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Temporal analysis of fare evasion in Transantiago: A socio-political view

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ABSTRACT

Although fare evasion is a common problem in transport systems worldwide, the level of fare evasion experienced in Transantiago is considerably higher than the global average. This study aims to identify how social, political, and cultural components may affect levels of fare evasion experienced to complement and broaden the current research lines.

A longitudinal econometric analysis is performed to determine the impacts of transport system variables (bus fare, ticket inspection, number of paid zones, and quality), macroeconomic variables (unemployment and informal employment), and socio-political variables (Transantiago and government approval, reference to scandals in the media, and general trust/confidence experimented at social level). Socio-political variables are included under the assumption that a negative perception regarding these variables may hinder the willingness of users to pay the transport fare.

Results confirm existence of a positive autoregressive effect, suggesting a contagious effect in behaviour. An increase in level of inspection reduces fare evasion and an increase in bus fares increases fare evasion. New findings of this study include introduction of government approval and confidence/trust towards political and economic institutions and the ruling class as variables with a contrary effect towards fare evasion, i.e. a decrease in government approval and confidence/trust increases fare evasion.

1. Introduction

Although fare evasion is a common problem in transport systems worldwide, the level of fare evasion experienced in Transantiago is approximately six to seven times higher than the global average of 4.2% (Guarda et al., 2016a), reaching its highest level in December 2016 at 34.6% and 25.5% in the second trimester of 2018 (Programa Nacional de Fiscalización, 2018). These high levels of fare evasion translate to a considerable amount of pressure on the financial sustainability of the systems, considering that the operating costs must be covered by fare revenue and government subsidy. The annual losses due to fare evasion for Transantiago are estimated to be USD 140 million (EMOL, 2017). For the year 2015, it was estimated that losses due to fare evasion where 50% of the subsidy provided to the system (Allen et al., 2019). In addition to their direct costs, the research on behavioural ethics shows that daily dishonesty lowers trust, encourages negative social norms, spreads and increases the prevalence of other unethical behaviours (Ayal et al., 2019), leading to a potential vicious cycle when the fare evading behaviour increases. Studies also show that an increase in fare evasion provokes perceptions of mistrust and insecurity in passengers, increases the psychological discomfort, and discourages the use of public transportation (Bijleveld, 2007; Killias et al., 2009; Reddy et al., 2011).

Fare evasion interventions have commonly focused on systems which are designed to punish fare evaders and optimise enforcement through inspections and physical barriers. Studies traditionally have considered passengers as rational actors who consider a trade-off between the costs and benefits of avoiding fare payment; alternatively, they have considered fare evasion as a reaction to operational/service characteristics and enforcement levels (Killias et al., 2009, Clarke et al., 2010; Reddy et al. 2011; Barabino et al., 2013, 2014; Guarda et al., 2016a; Guarda et al., 2016b). This perspective of fare evasion does not consider the social,

political, and cultural contexts in which fare evasion occurs, thereby excluding components which could be affecting the disposition of users to evade fares.

The measures considered for lowering fare evasion in Santiago include increased pursuit of fare evaders by increasing inspections, penalties, and the creation of a fare evader registry and the enforcement of fare payment by establishing physical barriers at the entry (which hinder the efficient operation of the system). All these measures are based on microeconomic and operational factors and do not attempt to determine the underlying causes of fare evasion. Moreover, current and past measures have lowered fare evasion for a small amount of time, but the increasing trend reappears. This suggests that fare evasion is not a problem that can be solved by only considering technical and operational methods, but it should be studied and intervened considering a multidisciplinary approach.

Recent studies in Chile (Buneder, 2016; Buneder and Galilea, 2017; Troncoso and de Grange, 2017) have expanded on the literature by including factors such as political approval and economic factors; however, social factors such as the level of anomie were not included. Expanding on a recent perspective on fare evasion (profiling the fare evader or understanding the motivations of the fare evaders), this study includes variables related to the political and cultural environment of an individual and not the personal motivation behind fare evasion. As Hauber (1980) suggests, subcultural norms have a high importance when explaining fare evasion; however, subcultural components are associated with the immediate circle of an individual (friends, family, etc.) and do not consider culture in a macro level. More importantly, as far as we are aware, no study has yet considered an analysis of fare evasion in relation to the approval rate of the government, trust levels, and the social state of anomie, i.e. low levels of satisfaction, low trust in the political and economic systems, and the lack of ethical norms or social standards in a society, which can result in an individual not identifying with the guidelines surrounding them or not feeling represented by society, which can result in a disposition to fare evasion. This occurs either because the individuals do not recognise the validity of the established social contract or because the individuals deliberately want to take from a system that they perceive as unjust and corrupt.

This primary goal of this study is to identify how social, political, and cultural components may affect the levels of fare evasion and disposition of the users to fare evasion. Specifically, this study analyses socio-political variables and factors related to the state of social anomie, to identify how the lack of social control and diminished institutional or social trust may affect the levels of fare evasion.

In this paper a longitudinal econometric analysis is presented using aggregated data from May 2010 to May 2018, modelled through an autoregressive integrated moving average (ARIMA) model to determine the impact of transport system variables (bus fare, ticket inspection, number of paid zones, and quality), macroeconomic variables (unemployment and informal employment), and socio-political variables (approval of Transantiago, approval of the government, reference to scandals in political, economic, and religious institutions in the media, and general trust/confidence experienced at the social or individual level).

The results obtained confirm the existence of a positive autoregressive effect, suggesting a contagious effect in the behaviour of users. According to our model, an increase in the level of inspection reduces fare evasion while an elevation in bus fare increases this rate. The new findings of this study include the introduction of the positive perspective regarding the government and confidence/trust towards political and economic institutions and the ruling class as variables with an inverse effect on fare evasion, i.e. a decrease in the approval rate of the government and confidence/trust increases the fare evasion and a greater level of anomie leads to an increase in the levels of fare evasion.

Finally, our research complements and broadens the current research lines and proposes new strategies of intervention by including variables that are not only related to operational factors and level of enforcement. Understanding the underlying causes of fare evasion helps to provide a better knowledge about fare evasion and its actors. Some of the proposals of this paper are focused primarily on how public transport agencies and the government can decrease fare evasion by increasing institutional trust, changing their fare payment and enforcement of fines, implementing bus fare strategies, and how service quality affects fare evasion, thus expanding the tools that are available for protecting the revenues from reduction owing to fare evasion.

The rest of the paper is organised as follows: the next section is a literature review of fare evasion; section 3 sets the theorical background, explaining how socio-political aspects such as trust, media references to scandals, social influence, and anomie might be affecting fare evasion; section 4 explains the econometrical methodology followed, including an explanation of the data set used, a correlation and co-integration analysis of the explanatory variables, and an analysis of the temporal behaviour of fare evasion, finishing with the methodology followed to generate and analyse different explanatory models; section 5 outlines the primary results of this study; in section 6, we propose four types of public policies based on our results; finally, section 7 outlines the primary conclusions of this study.

2. Fare evasion: literature review

This section includes a literature review on fare evasion and a comprehensive review of studies that focused on fare evasion in the Transantiago bus system.

While conducting their literature review on fare evader-oriented studies, Delbosc and Currie (2019) characterised three perspectives: the conventional transit system, customer profiling, and customer motivation perspectives. The conventional transit system perspective is focused on modifying the physical control or ticket inspection rate and is easy to measure and control, although it has its limits, especially in ‘open’ transit systems. The customer profiling perspective attempts to identify the customers who are more likely to evade the fare based on demographics; however, this perspective has little use beyond profiling and is ethically questionable. The customer motivations perspective provides a richer understanding of how customers define fare evasion and the attitudes, social norms, and circumstances that motivate the customers to evade fares. Thus, understanding these complex motivations can help improve revenue compliance at a time when most governments heavily subsidise their transit systems.

From the customer profiling perspective, certain studies focused on the demographics and travel determinants of fare evaders. These studies identified that young people, male customers, students, and migrants are more likely to evade fares; similarly, customers travelling on short trips are more likely to evade fares (Bucciol et al., 2013; Barabino et al., 2015). Barabino et al. (2015) determined that males, younger than 26 years, with a low education level, who are unemployed and/or are students, and without an alternative mode of transport other than the bus have a higher probability of being fare evaders. Moreover, people who make trips that are shorter than 15 min, who also are systematic users and are dissatisfied with the service, are possible fare evaders. Finally, the authors determined that a low level of inspections, knowledge of penalties, and previous ticket violations are determinants which make people more prone to evade fares. Bucciol et al. (2013) observed that young individuals, males, and non-European immigrants are more likely to travel without a ticket; moreover, travelling with other people can affect the decision to fare evade. Perrotta (2017) determined that low-income people, who are often unable to pay the fare, travel by evading the fares, abusing free transfers, or relinquishing goods.

While considering the motivational determinants and behaviour towards fare evasion (customer motivations perspective), previous studies focused on segmenting fare evaders in different clusters. Delbosc and Currie (2016) conducted a quantitative analysis in Melbourne and classified customers into three categories: deliberate, unintentional, and never-evaders. Deliberate evaders were the smallest cluster but the most frequent transit users. In contrast, unintentional evaders were more common but only evaded fares infrequently. The clusters also had distinct personality differences; deliberate evaders were more likely to be sensation-seekers and believed it was acceptable to bend the rules to save money. As each cluster has its unique characteristics, interventions must be adapted to each one. Hauber (1980) concluded that people evaded fares owing to economic, social (subcultural norms), and political reasons. He classified fare evaders into four groups: naive - accidental, conscientious - circumstantial (financial restrictions), regular - often (practices fraud regularly and includes the political fare evaders), and cunning, which includes customers who evade fares as often as possible to obtain a profit. While considering the adherence to norms, moral standards, and social stigma, Currie and Delbosc (2017) showed that honesty and permissiveness towards fare evasion were common determinants which can explain intentional and unintentional fare evasion.

As highlighted in the literature review presented by Barabino et al. (2020), besides fare evader-oriented studies, there are four other dimensions of studies that focused on fare evasion: economics, criminology, technological innovations, and operational research. We focused our review on the economic and criminological perspectives as they are closer to the aims of this research. On the economic perspective, four aspects were considered: measuring and managing fare evasion, inspection, fines, and ticketing systems.

Several authors attempted to optimise the ‘ideal’ inspection level and fine amount which can maximise profits (Bootheway, 2009; Barabino et al., 2013, 2014; Barabino and Salis, 2019). Bootheway (2009), using a mathematical model, concluded that an increased fine might reduce the overall percentage of fare evaders and that optimal fines which are dependent on the elasticity of the avoider with respect to increases in fine can be established; however, while increasing fines may reduce the total proportion of passengers who avoid payment, it causes migration from a free-rider who may have paid the lower fine to a free-rider who will seek to avoid the higher fine. Barabino et al. (2013) determined that the level of fines and the way in which they are collected both influence the cost-effectiveness of inspection efforts. In the latest version, Barabino and Salis (2019) proposed an accurate economic framework to determine the optimum inspection level (the number of ticket inspectors) in a long time window to maximise the system-wide profit when fare evasion occurs. This is the first framework that introduces: i) a refined characterisation of the passenger demand, ii) a profit function with new constraints, iii) an alternative estimation of the percentage of passengers who choose to evade fares, and iv) a new formulation accounting for inspectors who cannot penalise every passenger who is caught evading. This framework is flexible, and it may be applied to any urban context in which proof-of-payment systems are adopted.

While considering the criminological studies on fare evasion, Smith and Clarke (2000) provided a specific review on crime in public transport and specified several offences, noting that fare evasion has legal repercussions similar to other crimes or acts of dishonesty committed on public transport. According to the authors, fare evasion is committed because several opportunities are available; thus, preventive measures should decrease fare evasion. Hauber (1980) discovered a positive correlation between fare evasion and other minor crimes, i.e. as the higher fare evasion levels increase, other crimes become more frequent.

According to the deterrence and enforcement theory, physical measures such as access control and ticket inspection will lower fare evasion. Hauber (1993) concluded that increasing the frequency of ticket inspection reduces fare evasion, whereas increasing fines and lowering

bus fares do not have this effect; however, the author determined that the frequency of inspections did not reduce fare evasion beyond a certain level as a certain profile of fare evaders remain unaffected. Hauber et al. (1996) determined that an increase in effectiveness of inspectors resulted in less fare evasion despite creating more conflicts between the inspectors and the passengers. Killias et al. (2009) showed that the introduction of attendants on the train in Zurich reduced fare evasion; moreover, they demonstrated that the certainty of being fined worked as a deterrence in a non-linear way and that inspection could be allocated in certain hours and areas. Clarke et al. (2010) observed that reducing the inspection activities and issuing more fines provided no clear trends in fare evasion rates; moreover, the optimal balance between the level of inspection and the amount of the fine that reduces evasion to a minimum or what might be the minimum achievable evasion level could not be clearly determined. Bijleveld (2007) evaluated two procedures to recover the cost of the unpaid tickets and identified, surprisingly, that increased severity of punishment increased the rates of fare evasion. Buehler et al. (2017) showed that higher fines do not necessarily reduce fare evasion.

As our research aims to analyse how cultural components may affect the levels of fare evasion, we reviewed the research on cultural components in public transportation. Donghoon and Won Taik (2014) suggested that social capital, which is unique to each culture, must be considered as a design parameter for systems servicing passengers to establish appropriate risk-avoiding methods; they discussed that when the trust level of social capital is at a low level, extra resources must be employed to avoid risk. Therefore, for designing a product/service system, designers are required to set assumptions for understanding the expected behaviour and estimated abuse of the system. Nahuis (2009) showed that customers had a difficult time accepting innovations in payment methods because companies attempted, unsuccessfully, to correct the misbehaviour of passengers considering their morality and honesty.

Ayal et al. (2015) considered the insights from the growing fields of moral psychology and behavioural ethics to present a three-principle framework. This framework classifies forces that affect dishonesty into three primary categories and then redirects these forces to encourage moral behaviour. The first principle, ‘reminding’, emphasises the effectiveness of subtle cues that increase the salience of morality and decrease the ability of people to justify dishonesty. The second principle, ‘visibility’, aims to restrict anonymity, prompt peer monitoring, and elicit responsible norms. The third principle, ‘self-engagement’, increases the motivation of people to maintain a positive self-perception as a moral person and helps bridge the gap between moral values and actual behaviour. The authors state that external control, instead of encouraging people to be honest, and enforcement teaches them to avoid punishment or to become better cheaters. In fact, external punishments can overcome internal motivation and further separate people from their moral compass. Successful public policies should raise the moral barriers by reminding people of their own ethical code, encouraging social monitoring and responsible norms, increasing self-awareness, and prompting moral commitment.

Ayal et al. (2019) observed that descriptive social norm messaging campaigns can reduce fare evasion and orient people toward a more moral behaviour by exploiting the concept of social proof (knowing what others are doing or what others think one should be doing), where descriptive social norm messages are more effective than negative framing or traditional incentive approaches (sanction undesired behaviour); moreover, they continue to remain more effective over time. As anonymity releases people from their moral restrictions, increasing visibility cues aimed at reducing the sense of anonymity should elicit desirable norms. This study highlights the potential benefits of internal enforcement techniques to fight dishonesty in the field. In addition, the authors stressed the advantage of combining visibility cues and social norms when orienting people toward more moral behaviour.

Blumenberg and Weinstein Agrawal (2014) conducted a qualitive study in San José, California to determine how low-income households manage their mobility requirement. They determined

that these families rely on transportation assistance from non-profit organisations and their social network; moreover, they also reduced their expenditures on other household necessities such as food to be able to utilise transportation services. More importantly, the interview data suggests that certain households did not have the resources to purchase sufficient transportation to satisfy their basic transportation requirements; consequently, these customers had to reduce their travels and/or consider fare evasion.

Fürst and Herold (2018) conducted a survey with experts in public transport and determined that free riding is the largest and more frequent problem; however, manipulation, falsification, and forgery of tickets also occur. The best strategy is to intensify controls, ideally performed by ticket inspectors, which also gives passengers a feeling of service and security. Raising the service quality also has positive effects on free riding as sometimes people do not perceive a corresponding value for money. Other motives for fare evasion are protest, the thrill of not being caught, and most importantly, an attempt to save the fare.

While considering the city on which we focused our analysis, Torres-Montoya (2014) presented the first academic look at the fare evasion problem in the buses of Santiago, highlighting that users believed that the value of the service did not justify paying for the fare and that fare evasion is also a cultural and political issue. This may be traced back to the implementation of Transantiago in 2007, where the long waiting times and crowded journeys during its first year resulted in bitterness and disapproval for the new system, which has persisted to this day. The author proposes legal modifications, economic incentives, quality of service improvements, and better communication as key components required to achieve a cultural transformation of the collective perception of the system, which ultimately determines whether users value the service sufficiently to pay the fare.

Guarda et al. (2016a) conducted an econometric study for Santiago and identified that the level of fare evasion is dependent on the level of inspection, proximity to a metro or intermodal station, bus-occupancy level, period of the day, geographic location, and number of passengers boarding and alighting at each bus stop. They also determined that using inspectors without the capacity to penalise customers at bus stops to remind passengers to validate their journeys is a cost-effective measure and results in a reduction in fare evasion. Guarda et al. (2016b) observed that fare evasion rates in buses in Santiago increased as: (i) more people boarded/alighted, (ii) more passengers boarded by a rear door, (iii) buses had higher occupancy levels, (iv) buses had more doors, and (v) passengers experienced longer headways. A modification in these variables is expected to decrease fare evasion without the requirement for increasing the inspection rate. The results indicate that fare evasion is greater during the afternoon and evening; however, it is unclear if it is higher during peak hours. The authors also observed that bus stops located in lower-income counties were associated with higher evasion rates.

Using a time-series analysis of fare evasion in Santiago, Troncoso and de Grange (2017) evaluated variables such as bus fare, ticket inspection, unemployment rates, and the approval rate of Transantiago. The authors determined the existence of an autocorrelated factor in fare evasion; moreover, they identified that an increase in the bus fare increases the fare evasion; in addition, increasing the fare inspection and unemployment decreases fare evasion. Buneder and Galilea (2017) also used a time-series approach for Santiago and evaluated variables such as bus fare, ticket inspection, quality measures, unemployment, and the approval rate of Transantiago. Their research determined that fare evasion was not driven up by an increase in the bus fare or a decrease in the public approval of the system; however, fare evasion was driven over time by an autocorrelated factor due to a contagious effect. They also identified a spatial correlation between social vulnerability and fare evasion.

Allen et al. (2019) proposed a general satisfaction-evasion behavioural model which considers (dis)satisfaction with other fare evading behaviours, attribute-specific satisfaction, overall satisfaction, reuse intention, and self-reported fare evading behaviours of users. Based on a survey of users of the metro and bus systems in Santiago, it was determined that the evading behaviour increases when satisfaction with (i.e. attitude towards) the fare evading behaviour of other users increases (contagious effect), and when satisfaction with reliability of services decreases. The authors also created a general profile of fare evaders and identified that the following factors motivated users to avoid fare evasion: possessing a discount, being female and of more age, having a higher education, higher an income, and living in high-income counties. Considerably infrequent users and heavy users are more prone to evade fares. An increase in the waiting time also increases the chances of fare evasion; further, students are more prone to evade fares as the contagious effect is highly plausible among students.

3. Theory: social, political, and cultural components

In this section, we will introduce the concept of socio-political context (section 3.1). Owing to the importance of the variable 'trust/confidence' in our model, this concept must be explained in more detail. Satisfaction and trust towards a political-economic system motivates citizens to behave honestly in daily life. Low levels of trust within a society are associated with a high level of anomie (section 3.2.2). We can establish that low satisfaction and trust increases the willingness to evade fares.

Further, the psychological and sociological aspects involved in decision-making are introduced to explain how the environment of an individual can affect their disposition to fare evasion (section 3.2). Disposition to fare evasion may be determined by social and economic factors, personality, and risk aversion of each subject. Social context affects the personal beliefs of an individual, how they define fare evasion, and the attitudes, social norms, and circumstances that motivate them to evade fares.

3.1 Socio-political background

In the following section, we introduce the current socio-political context in Chile, focusing on the elements that may affect the disposition to evade fares. Satisfaction and trust towards a political-economic system motivates citizens to behave honestly in daily life (Fukuyama, 1995). We speculate that, when people feel represented by the government and believe that it has their best interests in mind or when they perceive that companies are behaving honestly without exploiting them, the willingness to evade fares diminishes (section 3.1.1).

Camaj (2014) determined that citizens learn about the effectiveness and integrity of political, economic, and social institutions from the media, which directly affects the image that people have about the competence and integrity of these institutions. Gutiérrez et al. (2010) proposed that there is a relationship between the image/credibility that users have of a public institution, perceived quality/satisfaction of users, and attitudes/behaviours of citizens towards this service. Based on the interaction between the media, the image of the political, economic, and social institutions, perceived quality/satisfaction of users, and attitudes/behaviours of citizens, we established the requirement to study the influence of scandals published in the media on fare evasion (section 3.1.2). As the media affects the image that people have about the political, economic, and social institutions, which consequently directly affects the satisfaction and trust towards a political-economic system, we expect that more references to scandals in the media will increase the fare evasion behaviour.

3.1.1 Institutional and personal trust/confidence

Trust/confidence can be defined as the ability to depend on and cooperate with another (henceforth, 'another/other' is a reference to an individual, an institution, or a system) despite not having full certainty about their capacity and disposition to ensure our integrity or self-interest. When we trust, we have the expectation that this other being will act in a way that is just and beneficial or at least not harmful to us. Trust exists at three different levels: interpersonal, institutional, and systemic level. In each of the three levels, the individual relies on the abilities and technical competences, moral integrity, and/or willingness to adhere to certain ethical and social standards pertaining to the other (Luhmann, 1996).

In recent years (especially since the return of democracy in Chile), there is a concern about a deterioration in confidence and its potential consequences at political, economic, and social levels. At the political and economic spheres, distrust affects the legitimacy of institutions and political participation; moreover, it results in a generalised feeling of abuse and vulnerability in citizens towards institutions. High institutional and systemic mistrust is linked to a greater demand for regulation and the incorporation of transparency in private and public institutions (Porath, 2018). Given the benefits it provides, trust/confidence has been declared a key element of the social and economic development of a country; the lack of confidence has been identified as one of the primary factors that can explain the problems within societies (Irarrázaval, 2015). At an economic level, a strong correlation was observed between trust/confidence and the GDP of a country, because a stronger trust/confidence reduces the transaction costs, increases flexibility, and autonomy of institutions. At a political level, trust is an essential component for ensuring stability and the appropriate functioning of a democratic system; the ability of institutions to enforce the rule of law depends on the legitimacy they have before citizens. This legitimacy reduces the requirement for monitoring the compliance of policies; moreover, it is expected that individuals will voluntarily conform to the regulations in this case. Finally, at a social level, mistrust generates low levels of public spirit (self-regulation of individuals), and opportunism and free riders will prevail. When there is no trust, there is no inclination to cooperate and no incentive to contribute to the common good and obey the law without coercion (Centro UC Políticas Públicas, 2015; Labarca Encina, 2012).

In addition, Fukuyama (1995) links the concept of trust to social capital and defines social capital as one of the key drivers affecting the choices of individuals to contribute to public goods and the wellbeing of societies. Trust is the expectation of regular, honest, and cooperative behaviour from each member of a community, based on commonly shared norms. Social capital is the capacity that arises from the prevalence of trust in a society or in certain parts of it (Fukuyama; 1995). Greater social capital and high levels of trust inside a society leads to a lower requirement for external controls (Labarca Encina, 2012). Based on this, Donghoon and Won Taik (2014) identified that transport system designers must consider social capital as a design parameter, because when the trust level and social capital are low, greater resources must be expended to avoid risk.

3.1.2 Reference to scandals in the press and the role of the media

Satisfaction with a political-economic system is considered to be a reason for citizens to behave honestly in daily life (Fukuyama, 1995). It is expected that, as long as the citizens feel represented by the government and believe that it has their best interests in mind or perceive that companies are behaving honestly without exploiting them, the willingness to evade fares diminishes. The inverse effect may also be established, by considering that fare evasion is an expression of dissatisfaction against cases of corruption, collusion, and the negative perception that people have towards public and private entities.

While considering the role of the media on public opinion, political science uses the concept of 'agenda-setting'. All news media process and filter information to their users; eventually, the aspects that are prominent in the news media usually become prominent in public opinion (Valenzuela, 2019). Camaj (2014) determined that citizens learn from the media about the effectiveness and integrity of political, economic, and social institutions; further, the media also affects the criteria used by people to judge the effectiveness of institutions and the influence of their elite class, thereby directly affecting the perceptions of people about the competence and integrity of the government. Agenda-setting establishes that media, through their editorial lines and the manner in which they report certain social, economic, or political scandals, will affect how citizens perceive their surroundings and the institutions, thus setting the base for social discussion and actions of citizens (Camaj, 2014; McCombs, 2005).

In addition, McCombs (2005) states that both traditional and attribute agenda-setting involve the transfer of salience, which implies that elements prominent in the media agenda become prominent eventually on the public agenda. While considering the psychological effects of agenda-setting, individuals have an innate requirement for orientation, which may be provided by the news media. Thus, it can be said, '*The media not only can be successful in telling us what to think about, they also can be successful in telling us how to think about it'* (McCombs, 2005). Furthermore, the basic idea of this theory has remained straightforward: agenda-setting refers to the process by which issues, public figures, companies, or government institutions that are deemed relevant by the news media, as well as the attributes used to describe these elements, often become relevant to public opinion (Valenzuela, 2019).

Kingdon (2010) adds that agenda-setting works as a political process by itself. Kingdon explains how certain issues come to the attention of government in the first place and why certain problems become a part of the agenda while others do not. He provides a theory that includes three separate streams: problem, policy, and political. The problem stream is when particular problems are identified. Policy stream is dominated by academics, researchers, bureaucrats, and others who analyse the details of various issues. Finally, the political stream is dominated by the visible people in the government who help to identify the major issues of political importance, but not the detailed alternatives. Political issues are based on the national mood, party in power, and other political events. Issues are included in the decision agenda when all three streams interact. Furthermore, Kingdon states that the causal-effect relation between the issue-based agendas of the public and media does not rule out the possibility that another variable is responsible for the relationship between the two agendas. Journalists and audience can be independently affected by governments or real-world events (Valenzuela, 2019; Van Ealst and Walgrave, 2016).

Even though agenda-setting is a multi-faceted method, it has become more complex and the concept has expanded to include several other aspects beyond the transfer of salience of issues from the media agenda to the public agenda after McCombs first described the concept in 1968 (Valenzuela, 2019). This paper focuses on how the media can affect public opinion and the consequences of agenda-setting on attitudes and behaviours to identify the relationship between scandals referred to in the press and the possible effects on fare evasion disposition.

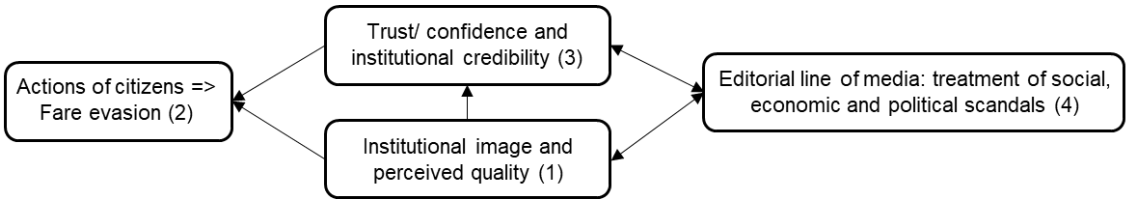

Figure 1. Relation between the actions of citizens (fare evasion), trust/confidence and institutional credibility, institutional image and perceived quality, and treatment of scandals by the media

Gutiérrez et al. (2010) proposed that there exists a relationship between the image/credibility that users have of a public institution, perceived quality/satisfaction of users, and attitudes/behaviours of citizens towards this service (Figure 1, relation between boxes 1 and 2). The set of beliefs in the mind of individuals (originated by how they perceive quality measures) will determine the level of trust/confidence that the public has on an institution (Figure 1, relation between boxes 1 and 3). Trust/confidence is determined by the honesty and benevolence perceived in the behaviour of the institution that is providing this service, which is reflected in the quality of the service delivered. The system works in such a way that, for example, if the service provider has a positive image and people trust that this institution has their best interest in mind, mistakes are forgiven; but serious errors affect the image and credibility of the institution; thus, when the image that the users have of a service deteriorates, the impact of a mistake becomes greater. Finally, citizens will demonstrate certain behaviours/attitudes depending on the level of trust and satisfaction they have towards the service, i.e. low level of trust and satisfaction may lead to the disapproval of the public and acts of protest (passive or active) may occur (Figure 1, relation between boxes 3 and 2).

As previously mentioned, citizens learn about the effectiveness and integrity of the public and private institutions (institutional image) from the media; this information is used by individuals to establish if an entity deserves their trust or not and to determine the level of quality of the said entity (Figure 1, relation between boxes 1 and 4 and 3 and 4). Both factors affect the behaviour of users and their preference toward a service and/or institution (Gutiérrez et al., 2010) (Figure 1, relation between boxes 3 and 2 and 1 and 2).

Thus, it is possible to determine the relationship between the actions of users of public transport (evading fare payment as a reflection of a negatively perceived quality and as a medium of protest), trust/confidence towards institutions, and editorial line regarding scandals in the medias. Based on this, we can establish the requirement to study how media scandals and general trust/confidence can affect fare evasion.

3.2 Psychological and sociological aspects

The disposition to fare evasion may be determined by social and economic factors, personality, and risk aversion of each subject. Social context affects the personal beliefs of individuals, how they define fare evasion, and what attitudes, social norms, and circumstances motivate them to evade fares.

From various categories of fare evaders (Bucciol et al., 2013; Barabino et al., 2015; Delbosc and Currie, 2016; Buneder, 2016; Salis et al., 2017; Delbosc and Currie, 2018), we can establish that there is a group of deliberate evaders, willing to repeat this act and who rarely pay their fares. This group of users have a lower level of aversion to risk, higher level of disconformity with the system, lower honesty levels, and a more permissive attitude towards fare evasion (Currie and Delbosc, 2017). Delbosc and Currie (2016) observed that fare evaders feel that the systems do not treat them fairly and that the transit system is operated

by private companies for only earning money. In addition, Hauber (1980) and Nahuis (2009), suggest that there exists a group of fare evaders that use political justification for their behaviour (ideological opponents); in the opinion of these fare evaders public transportation is a public service that everyone should be able to use for free. In fact, 45% of people in Santiago state that fare evasion is a valid form of protest against the system and private companies (Brújula, 2017).

3.2.1 Social influence on individuals

Gino et al. (2009), from a sociological and psychological perspective, introduced the existence of a contagious effect in unethical behaviour, establishing that the propensity to unethical behaviours is dependent on social norms and that individuals can change their behaviour when exposed to the dishonesty of others. Studies applied to Transantiago propose that exposure of a passenger to fare evasion increases the propensity to evade fares (Buneder, 2016; Guarda, 2015; Allen et al., 2019). Gino et al. (2009) state that the moral conceptions in societies are a good predictor of the frequency of illicit acts; however, there are also other factors that affect individual behaviour such as the influence group dynamics, emotional, or situational contexts. They proposed three sources of influence that exist between individuals:

- When exposed to the dishonesty of others, individuals may change their estimate of the likelihood of being caught cheating. This leads to an underestimation of the probability of being discovered. According to the rational crime theory, a lower probability of being caught will increase the disposition to evade fares.
- *Saliency* of actions: When individuals are exposed to the unethical acts performed by others, it will draw attention to their own moral standards, which may reduce the disposition to commit unethical acts.
- Changes in the understanding of a person of social norms related to dishonesty: This factor depends on the degree to which an individual identifies with the group committing unethical acts. When they identify with the offending group/persona, the disposition of an individual to commit unethical crimes may increase.

This concept is similar to the proposal by Hauber (1980), which states that honesty appears to be a learned mentality, leading to a tradition of fraud in public transportation. In addition, Hauber (1980) explains that a person committing a fraud must reduce his own moral dissonance by justifying his offence, leading to a change in attitude, which facilitates the occurrence of further acts and an increase in risk level.

Anonymity is a key component of group influence. When people act in a collective context, they may undergo a process of ‘de-individualisation’, where individual standards are replaced by those of the group. The imitation of the behaviours observed in others increases and various mechanisms of social contagion are triggered (Guarda, 2015). Interestingly, Nahuis (2009) identified that, after the introduction of seasonal tickets that did not require validation in Amsterdam, fare evasion increased, most probably because of the appearance that nobody paid attention to users increased the ability of fare evaders to avoid recognition. The literature agrees that the exposure of passengers to fare evasion increases the propensity to copy this act (Reddy et al., 2011; Bucciol et al., 2013; Guarda et al., 2016b; Buneder and Galilea, 2017; Allen et al., 2019).

The concept of what is considered a crime or an unaccepted act is socially constructed, i.e. determined by social reality, the context of an individual, and the social institutions in which he is inserted, such as family, religion, and school (Reyes, 2008). For Santiago de Chile, data show that approximately 15% of passengers did not consider this act as a crime (Brújula, 2017); once this occurs, society is unable to avoid these acts owing to the lack of social

structures. There are sectors where fare evasion is practically the norm and where this is a daily experience, i.e. practically all users of the public transport system observe fare evasion on their trip (GFK, 2017). This may lead to normalisation and acceptance of this behaviour for the case of Santiago de Chile.

3.2.2 Anomie and criminology

As mentioned in section 3.1.1, the belief of an individual and how he/she interprets reality is a social construct. To define the behaviour of a person in society and his/her compliance with social norms, the concept of anomie is introduced. Anomie can be defined as a lack of ethical norms or social standards in a society, where an individual does not identify with the guidelines surrounding them and when he/she does not feel represented by society; consequently, society loses the ability to regulate the behaviour of an individual. Durkheim determines that the guidelines used by people to interact with each other are disintegrating; therefore, individuals are unable to determine how to interact with each other and identify the norms to be followed; consequently, social bonds are weakened and society loses its capability to adequately integrate and regulate individuals (León Porath, 2018).

Robert Merton linked the concept of anomie with crime and criminology by complementing the definition of anomie as a mismatch between the goals established by society and the means it provides to its members to achieve them. This mismatch explains why individuals choose to commit a crime to achieve the established goals/expectations of society, without having the adequate tools to accomplish these expectations (León Porath, 2018; Carvacho, 2018). The applied concept of anomie to criminology can be related to fare evasion through the concept of expectations and impulse control, i.e. if the difference between what the individuals have been promised by Transantiago and what they are receiving is significantly broad, criminal impulses will arise, which cannot be suppressed by society (León Porath, 2018).

Finally, another critical element associated with the state of anomie in a society is ‘trust/confidence’ towards institutions and others. It is argued that the lack of trust/confidence towards institutions/others and the failure to respect social norms will lead to a lack of consensus on desirable social behaviours and will facilitate deviant behaviour (Muratori et al., 2013). Muratori et al. (2013) also established that anomie can be measured indirectly by the level of trust/confidence that society has in their institutions and other individuals.

To summarise, in section 3.1, we identified a relationship between the actions of citizens (fare evasion) and their trust/confidence towards institutions, the public service image/credibility, and the editorial line of the media (Figure 1). In section 3.2, we established how society influences the behaviours and beliefs of individuals. Anomie determines if/how society will be able to control the behaviour and criminal impulses of a person, such as fare evasion. As the anomie of societies increases, the more likely it is that criminal/unethical behaviour will occur. Institutional/systemic trust/confidence is an indirect method to measure the level of anomie in a society. Thus, we can determine the relationship between the behaviour of an individual (fare evasion), institutional trust/confidence and image/credibility, the role of media (treatment of scandals), and the level of anomie in a society.

Since October 2019, Chile has been experiencing a social uprising, which started with a raise in the metro fare (approximately 0.03 USD) and mass fare evasion, which resulted in massive protests and riots and a referendum for a constitutional reform. However, this movement transcended public transport issues, discovering deeper roots in social injustice and the feeling of abuse with respect to political and economic institutions. As Gutiérrez et al. (2010) established, low levels of trust and satisfaction towards a public service can lead to disapproval of the public and acts of protest (passive or active). One passive form of protest is fare evasion and active forms of protest include the protests and riots that were observed. Political scientists

and sociologists have linked this phenomenon to the low level of trust and state of anomic experienced in the Chilean society, which has resulted in a rupture in the 'social contract' (Porath, 2020). Trust/confidence towards institutions in Chile have fallen to an all-time low at an average of 7%; further, only 1% of people declared that they feel represented by the government; however, 60% of people declared that they feel represented by the social movement (Marta Lagos, 2019).

Figure 2 shows a picture captured by the authors outside of a metro Station in Santiago at the end of 2018, when this research was being conducted, which was approximately one year before the social uprising. With the slogan '*Nos están cagando, evade'*, which approximately translates to '*They are using us, evade fares'*. One of the first slogans used during the mass fare evasion was '*Evadir, no pagar, otra forma de luchar'*, which implies '*Fare evade, do not pay, another way of protest'*. These two slogans represent the general sentiment in the Chilean population, which, when associated with an increase in the Metro fare, transformed itself into the perfect breeding ground for revolt.

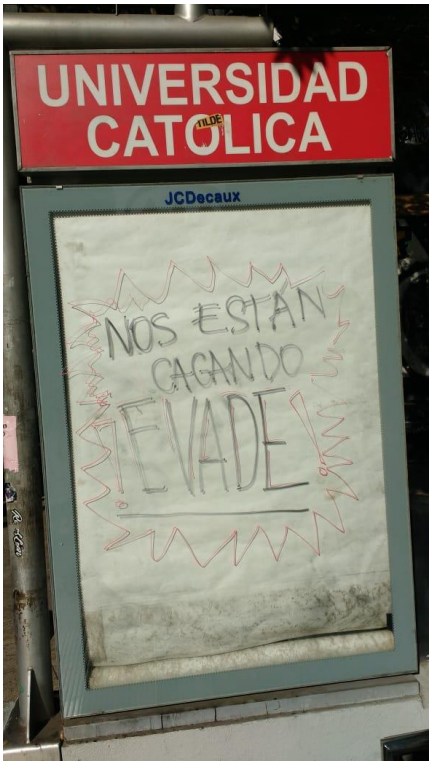

Figure 2. Fare evasion sentiment in Santiago, Chile. Image captured in the third trimester of 2018

4. Methodology

In this study, a longitudinal econometric analysis was performed using aggregated data from May 2010 to May 2018, which were modelled through an ARIMA model to determine the impact of the transport system variables (bus fare, ticket inspection, number of paid zones, and quality measured through the factor of frequency and regularity compliance), macroeconomic variables (unemployment and informal employment), and socio-political variables (approval rate of Transantiago, approval rate of the government, reference to scandals that occurred in political, economic, and religious institutions in the media, and general trust/confidence experienced at the social level). This last variable is trust/confidence, which is used as a double variable, allowing the measurement of, on one hand, a political

aspect, which is a cultural component associated to the level of anomie experienced in a society. As mentioned in section 3.2.2, Muratori et al. (2013) established that anomie can be measured indirectly by the level of trust/confidence that society has on its institutions and other individuals.

Following an economic perspective, the transport system variables such as bus fare are expected to have a positive relation towards fare evasion, i.e. an increase in bus fare should generate an increase of fare evasion as an increase in income used for transportation reduces the available income for other expenditures. According to the deterrence theory, more ticket inspections and an increase in the number of paid zones are expected to have a negative impact on fare evasion, i.e. an increase in these variables is expected to decrease fare evasion. Finally, an increase in quality measures/perceived quality is expected to increase the willingness of the user to pay bus fares (Guarda, 2015; Buneder, 2016; Troncoso and de Grange, 2017).

Unemployment and informal employment are included as macroeconomic proxy variables and are assumed to have a positive relation towards fare evasion, i.e. an increase in unemployment and informal employment is expected to increase fare evasion under the hypothesis that less people will have the capability to pay for the bus fares (Buneder, 2016).

Socio-political variables (approval rate of the government or Transantiago) are included under the assumption that a negative perception on these variables may hinder the willingness of users to pay for the service provided; thus, a negative perception/discomfort with the government or transport system may be expressed as fare evasion. As mentioned in section 3.1, the dissatisfaction of people with the government may perform a role in the level of fare evasion (act of protest); this variable seeks to measure a part of the 'political environment' in which society is embedded (Porath, 2018).

Further, a reference to scandals in the media was included because the editorial line of the media shapes the public opinion about social, political, and economic institutions (section 3.1.2). Church scandals was included owing to the fact that the Chilean society still has a moral connection with their religious institutions as 67% of the population declared an affiliation to an institutional religion (Cadem, 2018). In addition, McCombs (2005) states that organised religion performs a significant agenda-setting role in the lives of its adherents. Thus, when more scandals are revealed in the media, the discontent of users increases, which lowers their willingness to pay.

Trust/confidence towards political and economic institutions and the ruling class was included as a double variable allowing the measurement of socio-political and cultural components. Thus, on the one hand, trust is directly linked to the willingness of users to pay. A lower level of trust may be expressed through actions of protest such as fare evasion (section 3.1.1). On the other hand, trust is a variable that indirectly measures the social anomie (a state where society is unable to force social control on individuals, thus generating a state where social norms are not followed; section 3.2.2) (Porath, 2019). The 'ruling class' is defined as the group inside a society that directly influences politics, education, and the government using their wealth or power.

In the following section, a brief statistical analysis of the explanatory variables is presented. A stationarity and autocorrelation analysis of fare evasion was performed to determine if an ARIMA model is the best method to model fare evasion. Finally, we explain the steps used to generate and compare the different explanatory models. For a summary regarding the data set used, please refer to Appendix A.

4.1 Explanatory variables in the statistical analysis

In the following section, we will perform a correlation analysis to identify any relevant relation between variables. A co-integration test was performed on those variables with high correlation towards fare evasion (approval of the government, church scandals, other scandals, and institutional/elite trust/confidence).

4.1.1 Correlation

Two types of correlations (Table 1) were considered as the results varied according to the amount of data considered. The first column of Table 1 lists these results for the period considered (May 2010 – May 2018); the second column shows the correlation with fare evasion for all available data. The data in bold font presents the correlations that are higher than an absolute value of 0.5.

Table 1. Correlation analysis

	May 2010 - May 2018	**Available Data**
Bus fare	0.189	**0.715 *** * May 2007 – May 2018
Ticket inspection	0.138	0.129 * August 2008 – May 2018
Bus frequency	0.223	**0.577 *** * January 2009 – May 2018
Bus regularity	-0.49	-0.175 * * January 2009 – May 2018
Paid zones	0.293	0.458 * * December 2007 – May 2018
Informal employment	0.18	**-0.543 *** * May 2007 – May 2018
Unemployment level	-0.226	0.482 * * May 2007 – May 2018
Approval rate of the government	**-0.716**	**-0.692 *** * May 2007 – May 2018
Approval rate of Transantiago	-0.385	-0.407 * * January 2010 – May 2018
Political scandals	0.198	0.161 * * May 2007 – August 2018
Economic scandals	0.053	0.194 * * May 2007 – August 2018
Church scandals	**-0.554**	-0.170 * * May 2007 – August 2018
Other institutions scandals	**0.658**	0.074 * * May 2007 – August 2018
Institutional and elite trust/confidence	**-0.851**	**-0.766 *** * December 2007 – May 2018
Trust/confidence in others	0.414	0.191 * * December 2007 – May 2018

As previously mentioned, we noted that correlation varies according to the horizon considered. Bus fare, bus frequency, and informal employment have a higher correlation when we included earlier periods. Thus, it may be inferred that these variables had a higher impact in fare evasion in early years of the inception of Transantiago. Church scandals and other scandals demonstrated a higher correlation when only using data starting from May 2010. It may be

presumed that these variables have a higher impact in the later years of the operation of Transantiago. The approval rate of the government and institutional and elite trust/confidence show a high correlation for both periods that were analysed. The bus fare and the political, economic, and other institutional scandals demonstrated a positive correlation, i.e. an increase in these variables generated an increase in fare evasion. A positive perception of the government and Transantiago and the trust/confidence on institutions and the elite class demonstrated the expected negative correlation, i.e. when these variables decreased, fare evasion increased. Ticket inspection, bus frequency, paid zones, church scandals, and trust/confidence in others did not demonstrate the expected correlation. Informal employment and unemployment levels changed the relation with fare evasion depending on the period analysed.

4.1.2 Co-integration

To determine if the variables having a high correlation with fare evasion demonstrate a relation of causality in addition to correlation, a co-integration test was performed. High correlation is defined as a value above the absolute value of 0.5; Thus, the positive perception regarding the government, church scandals, other institutional scandals, and the trust/confidence on institutions and the elite class were analysed. Co-integration was tested using the Engle–Granger (EG) test with MacKinnon critical values (Qiu, 2015) (for further information on EG co-integration method, refer to Appendix B).

Table 2. Co-integration test results

	EG	P	Co-integration
Government approval	-1.860	>= 0.1	No causality
Church scandals	-2.180	>= 0.1	No causality
Other institutions scandals	-2.520	>= 0.1	No causality
Institutional and elite trust/confidence	**-2.727**	**<= 0.077**	**Causality**

Table 2 lists the results of the co-integration test. The values in bold indicate the variables that demonstrate a causality relationship with fare evasion with a confidence higher than 90%. The approval of the government, church scandals, and other institution scandals did not show a causality relationship with fare evasion with a confidence ≥ 90%. The institutional and elite trust/confidence shows a causality relationship with fare evasion with a 92.3% confidence.

4.2 Fare evasion analysis

As previously mentioned, fare evasion is modelled through an ARIMA model. Two components of fare evasion time series were analysed to determine if this mathematical procedure is adequate: first we analysed stationarity using the Kwiatkowski-Phillips-Schmidt-Shin test (Hyndman and Athanasopoulos, 2018), which determined that fare evasion is non-stationary and must be differentiated once to obtained a stationary time series presenting a linear tendency; then, we tested fare evasion data for autocorrelation using a visual test of the autocorrelated factor (Hyndman and Athanasopoulos, 2018) and determined that fare evasion has an autocorrelated effect with previous periods until period t-24 months. We concluded that the ARIMA model is adequate to model the relation between fare evasion and the explanatory variables.

5. Results and discussion

In this section, the model we have obtained will be presented. Model adjustment was based on 80% of the available data (January 2010–December 2017) and validation of the different

models was performed based on the remaining 20% of the data (January 2018–May 2018). Our resulting model is of the type ARIMA (1,0,0) $(1,0,0)_{12}$, which implies that it has an autocorrelated factor of p = 1 with the previous period and a seasonal factor of P = 1 with the same period of the previous year (m = 12). The explanatory model has a predictive error of 3.57% over the evaluation data. Residues appeared to have an autocorrelation for the periods t-3 and t-17 months, but when a Ljung–Box test was applied, autocorrelation was discarded; thus, the resulting model was able to incorporate all the available information. The mean for the residues was -8.8 E^{-05}, implying that our model is not biased to the available data.

The variables considered included fare evasion from the previous period (autocorrelation between periods) and the same period from the previous year (seasonality). The transport system variables included the level of ticket inspection and bus fare. New findings of this study included the introduction of the approval rate of the government and confidence/trust towards institutions and the ruling class. All variables, except for bus fare, have a high significance with a confidence interval higher than 95%. Table 3 lists the estimated value and statistical significance for the considered variables.

Table 3. Model results

Variable	Estimated	Pr (>|z|)	Statistical significance
Fare evasion t-1	0.7414	< 2.2 E-16	***
Fare evasion t-12	-0.3173	0.0035	**
Intercept	0.4782	1.57 E-10	***
Ticket inspection	-0.0058	0.0194	*
Bus fare	0.8225	0.7417	
Approval rate of the government	-0.1181	0.0049	**
Institutional and elite trust/confidence	-0.0080	2.72 E-13	***

Statistical significance: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 4 lists the details of a comparison between our model and those presented by Buneder (2016) and Troncoso and de Grange (2017). The table lists the factors that were analysed by each author ('-' indicates a factor that was not analysed); '×' indicates that the factor was determined to be not significant; '✓' indicates that the factor was determined to be significant; the type of relation is shown with arrows ('↑' in case the factor has a positive relation and '↓' in case it has a negative relation with fare evasion).

Table 4. Comparison between our model and the models presented by Buneder (2016) and Troncoso and de Grange (2017)

Factor	Model	Buneder (2016)	Troncoso and de Grange (2017)
Autocorrelation	✓ ↑	✓ ↑	✓ ↑
Bus Fare	✓ ↑	×	✓ ↑
Ticket Inspection	✓ ↓	×	✓ ↓
Quality measurements	×	×	-
Unemployment	×	×	✓ ↑
Political satisfaction	✓ ↓	×	×
Sociological factors	✓ ↓	-	-

Neither of the previous papers analysed sociological factors and Troncoso and de Grange (2017) did not analyse the impact that quality factors (frequency and regularity) may have on fare evasion.

The models proposed by Troncoso and de Grange (2017), Buneder (2016) and the model obtained in this research are consistent with respect to the autocorrelation factor of fare evasion, i.e. the fare evasion was identified to have a positive autocorrelation with its previous

period. Both authors argued that this effect is, most probably, owing to the existence of the contagious effect. This effect was extensively described in the literature (section 3.2.1) (Hauber, 1980; Gino et al., 2009; Nahuis, 2009; Reddy et al., 2011; Bucciol et al., 2013; Guarda, 2015; Buneder, 2016; Allen et al., 2019).

While considering the bus fare and ticket inspection, the conclusions of this study are similar to those obtained by Troncoso and de Grange (2017), i.e. an increase in bus fare generates an increase in fare evasion and an increase in ticket inspections generates a decrease in fare evasion. These findings are also consistent with the global evidence, where it is observed that a low level of inspection is a determinant which results in more people demonstrating a disposition to fare evasion (Barabino et al., 2015; Killias et al., 2009). The same theory was supported by crime and punishment research (Beyleveld, 1980; Von Hirsch et al. 1999; Hauber, 1993). It is important to note that although in our results bus fare did not present itself as a significant factor, we can establish a positive relation with fare evasion; however, the level of impact cannot be determined. According to Ortúzar and Willumsen (2011), variables considered as relevant may be included even if they do not comply with statistical significance.

When we analysed quality factors, the conclusions were the same as those obtained by Buneder (2016), i.e. the quality measures do not explain the fare evasion levels. This result marginally contradicts the findings of other studies (Torres-Montoya, 2014; Barabino et al., 2015; Guarda et al., 2016b; Fürst and Herold, 2018; Allen et al., 2019), where it was determined that, at least at an individual level, the quality levels are useful for explaining fare evasion levels; however, the same cannot be observed at the systemic level.

Troncoso and de Grange (2017) observed that the unemployment rate has a negative effect on fare evasion, primarily because people with low job security will be more likely to not pay their bus fare; moreover, once they are unemployed, they will not travel by bus. Barabino et al. (2015) and Bucciol et al. (2013) showed that unemployed individuals are more likely to evade fares. In this study, neither unemployment nor informal employment showed a significant influence on aggregated level of fare evasion. We suggest an elaborate study on the relationship between unemployment rate and fare evasion to better understand the mechanism that affects fare evasion.

While considering the analysis performed on factors of political satisfaction, both Troncoso and de Grange (2017) and Buneder (2016) determined that the approval of Transantiago is not a significant variable. In this paper, this variable was also analysed, and it was identified that the approval rate of the government is a better variable to explain fare evasion levels. This is consistent with the findings of Hauber (1980), who suggested that there exists a group of fare evaders (ideological opponents) who use political justification for their behaviour; in their opinion public transportation is a public service that everyone should be able to use for free. Several studies considered the approval rates of Transantiago (Buneder, 2016; Buneder and Galilea, 2017; Troncoso and de Grange, 2017) and this variable was determined to be not significant; therefore, we expanded our model to include the approval rates of the government and identified that this variable could better explain fare evasion. One possible explanation is that the approval rate of the government indicates a general distrust and discomfort towards the political system, i.e. a wider and more general feeling, which is also reflected by the fact that institutional trust is a variable that affects fare evasion; however, the approval rates of Transantiago was measured to indicate satisfaction with the transport system, which includes quality factors that do not appear to be relevant (consistent with Buneder, 2016).

While considering the variables that were identified to be significant, a few deductions and remarks can be presented:

- Autocorrelation with previous periods: The results are consistent with prior studies presenting a positive autocorrelation with the previous period. This may be explained through the existence of a contagious effect (section 3.2.1). When people evade fares because they observe that other people do it too, fare evasion becomes a social norm, which makes it a significantly difficult phenomenon to interrupt.
- Ticket inspection: The inclusion hypothesis of this variable is confirmed. As people perceive that the possibility of being inspected increases, the level of fare evasion decreases, which is also consistent with an economic approach to rational decision making.
- Bus fare: An increase in bus fare shows a positive effect on fare evasion; this might be owing to the existence of users who do not have sufficient income to pay the fares or the existence of users who do not want to pay a higher fare when they do not perceive an increase in quality. As bus fare has a low significance level, the impact on fare evasion is not known; nevertheless, a positive relation exists.
- Government approval and institutional and elite trust/confidence: The inclusion hypothesis of both variables is confirmed. When approval of the government and institutional and elite trust/confidence decreases, fare evasion increases.
  Transantiago is a dual-faceted system; although it is considered as a public service, it is provided directly by private parties. Based on Gutiérrez et al. (2010), who established a relationship between the low level of trust and satisfaction towards a public service and the disapproval the public and acts of protest (passive or active), fare evasion may be considered as a passive form of protest that a citizen uses against what he interprets as an unjust political and economic system (refer to section 3.2.2 regarding social uprising in Chile).
  A decrease in the approval levels of the government is a reflection of the social discontent with the actions and policies of the government; when citizens feel that the policies applied are not directly beneficial to the people, the approval of the government decreases. The loss of confidence in public institutions and the elite class of the country reflects the sense of abuse that society has regarding those who manage the country economically and politically (section 3.1).
- Finally, it is important to note that the variables that were identified to be significant will also have an effect over time owing to the inclusion of the autoregressive factors.

6. Public policy proposals

Fare evasion is part of the reality of all transport systems worldwide. The following proposal of public policies do not aim to achieve zero levels of fare evasion, but to lower the observed levels to one which does not risk the sustainability of the system. The classic binary perspective that considers fare evasion to be a crime and that fare evaders must be penalised has several negative consequences. The application of certain measures can generate antagonism between the authorities and the public, thereby increasing the existing distrust and discontent, generating a hostile environment, and causing political alienation.

Recent studies have highlighted the limitations of external enforcement (Ayal et al., 2015; Ayal et al., 2019). Bijleveld (2007) showed, surprisingly, that increased the severity of punishment increased the rates of fare evasion. Moreover, these operations generate stress, displace internal responsibility (Ayal et al., 2019), and may result in aggressive behaviour (Smith and Clarke, 2000; Bijleveld, 2007; Delbosc and Currie, 2018; Ayal et al., 2019). Furthermore, instead of encouraging people to be honest, enforcement teaches them to avoid punishment and external punishments can increase internal motivation and further separate people from their moral beliefs (Ayal et al., 2015).

Based on the findings of the study, we suggest that external measures, even though they work for certain type of fare evaders (Barabino et al., 2020), are insufficient and do not alleviate the social cause of fare evasion as the multi-faceted components of fare evasion are ignored. It is highly difficult that a strongly rooted cultural component will change by only increasing external controls.

6.1 Measures to increase institutional and elite trust/ confidence and motivate change in behaviour

This section proposes measures that may affect the conception and attitude that individuals and society have about fare evasion. In contrast to current policies, these measures do not seek to impose external control, but rather attempt to generate internal and cultural changes so that individuals and society are the ones who control or modify their own attitudes.

Based on section 2.1 and the results obtained in this work, control, regulation, and transparency of public and private institutions are the primary proposals to tackle the existent crisis of trust and to diminish the effect of this social phenomenon on fare evasion. Citizens today are more critical and less tolerant to abuse of power and actions outside the law; consequently, it is necessary to establish and strongly apply sanctions to restrict fraud and corruption. All this should be accompanied through a process that allows the rebuilding of the reputation and credibility of the political, economic, and social actors so that citizens can regain trust on these institutions (Porath, 2018; Irarrázaval, 2015). As mentioned in section 3.1.1, the minimum condition for the individual to decide to trust is the expectation that the institutions will act for the collective welfare, thus fulfilling the moral and ethical expectations deposited in them. The implementation of these guidelines should not be minimised by the institutions and they must work constantly to demonstrate that their actions are consistent with the moral and ethical guidelines expected of them.

Some of the substitutes for trust, and also a way to recover the lack of trust, is through control and transparency of the institutions involved. It is recommended that this control and transparency be exercised by a third entity, which must have the legitimacy, powers, and capacity to constitute itself as an authority capable of guaranteeing the construction of impartial rules (legislative function), observing compliance (supervisory function), and penalising in case of non-compliance (sanctioning function) (Centro UC Políticas Públicas, 2018).

Currently, private companies operating Transantiago have their income linked to compliance to quality measures such as frequency and regularity; however, the income received and penalty for non-compliance is not known by the users of the system; consequently, this information must be published periodically in mass media. The control and punitive methods of these companies must be transparent and publicised so that the citizens are aware of the actions taken and there is a reduction in the feeling of vulnerability and abuse. A more comprehensive study is proposed to identify the most effective means to publicise this information.

Advertising and informative campaigns aim at achieving changes in the behaviour of passengers through psychological actions (Barabino et al., 2020). Torres-Montoya (2014) state that these actions should include educational campaigns to change the collective psyche (fear of social rejection, desire of recognition, etc.) and effective communication to show the improvement of the system.

Ayal et al. (2019) determined that descriptive social norm messaging campaigns can reduce fare evasion and orient people towards a more moral behaviour by exploiting the concept of

social proof (knowing what others are doing or what others think one should be doing), where descriptive social norm messages are more effective than negative framing or traditional incentive approaches (denounce undesired behaviour) and remain more effective over time. Advertising campaigns have typically focused on raising awareness of the necessity to pay bus fare, by informing about penalties and criminal consequences (negative framing and incentive approaches). This approach should be changed to one that focuses on increasing the existing factor of trust. Thus, it is proposed that advertising campaigns should exploit the fact that Chilean society trusts at the micro level (i.e. another individual) by establishing a personal relationship with the consequences of fare evasion, as anonymous economic entities do not generate empathy (Porath, 2018).

Advertising campaigns should aim to change the collective attitudes of citizens and increase the perceived image and trust toward Transantiago as this is a system with low approval and low trust levels from the public. It is necessary to change the reputation of Transantiago considering that a bad image and low perceived quality generate a vicious cycle, resulting in the individual attaining more negative reactions towards the transport system (fare evasion; section 3.1.1).

A large proportion of the population occasionally evades fares (GFK, 2017), resulting in them being more likely to be sympathetic to those who do not intentionally commit these acts. Consequently, stigmatising and criminalising a large part of the population can decrease the political credibility of the entire system and decrease user satisfaction (Torres-Montoya, 2014). It is necessary to transform feelings of anger and disappointment into feelings of appreciation and satisfaction, thus increasing the legitimacy of the authorities and transport system.

Given that institutional and systemic trust was proposed as a dual variable in this work, it is also necessary to propose certain intervention policies from the perspective of anomie. Durkheim links anomie with education as a way to teach individuals to contain their passions and comply with the external constraints imposed by social norms. Durkheim argues that morality, understood as the set of external rules that determine behaviour, is central to a collective body. Thus, morality gradually achieves the discipline necessary to counteract the unlimited desires of individuals (López Fernández, 2009).

It is important to emphasise that most people agree that fare evasion is damaging to other passengers and is a dishonest act (Dirección de Transporte Público Metropolitano, 2017). It may be concluded that until 2018, fare evasion was not yet a widely accepted act and most of the population did not tolerate fare evasion. Therefore, educational and communicational interventions can motivate greater social control by non-evaders towards fare evaders. Successful public policies should raise the moral barriers by reminding people of their own ethical code, encourage social monitoring, and implement responsible norms, thereby increasing self-awareness and prompting moral commitment (Ayal et al., 2015).

6.2 Fare payment enforcement and fine policies

In economic terms, the two most important deterrents of fare evasion are the probability of being caught and the punishment that the fare evader receives upon being discovered. Therefore, the most obvious way to deal with fare evasion is on-site inspection of payment compliance. Additionally, inspections increase the sense of security and reduce vandalism (Barabino et al., 2020). The results of this research show that ticket inspection affects fare evasion, i.e. an increase in inspection is expected to generate a decrease in fare evasion.

The levels of inspection in Santiago are currently insufficient and the effectiveness, in terms of detected fare evaders, is relatively low. The inspection rate is only 0.1% and the rate of penalising is also significantly low, close to one infraction out of every 10 users who are

inspected, i.e. 0.001% of trips (Tirachini and Quiroz, 2016; Buneder, 2016). The amount of fine is not low, approximately 95 times the trip cost, when compared to other cities (Tirachini and Quiroz, 2016); however, only 68% of those fines are actually payed (SOCHITRAN, 2018). Low level of fare inspection was presented as one of the reasons for the high rate of fare evasion of Transantiago; these low levels have established a feeling of impunity in fare evaders. Tirachini and Quiroz (2016) proposed that the inspection rate should be, at least, increased to 5%. Barabino et al. (2015), Buehler et al. (2017), Hauber (1993), and Von Hirsch et al. (1999) proposed that it is better to focus on the inspection rate rather than on the amount of fine.

A clear methodology to assign inspectors must be established by considering the probable revenues collected by fines, increase in bus fare payment, and direct/ indirect costs involved (SOCHITRAN, 2018). In this context, Barabino et al. (2013, 2014) and Barabino and Salis (2019) developed optimisation models that determine the optimum inspection levels in a transport network to maximise the system-wide profit when fare evasion occurs. Bootheway (2009), using a mathematical model, concluded that an increased fine might reduce the overall percentage of fare evaders and that optimal fines can be established, which is dependent on the elasticity of the avoider with respect to increases in fines; however, while increasing the fines may reduce the total proportion of passengers who avoid payment, it causes migration from a free-rider who may have paid the lower fine to a free-rider who will seek to avoid the higher fine.

Certainty of punishment must reach levels that will change the subjective perception of inspection; moreover, substantial deterrent effects can be expected between the lower and upper thresholds only (Beyleveld, 1980). Killias et al. (2009) demonstrated that the certainty of punishment works as a deterrent in a non-linear way (increase in ticket inspection in certain hours decreased fare evasion in other time periods also) and benefits from increased certainty can be maximised if checks are concentrated on critical hours and areas.

However, it will not be easy to observe empirically the levels of inspection at which any additional increment will increase awareness of risk and thus reduce fare evasion (Beyleveld, 1980); consequently, fare inspection should not be maximised, but an optimal level should be identified by considering the balance between investments in control and returns in the form of additional ticket sales. Specifically, in the Chilean case, we must also consider that public transport receives a subsidy corresponding to the number of passengers transported by the system. Fare inspection, and the possible decline of fare evasion, will thus result in better visibility of passengers who were previously invisible to the system, thereby generating a trade-off between fare income and greater subsidy and inspection costs. Inspection costs are not only linked to direct costs, but also involve indirect costs such as greater travel time and use of police force, because in Chile, inspections are conducted by stopping a bus, closing its doors, and using a police force for the safety of the inspecting personal.

Consistent with the findings of Delbosc and Currie (2018) and Buneder (2016), Killias et al. (2009) and Hauber (1993) stated that there appears to be a ceiling beyond which additional increments in controlling methods do not decrease fare evasion, as certain passengers who are not discouraged by dramatically increasing the levels of control, may have different personalities and social characteristics, and their decision may not be changed by any policy changes. In addition, Hauber (1980) and Bijleveld (2007) identified that, for certain group of deliberate fare evaders, an increase in fines and legal consequences will not affect their disposition to evade fares.

Guarda et al. (2016a) proposed the employment of inspectors in certain bus stops without enforcement powers, which should remind users to pay fares; this intervention is expected to lower fare evasion and increase visibility of non-payers. This intervention is similar to the one incorporated by Netherlands, where supervisory officials without formal police powers can

make an effective contribution towards control of crime by ensuring that rules are complied with, at a lower cost than the traditional police force and with relatively few adverse consequences such as violence; however, this measure is functional only in the social and cultural context of Dutch cities (Hauber et al., 1996).

As anonymity releases people from their moral restrictions, increasing visibility cues aimed at reducing the sense of anonymity should elicit desirable norms (Ayal et al., 2019). In this regard, an innovative measure was applied in the city of Bogotá, where the inspectors can apply social punishments such as forcing fare evaders to write '*I will not sneak into the system anymore*' (Tirachini and Quiroz, 2016). This last measure is a direct social punishment as it is shameful for the offender, has high visibility, and is an act that requires the fare evader to spend time out of his schedule. This measure generates direct discomfort in the fare evader and satisfies the objective of publicising the consequences of the fare evading behaviour.

6.3 Bus fare

Although the level of bus fare does not appear to be statistically significant, we decided to incorporate this variable in our model as it shows a positive relation towards fare evasion. Ortúzar and Willumsen (2011) stated that variables considered as relevant may be included, even if they do not comply with statistical significance. However, it is necessary to be cautious with the interpretation and proposals regarding bus fare as the effect of this variable is very low. Increase in fare evasion due to the increase in bus fare can be owing to two reasons: first there are users who will not be able to pay the bus fare and must adjust their budget; second, an increase in bus fare without an increase in perceived quality generates an increase in social discontent, thus providing certain bus users an argument for not paying the fare.

To tackle the first group of fare evaders, it is necessary to study bus fares and subsidies directed to these groups. According to GFK (2017), 20% of their sample specified that people evade fares because the bus fare is too expensive and 40% mentioned that a fare reduction as a good measure to decrease fare evasion. However, Tirachini and Quiroz (2016) determined that, in comparison with other cities, the base fare for the lower-income socio-economic group does not explain the high level of fare evasion of the system in Santiago. Conversely, Guarda (2015) determined that there is an income factor, by determining that fare evasion is significantly higher in counties with lower average income per household. Buneder and Galilea (2017) determined that the bus fare is not a significant variable when explaining fare evasion at a systemic level; nevertheless, when performing a spatial analysis, socio-economic factors perform a significant role. Fare evasion and low income are related on a local level (Reddy et al., 2011; Guarda, 2015; Buneder, 2016; Allen et al., 2019) and qualitative studies show that people evade fares or relinquish other goods/services for more affordable transit (Blumenberg and Weinstein Agrawal, 2014; Perrotta, 2017); however, according to the findings of this study and those of the study by Buneder and Galilea (2017), the bus fare does not have an impact on the system level of fare evasion. A deeper study on the relationship between income level and fare evasion is recommended, which should also consider unique sociological factors, such as the existence of welfare, one-head households, informal employment, of each social group that was evaluated.

The second proposal, which seeks to affect the level of social discontent that an increase in bus fare generates, is that the reasons and methodology determining a bus fare increase must be publicised as currently the process is not known by the population, especially by the users of the system. It is recommended to perform information dissemination and transparency campaigns to reduce possible social discontent in users. As mentioned in section 5.1, the increase in transparency is one of the measures proposed to counteract the decrease in confidence; this same principle must be applied to bus fare increases.

6.4 Service quality improvement

Although quality service is not incorporated into the model proposed in this paper, it is important to consider that the interaction of a bus fare increase without an increase in perceived quality, directly affects the approval rate of the government and the confidence towards the public and private institutions involved in the public transport system. As mentioned, Gutiérrez et al. (2010) determined that there is a direct relationship between perceived quality and attitudes and actions that the citizen will have regarding a public service (section 3.1.1). Thus, measures that indicate an improvement in the system and service can be interpreted as an anti-fare evasion measure. The services must improve continuously to be able to guarantee their quality and adapt towards changing expectations and requirements of the users.

The most frequent justification for non-payment of bus fare is the discomfort regarding the service level of the system. Irregularity in bus circulation, refusal to stop at designated bus stops, and poor condition of the buses will negatively affect the disposition of users to pay the bus fare (Torres-Montoya, 2014; Tirachini and Quiroz, 2016). Allen et al. (2019) even stated that the fare evasion in Santiago affected the service quality by causing the bus driver to not stop at certain bus stops, if they perceived that the passengers would not pay the fare. Torres-Montoya (2014) states that, to increase the willingness to pay bus fare, it is critical to increase the level of service, as a low service quality contributes to the poor perception of users and may directly contribute to higher fare evasion. Fürst and Herold (2018), Barabino et al. (2015), and Allen et al. (2019) presented similar results, i.e. service satisfaction appears to be useful in explaining fare evasion propensity. In fact, 37% of passengers state that increasing the quality of Transantiago would decrease fare evasion (GFK, 2017). Using customer satisfaction surveys, Allen et al. (2019) showed that, for Transantiago, evading behaviour increases when satisfaction with the fare evading behaviours of other users increases (contagious effect) and when satisfaction with reliability decreases.

Systems that provide adequate staffing, have easy transfers, and supply frequent and regular service are less likely to provide conditions favourable to petty crime and fare evasion (Smith and Clarke, 2000). Guarda et al. (2016b) identified that increasing bus fleet and improving regularity and bus design (number of doors or capacity) can address fare evasion as an alternative to more dedicated enforcement of fines or increased inspection.

7. Conclusions

Fare evasion is a phenomenon that integrates not only the transport system, but also other dimensions of the behaviour of people and the political and social contexts. To determine effective policies to reduce fare evasion, this problem should be studied from different approaches and in a multidisciplinary manner. Recently, fare evasion studies based in Chile have shifted from considering passengers as rational actors who consider the trade-off between cost and benefit of avoiding fare payment and have tried to understand the underlying factors of fare evasion (Buneder, 2016; Troncoso and de Grange, 2017). This study attempted to build on this perspective and included variables related to the political and cultural environments of an individual and not only the personal motivation behind fare evasion. Specifically, this study analysed the socio-political variables and factors related to the state of social anomie to identify how the lack of social control and diminished institutional or social trust may affect levels of fare evasion.

The results obtained confirm the existence of a positive autoregressive effect, suggesting a contagious effect in the behaviour of users. According to our model, a higher level of inspection reduces fare evasion while increase in the bus fare increases this rate. New findings of this

study include the introduction of approval rate of the government approval and the confidence/ trust towards political and economic institutions and the ruling class as variables with a contrary effect on fare evasion, i.e. a decrease in the approval rate of the government and confidence/ trust increases fare evasion. The latter suggests that fare evasion is a social phenomenon that should not only be intervened on a technical level, but should be studied by other disciplines.

Since October 2019, Chile has been facing a social uprising, which started with an increase in the metro fare, resulting in mass fare evasion, followed by large-scale riots and several social demands that transcend the issues pertaining to transportation and is primarily rooted in social injustice and the feeling of abuse regarding political and economic institutions. The demands for transparency, equality, and dignity are stronger than ever. Our work is a first step to understand the political expression behind fare evasion and a deeper appreciation of the social challenges expressed in fare evasion. Currents events in Chile have shown that avoiding a broader social approach towards fare evasion may unleash innumerable social consequences and that problems related to public transport may catalyse several social movements and demands.

Further, the increase in the state of social anomie and individualisation in societies must be considered; thus, it is expected that actions such as fare evasion will increase if multidisciplinary interventions are not performed. The concept of an unaccepted act is socially constructed, determined by social reality, the context of an individual, and the social institutions in which they are inserted, such as family, religion, and school (Reyes, 2008). Interventions should consider the cultural difference, as trust levels and anomie of societies are primarily determined by the socio-cultural environment (Labarca Encina, 2012). Interventions applied in other countries should be used as guidelines but must be adapted to the unique social characteristics of the Chilean society (León Porath, 2018). Donghoon and Won Taik (2014) suggest that social capital, which is unique to each culture, must be considered as a design parameter for systems that service passengers to establish appropriate risk-avoiding methods, i.e. when the trust level of social capital is low, extra resources must be expended to avoid risk. Strategies should not only embrace physical and technological interventions, but also cultural and political changes (Barabino et al., 2020).

In this paper, two types of public policies were proposed: on the one hand, there are measures that can increase the institutional and systemic trust that individuals have; on the other hand, the second set of proposals seek to affect those variables related to the transportation system.

The first policies were not aimed at controlling the external impulses of the individual but were considered to change the perception that society has about itself and the system to persuade each individual to change their behaviour through the change in social regulations. It is important to emphasise that these measures will not have an immediate short-term effect as any intervention that seeks to modify development and behaviour of society requires time; however, it is expected that these measures are sustainable over time and independent of external controls. While external enforcements are effective at lowering fare evasion for certain type of fare evaders, it might not be the most effective in terms of cost-benefits, or its potential to further enhance the ethical conduct of passengers (Barabino et al., 2020).

The second set of measures refer to the transport system environment, i.e. fare payment enforcement and policies related to fines/penalties, bus fare strategies, and service quality improvement.

In economic terms, the two most important deterrents of fare evasion are the probability of being caught and the punishment that a fare evader receives upon being discovered; thus, according to the results of this research, increasing the inspection rates will decrease fare evasion. In addition, other studies have determined that it is better to focus on increasing the

certainty of being punished rather than the fine amount (Hauber 1993; Von Hirsch et al., 1999; Barabino et al., 2015). However, an optimal level of fare evasion must be determined by factoring direct/indirect costs and the benefits of increasing control (Beyleveld, 1980; Killias et al., 2009; Barabino et al., 2013; Barabino et al., 2014; Barabino and Salis; 2019). Additionally, other measures were proposed such as the placement of inspectors without enforcement powers in certain bus stops (Guarda et al., 2016a) or measures aiming at decreasing anonymity and increasing social visibility (Ayal et al., 2019; Tirachini and Quiroz, 2016).

While considering the relationship between the amount of bus fare and fare evasion, two measures were proposed. First, to tackle fare evaders that cannot pay for bus fare, the introduction of direct subsidies can be studied. Fare evasion and low income are related on a local level (Reddy et al., 2011; Guarda, 2015; Buneder, 2016; Buneder and Galilea, 2017) and qualitative studies show that people evade fares or relinquish other goods/services for more affordable transit (Blumenberg and Weinstein Agrawal, 2014; Perrotta, 2017). Secondly, information dissemination and transparency campaigns informing the reasons behind a fare increase must be performed to reduce possible social discontent arising from a bus fare increase. As mentioned, the increase in transparency is one of the measures proposed to counteract the decrease in confidence.

Although quality service was not incorporated into the model proposed in this paper, it is important to consider that a bus fare increase without an increase in perceived quality, directly affects government approval and confidence towards the public and private institutions involved in the public transport system. Thus, measures that indicate an improvement in the system and service can be interpreted as an anti-fare evasion measure. The services must improve continuously to be able to guarantee their quality and adapt towards changing expectations and requirements of the users. Smith and Clarke (2000), Torres-Montoya (2014), Barabino et al. (2015), Guarda et al. (2016b), Fürst and Herold (2018), and Allen et al. (2019) show that satisfaction and service quality can address fare evasion as an alternative to more dedicated fine enforcement or increased inspection.

Future research should examine the public transport system and determine the factors of perceived quality and confidence/trust affecting Transantiago to establish how to reduce fare evasion when there is a permanent increase of distrust in society. The link between trust/confidence and anomie as a measure of cultural components should only be considered as the first approach and should be expanded to include other aspects to better understand the impact of cultural components on acts such as fare evasion. The aspects of social justice and criminology were not analysed in this paper. We suggest that further studies should include data such as income distribution, poverty levels, and crime level, especially considering that certain studies have discovered a positive correlation between the frequency of fare evasion and the occurrence of minor crimes (Hauber, 1980; Smith and Clarke, 2000), which is consistent with social anomie-based theory of fare evasion. Finally, macroeconomic data could be included to explain abrupt changes.

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Appendix A

As previously mentioned, in this study we have considered the following explanatory variables:

- Transport system variables: bus fare, ticket inspection, number of paid zones and quality measured by frequency and regularity compliance.
- Macroeconomic variables: unemployment and informal employment.
- Socio-political variables: approval of Transantiago, government approval, mention of scandals in the press and general Trust/ Confidence experimented at social level.
- Additionally, the following binary variables have been included: yearly seasons, changes in contracts between Transantiago's operators and government and changes in presidential terms.

Due to available data, period between January 2010 and December 2017 will be analysed. The following table summarises data used, including source of each data, time interval available, the number of observations and periodicity.

Table 5. Database summary - source, availability, number of observations and periodicity

Variable	**Fare Evasion**	**Bus Fare**	**ICF**
Period Available	May 2007 - June 2018	May 2007 - June 2018	January 2009 - June 2018
Source	Programa Nacional de Fiscalización - Índice de evasión	DTPM	DTPM Informe de Gestión 2017 - Anexos
Number of observations	87	134	114
Periodicity	monthly/ trimestral trimestral since June 2012	monthly	monthly
Variable	**ICR**	**Fare Inspection**	**Number of paid zones**
Period Available	DTPM Informe de Gestión 2017 - Anexos	Programa Nacional de Fiscalización -Informes trimestrales	DTPM Datos Sistema de Transporte Público Metropolitano
Source	January 2009 - June 2018	August 2008 - June 2018	December 2007 - July 2018
Number of observations	114	119	87
Periodicity	monthly	monthly	annual/ monthly monthly since January 2012
Variable	**Change in Contracts**	**Unemployment Rate**	**Informal employment rate**
Period Available	-	INE	INE
Source	May 2007 - June 2018	May 2007 - June 2018	May 2007 - June 2018
Number of observations	134	134	134
Periodicity	monthly	monthly	monthly
Variable	**Transantiago Approval Rate**	**Government Approval Rate**	**Change in Political Authority**

Period Available	Adimark Evaluación Gestión de Gobierno May 2017	Encuesta CEP, Estudio Nacional de Opinión Pública, septiembre - October 2017	-
Source	January 2010 - May 2017	May 2007 - October 2017	May 2007 - June 2018
Number of observations	51	41	134
Periodicity	No periodicity / monthly monthly since March 2014	No periodicity	monthly

Variable	**Number of scandals mention in the press**	**Trust/ Confidence**
Period Available	Facultado de Comunicaciones PUC - Escuela de Periodismo	Centro de Estudios de Realidad Contemporánea
Source	May 2007 - August 2018	December 2007 - September 2017
Number of observations	47	12
Periodicity	April, August, October	No periodicity

Fare evasion data has been obtained from “Dirección de Transporte Público Metropolitano” (DTPM), which is available monthly between May 2007 and end 2012 and every three months since then. Bus fare has been obtained from DTPM, is available monthly and has been adjusted to reflect inflation. Enforcement level has been obtained from Chileans Ministries’ of Transport inspections department, data is available monthly from August 2008 and has been included in our model using a logarithmic transformation (ln). Number of paid zones data has been obtained from DTPM, until 2012 data is only available for December of each year. Quality measured by frequency and regularity compliance can be obtained from DTPM and is available in monthly basis since 2009.

Unemployment and informal employment level can be obtained from Chileans National Statistics Institute and is publicly available on a monthly basis, only data for Santiago has been considered.

Approval of Transantiago has been obtained from Adimark’s survey of Santiago’s population, data is available since January 2010 and is measured between three and four times a year. Government approval is publicly available from “*Centro de Estudios Públicos”* and is measured twice a year.

Mention of scandals (categorized in four types of scandals according to the institution involved: political, economic, Church and other institutions) in the press data has been provided by Pontificia Cátolica de Chile Communications Faculty (not publicly available) and is measured for month of April, June, August and December since 2006. Only one newspaper has been measured (*El Mercurio*), following McCombs (2005) suggestion that journalist validate their sense of news by observing the work of elite members of the press, thus media has an effect on each other and that media coverage is highly homogenous. Furthermore, this homogeneity of the news media agenda has been a major source of journalism’s influence on the audience, because it makes it easier for the public to learn about issues and other topics in the news with little deliberate effort on their part (Valenzuela, 2019).

Data regarding Trust/ Confidence towards political, social and economic institutions and towards another individual has been provided by “Centro de Estudios de la Realidad Contemporánea” (not publicly available) and is measured two to three times a year, institutional Trust/ Confidence will be calculated as a simple average between political institutions (chamber of representatives, Senate and political parties), mass media (radio, television and newspapers), economical institutions (banks, companies and private health services) and politicians (representatives, senators, politicians and ministers) (Porath, 2018).

Yearly seasons has been modelled through the use of binary values for each season. Changes in contracts between Transantiago’s operators and government was captured trough a binary variable with value 1 from March 2012, an alternative variable has been considered to include the fact that contracts are operational starting on May by modelling this variable as a binary variable with value 1 starting May 2012 (Buneder, 2016). Changes in presidential terms has been modelled as binary variables for when President Michelle Bachelet and President Sebastián Piñera have been in government.

Due to data availability only the period between January 2010 and May 2018 will be analysed, information missing between data collection will be assumed as a lineal interpolation between two points.

Appendix B

Cointegration analysis using Engle - Granger (EG) method

R software (aTSA package) uses a cointegration analysis based on the Engle – Granger (EG) method and uses MacKinnon critical values (Qiu, 2015). This package has as output confidence interval at which the null hypothesis of no cointegration can be rejected, thus concluding that two variables are cointegrated.

First step of this algorithm is to adjust a linear regression to obtain μ and B (Qiu, 2015).

$y[t] = \mu + B*x[t]+e[t]$
$y[t]$ = dependent series in t
μ = constant
B = vector coefficient
$x[t]$= explanatory series in t
$e[t]$=error in t Eq. (B.1)

Once the previous linear regression has been adjusted, residuals z[t] need to be tested using Dickey – Fuller test in order to determine if these residuals are white noise. Null hypothesis states that these residuals are white noise, which is equivalent to determine that variables y and x are cointegrated (Qiu, 2015).

$z[t] = y[t] – y'[t]$
$y'[t]$ = adjusted value of the dependent variable in t Eq. (B.2)

Credit Author Statement

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