Preferences of Public Transport Passengers Towards Contactless Card Payments - The Case of Greece

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SHORT SUMMARY

This research aims to evaluate public transport passengers' preferences regarding contactless bank card payments. Data collection was conducted through an online questionnaire with focused questions, completed by 550 commuters. Subsequently, binary and multinomial logistic regression models were developed, which showed that the likelihood of acceptance and use of the new ticket validation system is influenced by convenience, familiarity with contactless payments, demographic characteristics, habits, and passenger's opinions on a modern and digital transport system. As the difficulties in purchasing tickets decrease and payment security is ensured, passengers are more likely to adopt the new payment and boarding system. Those who seek information about the new system are more likely to embrace it, as they recognize its benefits. Access to information and familiarity with contactless payments play a critical role in strengthening their confidence, making them more open to new payment practices, such as using bank cards or digital wallets.

Keywords: public transport, contactless payments, passengers' preferences, logistic regression.

1. INTRODUCTION

The use of contactless payments has emerged as one of the most modern and convenient transaction methods for services and goods worldwide. Public transportation systems should adapt to societal advancements and operate with passenger needs in mind. Integrating contactless payments using smart cards into public transport is essential for making these systems a more attractive and practical option for daily commuting. A brief literature review on the subject highlights the advantages and challenges of contactless payment systems and provides insights into passenger reactions. Results show that these systems have gained widespread adoption in major cities, such as London with the Oyster Card and Paris with the Navigo Card, demonstrating their potential to improve efficiency and user experience in urban mobility (Soehnchen, 2022).

Contactless payment systems using smart cards rely on Near Field Communication (NFC) technology (Henry et al., 2015), QR codes (Jenkins & Ophoff, 2016), and mobile payment applications like Apple Pay and Google Pay (Kagan, 2020). Closed-loop systems, like those found in many public transit networks, operate exclusively within the transportation network, offering a

secure but limited payment option (First Data Corporation, 2010). Open-loop systems, by contrast, allow users to utilize a single card across multiple services and locations, enhancing usability and reducing management costs. These systems support a shift towards cashless transactions, improving safety for transit employees and reducing cash handling risks (Soehnchen, 2022; Blythe, 2004). Furthermore, studies such as those by Chira-Chavala & Coifman (1996) underline the operational and planning benefits of smart cards, which automate data collection for revenue, passenger load, and performance metrics, offering valuable insights for transit authorities at reduced costs. While implementation challenges exist, such as initial costs and coexistence with traditional systems, smart card technology represents a pivotal step in modernizing public transportation.

Based on the above, the aim of the present paper is to evaluate Greek public transport passengers' preferences regarding contactless bank card payments and to identify the factors influencing their acceptance of this payment method. Furthermore, the study will explore the key challenges and issues reported by passengers concerning the potential future use of this system. Specifically, the research will examine the main reasons that lead passengers to either prefer or avoid using contactless payment systems, as well as the role of demographic characteristics, such as age, gender, income, and education level, in shaping their acceptance of these payments.

2. METHODOLOGY

Data Collection

To conduct the research, a specially designed questionnaire was developed to address the study's specific objectives. The questionnaire consists of 14 demographic questions and 20 items focused on gathering information about passengers' commuting habits, modes of transport, concerns, and preferences regarding public transportation and payment methods. The questions were crafted based on insights from the literature, emphasizing factors that influence the adoption of new systems. With an average completion time of under five minutes and clear, concise phrasing, the questionnaire ensured accessibility and high response quality. A total of 550 responses were collected electronically, providing a significant and representative sample of the general population.

Table 1 provides an overview of the demographic distribution within the sample, highlighting variables such as gender, age, education, and income. The gender representation is almost balanced, with 48.91% female and 51.09% male participants. The age distribution shows a strong representation across all age groups, with the largest proportions being 35-44 years (25.09%) and 45-54 years (23.45%), ensuring a comprehensive age range. In terms of education, the sample covers a diverse spectrum, with high school (35.09%) and university graduates (35.27%) forming the majority, complemented by vocational/technical college (9.28%) and postgraduate qualifications (15.45%). Income levels are distributed across three main categories, with 34.91% earning less than €15,000, 35.45% earning €15,000-30,000, and 28.91% preferring not to disclose their income. Overall, the sample appears representative, reflecting a broad cross-section of gender, age, education, and income distributions, ensuring the findings are relevant and generalizable.

Table 1: Summary of Sample Demographics

Categories	Gender	Age	Education	Income
female	48.91%	-	-	-
male	51.09%	-	-	-
18 - 24	-	18.73%	-	-
25 - 34	-	18.91%	-	-

35 - 44	-	25.09%	-	-	
45 - 54	-	23.45%	-	-	
> 54	-	13.82%	-	-	
middle_school	-	-	4.91%	-	
high_school	-	-	35.09%	-	
vocational_technical_college	-	-	9.28%	-	
university	-	-	35.27%	-	
postgraduate	-	-	15.45%	-	
<15.000 €	-	-	-		34.91%
15.000 € - 30.000 €	-	-	-		35.45%
>30.000 €	-	-	-		0.73%
prefer_not_to_say	-	-	-		28.91%

Statistical Analysis

Logistic regression models are used when the dependent variable is distinct. Logistic regression is used to create models for predicting the influence of the presence or absence of certain characteristics in the selection of a particular alternative. In that context, the utility function is defined as a function of the attributes and other factors influencing the respondent's choice regarding their preference for using a contactless bank card within the public transport system.

More specifically, the utility function is defined as a mathematical model that describes the probability of the choice of each individual among alternatives based on the attributes. Based on the utility maximization context, as described by McFadden (1974) and Ben-Akiva and Lerman (1985), the utility of an alternative i (U_i) consists of a systematic part V_i and an error term ϵ, where the systematic part consists of (a) a vector of attributes α with attribute values $Xi\alpha$ for a given alternative i, and (b) their marginal effect on utility $\beta i\alpha$ and an Alternative Specific Constant ASC that captures systematic but non-explained variability in the data:

$$U_i = V_i + \varepsilon \quad (1)$$

Where Vi is given by:

$$V_i = \beta' X_i + ASC_i \quad (2)$$

Both analyses were performed using the R-Studio software, utilizing the glm function for binary logistic regression and the mlogit function for multinomial logistic regression.

3. RESULTS AND DISCUSSION

Binary Logistic Model

The binary logistic regression analysis presented in Table 2 illustrates how different variables influence the acceptance of using a contactless bank card within the public transport system.

Table 2: Binary Logistic Regression Model

Variables	Coefficients	P-Value	Odds Ratio

Intercept	-0.707	0.065	-
Age [45-54]	1.003	0.033	2.73
Marital Status [married/cohabiting with a partner]	0.522	0.048	1.69
Difficulty in purchasing tickets due to lack of bank cards	-0.581	0.033	0.56
Interest in information about bank card payment systems	1.496	<0.01	4.46
Need for information from the bank about new payment methods	-0.801	<0.01	0.45
Ability to purchase tickets without cash	0.824	<0.01	2.28
Positive attitude towards technological innovations	1.333	<0.01	3.79

The analysis highlights key behavioral and demographic factors influencing the likelihood of adopting a new payment system for public transportation. Individuals who do not perceive the lack of card payment options on public transit as a barrier are 56% less likely to use the new system. This suggests that the absence of a pressing need for change discourages their willingness to try novel payment technologies, as they are content with the existing boarding methods.

Conversely, those with a strong interest in technological innovations are 3.79 times more likely to adopt the new system, indicating that technological adaptability plays a critical role in accepting new payment methods. Age also emerges as a significant factor; individuals aged 45-54 are 2.73 times more likely to adopt card-based payments compared to younger age groups. This could be attributed to their appreciation of the convenience and simplicity offered by such systems, alongside greater financial independence and higher card ownership among older passengers.

Marital status further influences adoption rates, with married individuals or those cohabiting with a partner being 1.69 times more likely to use card payments. This may stem from the positive influence of a partner in shaping preferences, fostering greater confidence and comfort in using the new payment method. On the other hand, those expecting guidance from their banks are 55% less likely to use card payments, reflecting a reliance on external support and potential apprehension about security and data protection in public transaction environments.

Lastly, the importance of proper communication and perceived benefits becomes evident. Individuals with a high interest in receiving information about card or digital wallet payments are 4.47 times more likely to adopt the system, underscoring the value of awareness campaigns. Similarly, passengers who view cashless ticket purchasing as an advantage are 2.28 times more likely to transition to card or digital wallet payments, highlighting their appreciation for the convenience of contactless transactions. These findings emphasize the need for targeted strategies to address barriers and promote the benefits of modern payment systems to increase adoption.

Multinomial Logistic Model

This section presents the findings of the statistical analysis on the question regarding whether the use of public transport would change if boarding with a contactless payment card or digital wallet were possible, as part of the survey questionnaire. The available responses were: "I would use PT more", "I would use PT less" and "I would not change my use".

Table 3: Multinomial Logistic Model

Variables	Coefficients	P-Value	Odds Ratio	Coefficients	P-Value	Odds Ratio
	"I would use PT more" option			"I would use PT less" option		
Intercept 1	-0.381	0.308	-			
Intercept 2	-	-	-	-0.561	0.362	-
Marital Status [married/cohabiting with a partner]	0.488	0.037	1.63	-0.939	0.026	0.391
Difficulty in purchasing tickets due to payment barriers	0.471	0.045	1.6	-	-	-
Interest in information about bank card payment systems	1.568	<0.01	-	-	-	-
Speed/convenience in ticket purchases	-	-	-	-1.291	<0.01	0.275
Cashless ticket purchase preference	-	-	-	-0.852	0.049	0.427
Negative attitude toward technological innovations	-0.873	<0.01	0.42	-	-	-

This section interprets the utility functions that analyze the likelihood of individuals increasing or decreasing their use of public transportation based on specific factors. Utility function U1, which represents the choice "I would use public transportation more frequently," includes four variables that influence this behavior. From the odds ratios presented in Table 3, several insights emerge:

Marital status significantly influences the likelihood of increased public transportation use. Specifically, individuals who are married or cohabiting with a partner are 63% more likely to increase their use of public transportation compared to those who are single. This finding highlights the potential impact of household dynamics on the perception and adoption of public transit services.

Interest in information about the new payment and boarding system significantly increases the likelihood of using public transportation more frequently, with these individuals being 4.8 times more likely to adopt such practices. This finding underscores the importance of targeted informational campaigns to foster adoption. Conversely, those unwilling to embrace technological innovations are 58% less likely to increase their transit use, indicating a resistance to change that hinders the shift toward modernized payment systems.

Utility function U2, which represents the choice "I would use public transportation less frequently," highlights also four key factors. Married individuals or those living with a partner are 61% less likely to reduce their public transit usage compared to those living alone. This indicates that the influence of a spouse or partner can enhance confidence and comfort in adopting the new payment system, thus maintaining or even increasing transit use.

Additionally, individuals who perceive the new system as offering faster and more time-efficient ticket purchasing are 73% less likely to reduce their transit use, emphasizing the value of time-saving features. Similarly, those who view the system as providing convenience, particularly in

the absence of physical ticket vendors or during ticket expiration, are 57% less likely to decrease their use. These insights highlight that convenience and efficiency play pivotal roles in maintaining or boosting public transit ridership through the adoption of advanced payment methods.

4. CONCLUSIONS

The findings of this study reveal several factors influencing the adoption of a new payment system in public transportation. Individuals who actively seek information about the new system are more likely to adopt it, highlighting the importance of awareness campaigns. Technological adaptability also plays a critical role, with those open to innovations significantly more inclined to use bank cards or digital wallets. Demographic factors, such as age and marital status, further influence preferences; individuals aged 45-54 and those in partnerships are more likely to adopt the system, likely due to their financial independence and mutual support. Conversely, resistance to technology and satisfaction with traditional systems decrease the likelihood of adoption. These results emphasize the interplay of user characteristics, technological familiarity, and perceived convenience in shaping behavioral intentions.

These findings provide actionable insights for policymakers and transit authorities aiming to promote modern payment systems. Informational campaigns that emphasize the benefits of contactless payments, such as speed, convenience, and flexibility, can encourage adoption. Collaborations with banks to address security concerns and provide clear user guidelines could further enhance trust. Targeted outreach efforts to older age groups and professionals in medium to large enterprises may also yield positive results, as these segments are more receptive to innovative payment methods. Additionally, offering incentives, such as discounts or loyalty rewards for using digital payments, can motivate hesitant users to transition from cash-based transactions to modern systems.

Future studies should expand the scope to include a more diverse population beyond the current sample, encompassing broader geographical and demographic contexts. Longitudinal research is needed to assess how user preferences evolve over time as technological familiarity increases. Exploring the effectiveness of educational programs and promotional campaigns in fostering adoption could provide further practical insights. Moreover, examining the integration of emerging technologies, such as mobile apps and biometric payments, within existing infrastructure could illuminate ways to enhance user experience and system efficiency. Such research will ensure that future innovations align with evolving societal needs and expectations, promoting sustainable adoption in public transportation systems.

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