs on the original model are above the 0,7 threshold (HAIR, RINGLE & SARSTEDT, 2011).

The outer loadings for the constructs were also analyzed. All outer loadings are valid at 5% confidence interval except for question 4 of the Perceived Risk construct.

The model was then analyzed as per statistical significance of the proposed research hypotheses. The summary diagram containing the path coefficients, statistical significance for the paths and outer loads and R2 are shown in Figure 3:

Figure 3 - Path diagram for Original Structural model (SmartPLS 3.0)



Source: Research Data (Smart PLS 3) (2020).

4.2 ADJUSTED STRUCTURAL MODEL

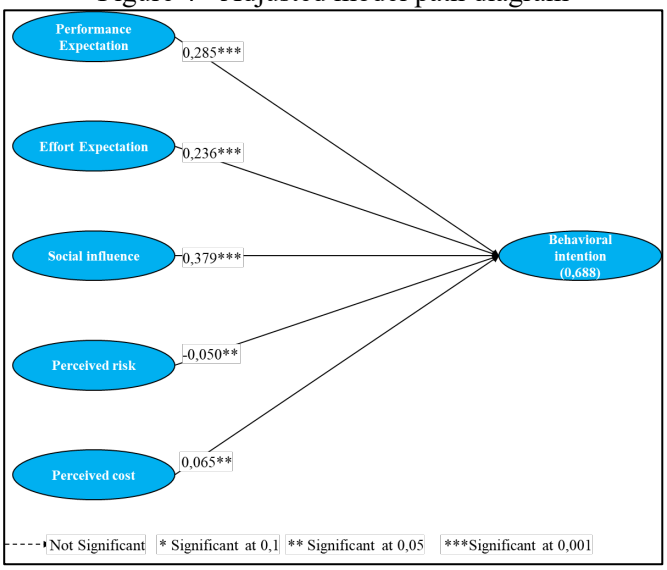
Considering the results of the original model, an adjusted model was tested. In this adjusted model question 4 of the perceived risk construct was removed. The model was then run with the same analysis methods as the original model, using a 5.000 sample bootstrapping (HAIR; RINGLE; SARSTEDT, 2011) technique in Smart PLS 3.3.2 software.

Validity test as per Cronbach´s Alpha have all values above the 0,7-minimum threshold (HAIR *et al*., 2009) and Average Variance Extracted also have all values above the minimum threshold. The test for composite reliability resulted in all constructs on the original model are above the 0,7 threshold (HAIR, RINGLE & SARSTEDT, 2011).

All outer loadings on the final model are above 0,7 (HAIR; RINGLE; SARSTEDT, 2011) and significant at 5% level.

The path coefficients were recalculated, and all the final constructs are validated at a 5% confidence interval and the resulting structural model to be used to test the moderating effects is finally graphically represented in Figure 4:

Figure 4 - Adjusted model path diagram



Source: Research Data (Smart PLS 3) (2020).

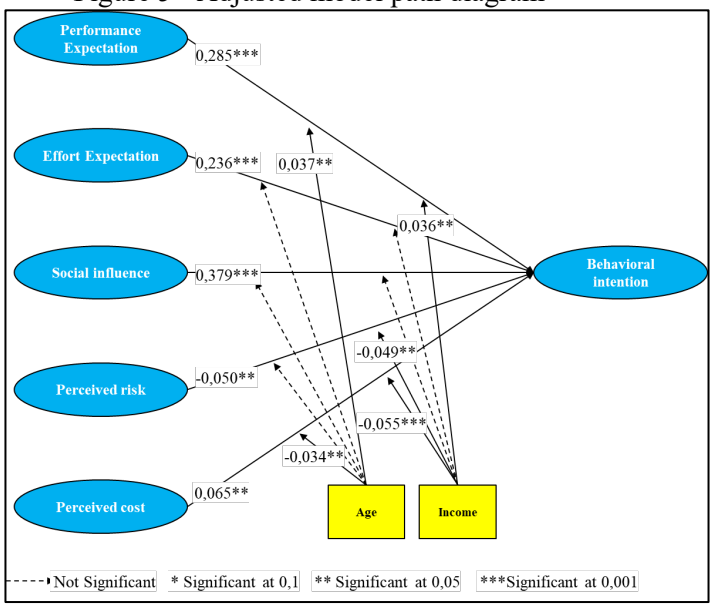
The adjusted model R Squared yields a 0,690 result and is consistent with general guidance on PLS models (HAIR; RINGLE; SARSTEDT, 2011). The F2 test resulted in 2,2275. A blindfolding test was conducted to evaluate the predictive relevance of the structural model. The resulting Q2 of 0,595 denotes an acceptable value per the guidance provided by Hair, Ringle and Sarstedt (2011).

4.3 MODERATING EFFECTS

After accepting the adjusted model, each moderating relation was tested. Each sub-model was then run with the same analysis methods as the original model, using a 5.000 sample bootstrapping (HAIR; RINGLE; SARSTEDT, 2011) technique in Smart PLS 3.3.2.

Hypotheses H6a, H6e, H7a, H7d and H7e were accepted at 5% significance. Figure 5 depicts the final structural model and the moderating effects:

Figure 5 - Adjusted model path diagram



Source: Research Data (Smart PLS 3)

5 DISCUSSION OF THE DATA ANALYSIS RESULTS

5.1 STRUCTURAL MODEL

Our structural model comprised of the 5 variables to understand behavioral intention to use mobile payments as proposed by Abrahao (2016) based on the precepts of the adapted UTAUT was confirmed. Each of the structural model components will be discussed in this section.

Performance Expectation has significant and positive influence on behavioral intention as per predicted by the UTAUT model of Venkatesh at al. (2003) and further demonstrated in studies by Chen (2008) and Oliveira (2016). This finding supports evidence that users consider that the adoption of mobile payments should lead to an increase in their overall efficiency while shopping and paying for their purchases when using mobile payments.

Effort Expectation was found to have significant and positive influence on behavioral intention thus confirming our H1. A higher perceived effort score in our scale means that the user valuates more the value of a simpler application in terms of ease of use thus indicates that the simpler a mobile payments solution seem to the user, the more inclined said user is to to adopt the technology. This finding confirms the model as proposed by Venkatesh *et al*. (2003), by Chen (2008) and several others.

Perceived Risk has significant and negative influence on behavioral intention to adopt mobile payments. Users are usually concerned on information safety and potential fraud risk, and the finding of the significance of perceived risk in our sample follows similar findings from Chen (2008) and Yang (2012).

Social Influence has significant and positive influence on behavioral intention in line with the prevision of the original UTAUT model as proposed by Venkatesh *et al*. (2003). This effect was also relevant in studies from Yang (2012) and Oliveira (2016), with a consideration that social influence is ever increasing in importance give the spread of mobile technology and the social networks amplifying one's own network and exposition to their opinions.

Perceived Cost was not found to be statistically significant at a 5% level on Abrahao (2016). But according to his recommendation to re-test with this dimension, considering potential limitations in his sample, this dimension was included in our hypothesis set. Interestingly, as with his previous finding, the results show a result that is against the hypothesis. Whereas the hypothesis considered that perceived cost had a negative influence on the behavioral intention to adopt mobile payments, our sample yielded a slightly positive relation (+0,075). This finding, although contrary to previous studies on adapted UTAUT for mobile applications, is in line with the direction of the effect found by Abrahao (2016) and Baptista (2015).

5.2 THE EFFECTS OF AGE

The results demonstrate that for our sample the moderation effect of age on Performance Expectation and Perceived Cost are supported whereas there is no evidence to support the moderating effects on the other variables.

Regarding the positive moderating effect of age on performance expectation our study found that the older group needs to perceive increased usefulness to switch to mobile payments than younger users. This can be related to the fact that the older group may have a larger cumulative historic on working with different payment methods and is already more inclined to continue adopting this current method and will migrate to mobile payments only if the perceived use case is strong enough to encourage so. This resonates with findings of

Porter and Donthu (2006) and Liébana-Cabanillas, Munoz-Leiva and Sánchez-Fernández (2015).

We found that income negatively moderates the perception of costs in the intention to use mobile payments when compared to lower income individuals. As studied by Eze (2013) this can be related to elder consumers, already having experienced and having access to multiple payment methods are more able to better evaluate the comparative cost of each method, thus leading to an increased perceived effect on their behavioral intention.

5.3 THE EFFECTS OF INCOME

The overall underlying assumption, in line with the findings by Hernández (2007) was that higher the income the higher the overall likelihood to adopt mobile technologies. One possible explanation is that higher income individuals have means to be early adopters of new smartphones that support better and safer ways to make mobile payments.

Income moderates positively the Performance Expectation construct. This means that higher income individuals do valuate higher performance standards when adopting mobile payments in relation to lower income individuals. This finding is in line with previous studies by Porter and Donthu (2006) and Chawla and Joshi (2018).

This study found a negative moderating effect of income on perceived risk. This finding is counterintuitive since usually higher income individuals experience less technology anxiety than lower income individuals (LEE, 2010) but in our case the risks being measured relate to possible data leaking and financial risks due to fraud and in this case higher income individuals spend more on their purchases and are generally more aware of risk implications.

Income does negatively moderate the Perceived Cost variable in our sample. In the study of Eze (2013) the income did not only moderate the effect of cost perception but when factored made cost perception the second most important factor to their reference model. For Chawla and Joshi (2018) higher income individuals have less time to spare and factor this time cost as being more important as it denotes an increased need for efficiency in their purchasing habits.

6 CONCLUSION

The confirmation of the reference model with the re-tested significance of the perceived cost construct adds another layer of validation to the main literature of mobile payments.

The inclusion of the moderating effects of age and income for Brazilian customers provide and extra component to the literature by adding understanding on how demographic factors change the perception of the general model latent variables while also providing significant insight to companies that are operating in this market.

6.1 LIMITATIONS OF THIS STUDY AND RECOMMENDATIONS FOR FURTHER STUDIES

The first limitation of this study is relative to the use of a non-probabilistic sample for the survey. This characteristic, while allowing for convenience, limits the generalization of its results.

One of the limitations in this non-probabilistic approach relies in the fact that the sample was obtained from users of a single Brazilian company. While the sample size is satisfactory for the statistical analysis, the fact that users were predominantly from the

southeastern region in Brazil leads to a possible further study with users on different Brazilian regions, giving a better understanding of the national population

Adding dimensions such as actual use of the technology and additional moderating effects that were not considered in this context, such as gender and education level, among others can provide a broader perspective on the subject.

At last, since this study is based on a cross-sectional sample that does not include the time variable, the findings could be enhanced by running the research on different time points to study for changings in behavior.

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