



What are the determinants in making people free riders in *proof-of-payment* transit systems? Evidence from Italy



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ABSTRACT

Nowadays, in *proof-of-payment* transit systems, fare evasion is provoking strong interest in public transport companies (PTCs) due to the relevant economic losses, social inequity and increased levels of violence affecting personal security. Therefore, there is the need to recognize possible fare evaders. By using 2177 on-board personal interviews, gathered from an Italian PTC, and logistic regression models, we isolate determinants of possible free-rider passengers and, hence, those whom it might be advisable to target in order to capitalize on the effect of the application of countermeasures on fare evasion put forward by the local PTC. We show that males, younger than 26 years, with a low education level, unemployed and/or students and without an alternative mode of transport other than the bus are more probably fare evaders. Moreover, people who make trips of shorter than 15 min, who are systematic users and are not satisfied with the service are possible fare evaders. Finally, we found that a low level of inspection, knowledge of fines and previous ticket violations are determinants which make people more prone to evade fares. These outcomes are very useful, because, to the best of our knowledge, they represent the first empirical contribution showing the determinants which help evaluate the propensity to be a fare evader, in probabilistic terms. Moreover, they could help PTCs understand who might be a fare evader, in order to anticipate suitable countermeasures.

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1. Introduction

Fare evasion occurs when a passenger does not have a ticket or has the wrong one and represents a chronic problem both for massive and collective transport systems (e.g. [Multisystems et al., 2002](#); [Reddy et al., 2011](#)). It is gaining relevance among public transport companies (PTCs) as the number of fare dodgers is well beyond the physical limit that PTCs find acceptable. Fare evasion mainly causes problems due to: lost fare revenues and damage to corporate image, social inequity and low levels of security. Based on data provided by 31 PTCs from 19 states worldwide, representing about 300,000 employees and 20 billion passengers per year, a study estimated that the phenomenon costs PTCs over 1 billion euros per year ([Bonfanti and Wagenknecht, 2010](#)). Moreover, fare evasion is at the root of a social inequity system, aggravating PTCs' subsidization needs and forcing paying passengers to increase their expenditure in order to counteract the financial effects of non-payment by evaders (e.g. [Abrate et al., 2008](#)). In addition, it reduces security levels because the actions employed to tackle it (e.g. increasing the number of inspectors) can trigger violence from fare evaders (e.g. [Bijleveld, 2007](#)).

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The study of fare evasion has mainly attracted scholars of security (e.g. crime) and economy, denoting a little multi-disciplinary scholarship to the argument and often presenting fascinating and different findings. From the *security* point of view, fare evasion can be included in the umbrella of studies that have analysed the application of possible countermeasures to face it. Recent studies have been based on field experiments and they have contributed to shedding additional light on the application of enforcement strategies (e.g. [Bijleveld, 2007](#); [Clarke et al., 2010](#)) or certainty of being caught (e.g. [Killias et al., 2009](#)) and have revealed some trends in fare evasion. In a controlled experiment on trains in the Netherlands, [Bijleveld \(2007\)](#) showed that the standard procedure to recover the cost of the unpaid ticket is more effective than the penalty collection procedure. In a Canadian case study on light rail transit, [Clarke et al. \(2010\)](#) showed that changes in the level of enforcement did not illustrate clear trends in changes in the weekly evasion rates. In a Swiss case study on suburban trains, [Killias et al. \(2009\)](#) showed that the certainty of being caught (i.e. the probability of having one's ticket checked) worked as a deterrent in reducing fare evasion, as well as security on board. From the *economic* point of view, fare evasion can be included in the umbrella of studies that have mainly analysed how to protect PTCs from economic losses. Recent studies have often focused on: (i) establishing the optimum level of inspection (i.e. the number of inspectors); (ii) organizing the scheduling of inspection teams in terms of timing and places; and (iii) evaluating the optimal choices of fare collection systems in public transport. More precisely, some approaches have been proposed concerning (i), such as: the probability of being caught evading the fare compared to the amount of the fine (e.g. [Bootheway, 2009](#); [Kooreman, 1993](#)), the maximization of the PTC's profit (e.g. [Barabino et al., 2013a, 2014](#); [Boyd et al., 1989](#)) and the simulation of a situation where an inspector checks whether a passenger abides by the rules of the game theory (e.g. [Avenhaus, 2004](#)). Looking at (ii), [Yin et al. \(2012\)](#) focused their efforts on analysing the inspection in more rigorous ways, and formulated an optimization model to establish the organization of scheduling inspection teams. In addition, [Borndörfer et al. \(2012, 2013\)](#) and [Correa et al. \(2014\)](#) focused on models for optimizing fare inspection strategies and studied the interaction between fare inspectors and users of a transportation network. Focusing on (iii), [Sasaki \(2014\)](#) provided a mathematical framework to evaluate which can be more profitable for a PTC: barrier or barrier-free fare collection systems.

Generally speaking, fare evasion can be classified according to the broad research on the unethical behaviour of people (e.g. [Gneezy, 2005](#); [Mazar et al., 2008](#); [Suquet, 2010](#)), as it somewhat represents its kind of specification. Very few studies have analysed personal determinants in order to derive the fare-evader "profile" (i.e. detecting determinants of who is more likely to evade the fare). Using an unobtrusive observation methodology, [Eddy \(2010\)](#) collected data on gender and demographic age of 280 people evading fares at Melbourne metropolitan stations, and reported, by using descriptive statistics, that people committing fare evasion are largely male and adult. By a direct measure of the ticket-holder (i.e. tickets and passes, of course), [Abrate et al. \(2008\)](#) and [Buccioli et al. \(2013\)](#) showed some relevant determinants of fare evaders, by using logistic regression models (LRMs). Based on 16,000 observations related to a sample of 12 Italian PTCs, [Abrate et al. \(2008\)](#) isolated a few socio-demographic characteristics of fare evaders. Using the logit model, they showed that the younger, unemployed and foreigners (i.e. not Italian) are the more probable fare evaders. A more refined work is presented in [Buccioli et al. \(2013\)](#). Indeed, they detected the individual determinants that predict unethical behaviour, supporting their argumentations on the topic of fare evasion. They collected data by using a two-step methodology focusing on: (i) basic socio-demographic information gathered by a visual estimate on 541 passengers and, (ii) specific behaviour of the person committing fare evasion gathered by a direct survey of 144 passengers. Using the probit model, they showed that young, male and non-European immigrants in the sample (citizens of Reggio Emilia) are more likely to be fare evaders. Yet, [Mehlkop et al. \(2007\)](#), in the context of the "Theory of Crime", model the utility function related to attitude to tax and fare evasion and link them to categorical determinants. Using a stated preference survey, respondents were asked hypothetical questions on: benefits resulting from evasion, the probability of being an evader, the severity of fines, the probability of being detected, the attitude towards norms and risk-taking. Based on more than 1900 interviews in Dresden and Berne, they showed that the attitude towards evasion is a function of the subject's knowledge of the phenomenon, while neglecting his/her socio-demographic characteristics.

Although all these studies added contributions, two relevant considerations arise. First, fare evasion is often faced focusing on the side of the PTC rather than that of the fare-evader. Indeed, security and economic studies opened doors to analyse the fare evasion issue on the principle of how to face it and/or protect the PTC from economic losses. However, these studies did not recognize who are the fare evaders. Second, no previous research has returned empirical data, in a single study, on the type of people who will probably commit fare evasion and their socio-demographic group, travel behaviour characteristics and personal knowledge of fare evasion. This integrated kind of data is somewhat ignored and missed from the research findings. Indeed, to the best of our knowledge, even if the work of [Buccioli et al. \(2013\)](#) can be considered the more refined study on this topic, it uses few data to evaluate the evader "profile". More important, they begin the analysis starting from caught-evader data and do not evaluate a possible propensity to evade the fare, by a direct question in a hypothetical scenario, even if they recognize the possible interest. On the other hand, [Abrate et al. \(2008\)](#) also began the analysis starting from the caught-evader data and limited their analysis to the socio-demographic characteristics and the purpose of the trip. Besides, they express the need to investigate the link between fare evaders and the firm-specific and enforcement variables, such as the level of inspection and fines. In addition, to the best of our knowledge, most advanced PTCs collect data on fare evaders, but they derive the fare-evader "profile", if any, by manipulating the report on fines, which contains few data about gender, age, and time of detection, while presenting outcomes by descriptive statistics.

Therefore, it is crucial to shed new light on the possible fare-evader "profile", making use of models and statistical data, thus answering the following research question:

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