PI-0393 Fare Evasion and its Impact on Measured Ridership

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Summary

Background

Caltrans seeks improved understanding of the correlation between fare evasion and ridership data, improved data collection practices, and actionable recommendations for addressing fare evasion while fostering a safer transit environment.

Post-COVID fare evasion in public transit systems, particularly in California, has reportedly surged, potentially skewing ridership data and impacting revenue calculations. Fare evasion rates, which were previously estimated at 20% for some agencies, have escalated to nearly 50% in some cases. This presents two core challenges: accurate ridership reporting and financial sustainability. Since fare collection equipment and data are pivotal in determining ridership numbers, unaccounted fare evasion can lead to underreporting, impacting funding, service planning, and policy decisions. Moreover, increased fare evasion may create a perception of diminished safety and contribute to broader social concerns.

More information is needed on how California transit agencies collect ridership data (e.g., Automated Fare Collection (AFC) vs. Automated Passenger Counting (APC) vs. manual counts), how they account for fare evasion, and how fare evasion trends have evolved.

Anecdotally, fare evasion on buses have noticeably significantly increased post-COVID. A recent NYT article reported that fare evasion rates have surged to 48% from 18% before the pandemic. (https://www.nytimes.com/2024/08/26/nyregion/nyc-bus-subway-fare-evasion.html). This raises concerns about the accuracy of ridership data, particularly in California, where some agencies rely heavily on fare equipment for ridership numbers.

By understanding fare evasion trends, agencies can implement targeted interventions to reduce evasion and improve financial sustainability. Accurate data collection will ensure more effective budgeting, improved service delivery, and greater public trust in transit systems. Additionally, addressing fare evasion contributes to a perception of increased safety, as studies have shown that visible enforcement and fare compliance foster a sense of order within transit environments.

Recommendations could include technology upgrades, revised fare enforcement strategies, and enhanced data collection practices, which could collectively foster a more equitable and financially stable public transit system.

Summary of Findings

1. Introduction

Taken theoretically, fare evasion in transit is seemingly a natural response to the presence of a fee-for-service and the possibility that the evader won't be held to account. This is an expression of the "free rider problem" in economic theory, a state of market failure that stems from people using goods or services that bear a cost for

society without contributing to the payment of the cost that supports them. The free rider problem dates back to ancient times and appeals to a moral and abstract concept of fairness in addition to the actual economic effects on the provision of value to individuals. For instance, if too many people use a service without paying, the burden on other users becomes higher (or their contributions stretched thinner) and the enterprise must face the possibility that its services are not sustainable. In transit, fare evasion affects farebox recovery, perception of safety, and data integrity when agencies use automatically collected fare data for information on the use of their system. From the user's perspective, the threat of steep punishment for fare evasion tends to have unequitable impacts, since studies support particular demographic and geographic patterns of evasion, and efforts to combat them use this information to target enforcement activities.

This PI looked at several questions: When and how does fare evasion occur, what do we know about interventions, what are the impacts on data collection, and how are those impacts addressed. There are also studies on equity implications that may be good for framing, but weren't part of the research question. It may be useful to closely examine whether it is worth going to great lengths to deter fare evasion, or if the issues presented can be addressed by other means. A familiar example is one in which a homeless person is encountered by transit police and escorted from a train. Is there a presumption that the person would pay the large fine levied by the transit agency? Is a fine or punishment likely to deter this person the next time they consider riding without fare? Is removing the person from the train of benefit to society? These questions aren't mentioned in the research need statement, but may be worth considering. Finally, there seemed to be no research titles that specifically look at the impacts of data inaccuracies, although several mention it as a basis for looking into methods of reducing evasion.

2. Observations

Much of the literature focused on how to reduce fare evasion. From profiling evaders, to recommending game-influenced enforcement practices and optimization of ticket inspection, to optimal pricing considering rider perception, most of the research focused on the practical issue of rooting out fare evasion and identifying the most effective means of deterrence.

Data discrepancies may be tied to predictable fare evasion or other non-interaction behavior. If conditions create an environment where fare evasion is predictable, the same factors that might be used to profile and catch free-riders might also be used to correct data. For instance, there may be an increase or decrease in unreported rides during peak times, at busy stations, or at the border of fare zones. It is worth noting that, from a data standpoint, a monthly pass that isn't checked creates just as much of a data gap as evaded fare, hence some studies' treatment of "fare non-interactions".

Santiago, Chile is a hotbed of fare evasion research. Presumably chosen for its remarkably high evasion rate on busses in the city, Santiago has been the subject of multiple studies. Other factors may include the complex social context of the city, operational characteristics that allow fare evasion such as open busses, multiple

experimental approaches to address their issues, and because of all of this, likely high levels of data availability.

Automatic Passenger Counting (APC) and Automated Fare Collection (AFC) systems represent a data leap. Compared to on-board surveys and inspection logs, APC and AFC enable study of many potential explanatory variables that would not be possible at a lower level of granularity. One study posits that discrepancies between counts in the two systems could be a proxy for fare evasion calculations. Another study investigates various ways of mining automated fare data, while a different study creates a method to correct origin-destination pairs that are degraded by fare non-interactions.

Fare evasion is a sensitive topic from an equity standpoint. Fare costs and transfer policies can lead to inequities in mobility, which can incite additional fare evasion in certain areas. Some literature suggests increased fare inspection and profiling to reduce overall fare evasion levels, with glaring equity concerns. Predictive policing may increase the number of fines issued, but it does not necessarily decrease the amount of fare evasion. This begs the question: are agencies truly achieving their goals by strict enforcement and fines?

There is strong literature on fare evasion behavior. From surveys to regression models using advanced data from automated collection, factors associated with fare evasion are very well understood. One article divides evasion into several categories, which are instructive: Accidental (wrong fare), determined (jumping barriers), economically stressed, intentional (fraud), and opportunistic (exploiting operational loopholes). Understanding why people skip payment is crucial in developing effective means to avoid it. The article goes on to recommend alternatives to enforcement that could be fruitful for future study.

3. Top Resources

Following are top resources in each of nine categories with a brief synthesis of each area. Abstract detail and additional citations are available at the end of the document.

<u>Overview</u>

Fare evasion on public transport: Who, when, where and how?
Angel Cantillo, Sebastián Raveau, Juan Carlos Muñoz
https://www.sciencedirect.com/science/article/pii/S0965856421003141

<u>Fare collection</u>

Investigation into public transport fare noninteractions using large-scale automatically collected data
Yin, Tianwei; Nassir, Neema; Leong, Joseph; Tanin, Egemen; Sarvi, Majid
https://australasiantransportresearchforum.org.au/wp-content/uploads/2022/05/ATRF2022_Resubmission_19.pdf

When passengers make public transportation trips without interacting with the fare system, demand is underreported and fare revenue is lost. It was found that fare noninteractions are lower for stops close to train stations, education facilities, stops that have been frequently inspected, and during the peak hours, but are higher for stops with large boarding flows, crowded services, evening periods and weekends. Importantly, conditioning on other variables, fare noninteractions at the boundary of the free service zone are higher in the morning peak but lower in the afternoon peak. Production of estimates of stop and time of day that could be used by agencies to effectively target fare inspection and off-board validation resources, as well as to improve the accuracy of scaling for inferred origin–destination matrices

Enforcement

Deterrence and fare evasion: Results of a natural experiment
Clarke, Ronald V; Contre, Stephane; Petrossian, Gohar
https://doi.org/10.1057/sj.2009.15

Studies indicate a potential bi-directional relationship between fare evasion and ticket inspection, developing a game-based optimization. Development of risk-based methods to optimize fare inspection incidence can lead to recognition of patterns and avoidance of fare inspection by determined fare evaders. Selective inspection, visibility, and in-person interactions with riders can all serve to reduce evasion. Focus on education over enforcement can help deter unintentional evasion, although San Francisco MTA had success reducing overall fare evasion rates with a suite of efforts geared toward risk-based policing at stations. In Edmonton, the likelihood of getting a ticket (as opposed to a warning) was increased deliberately, but this did not lead to a change in evasion trends in the period observed.

Data

A Synthesis on Data Mining Methods and Applications for Automated Fare Collection (AFC) Data
Cevallos, Fabian; Turino, Lilibeth; Jin, Xia; Florida International University
https://rosap.ntl.bts.gov/view/dot/61846

Studies have looked at the possibility of estimation of fare evasion using econometrics and data collected on fares and boardings. Using Automated Fare Collection (AFC) and Automated Passenger Counting (APC) systems, it may be possible to automatically track evasion. This is especially important for origin/destination matrix and trip elasticity development, where correction factors can be used to correct biases that are introduced due to fare evasion, both in partial stages and in whole trips. Investigation of irregularities in APC data indicate that fare inspection logs may have significant limitations in measuring evasion. Research suggests the ability to bridge the gap between traditional data sources and recent ones, leveraging recent advances in data-driven methods. This indicates potential for interim guidance for agencies only recently adopting new technologies.

Fare evasion behavior

Identification of the determinants of fare evasion
Cools, Mario; Fabbro, Yannick; Bellemans, Tom
https://www.sciencedirect.com/science/article/pii/S2213624X17302997

Fare enforcement literature is closely tied to evasion behavioral research but represents two distinct categories, one focusing on motivations of free-riders and the other focusing on optimum enforcement. Much of the behavioral literature focuses on observations of factors that can be quantified for the purpose of improving enforcement. Key factors in overall evasion figures are fare cost, inspection frequency, and frequency of use by fare evader demographic. Studies have observes evasion behavior as higher for young men, low income, evening boardings, stations with no physical barrier, vehicles that lack of off-board payment, and weak access to fare vending. Some research shifted to qualitative techniques, indicating that user perceptions about social norms and the probability of being caught are key factors. Research points to a "contagion effect", where the more pervasive fare evasion is, the more likely it is for a person to decide to skip fare. It is clear that understanding these perspectives has potential value in viewing the issue through a lens of providing best possible service. Still, inspection action and data observation must be systematic for insights on evasion behavior to be generalizable.

Local Agency impacts

The Blue-Ribbon Report on MTA Fare and Toll Evasion
https://www.mta.info/blue-ribbon-report-fare-toll-evasion

The New York MTA convened a Blue-Ribbon Panel of high-profile New Yorkers with expertise in relevant fields to better understand fare and toll evasion, and develop fresh solutions to the issue. After over a year of meetings and workshops, the blue ribbon panel reported on agency impacts and high volume of proposed solutions.

This PI didn't dive deeply into fare evasion rates within transit agencies, but Google AI offered insight on some of the largest transit providers in the state. Sources have been checked and are included in the bibliography. This is the only use of AI in this document:

- Muni (San Francisco):
    - Estimated 20% of riders don't pay their fare.
    - This represents an increase from the pre-pandemic rate of 12%.
    - Fare evasion reached a high of nearly 30% in July 2024 but has since dropped due to increased fare inspections and other measures.
    - The agency estimates fare evasion costs them millions of dollars annually and contributes to their budget deficit.
- BART (Bay Area Rapid Transit):
    - Estimates the loss of revenue from fare evasion to be between $22 million and $35 million per year.

    - A conservative estimate suggests that 4% to 5% of riders evade fares.
    - A civil grand jury report indicated a possible fare evasion rate of 15%, but BART disputes this figure and maintains that the actual rate is closer to 5%.
    - BART is implementing various strategies to combat fare evasion, including installing new fare gates and increasing enforcement efforts.
- LA Metro:
    - LA Metro is implementing measures to address fare evasion, such as increased enforcement, tap to exit, and improved security.
- San Diego MTS (Metropolitan Transit System):
    - Fare evasion is estimated to cost MTS up to $1 million per month.
    - Officials report that the percentage of total trips taken without fare payment has surged from 3% to over 32% since the switch to the Pronto fare payment system in fall 2021.
    - MTS is cracking down on fare evasion with stricter enforcement and penalties.

Equity

Discrimination, fairness and prediction in policing : fare evasion in New York City
Stolper, Harold
https://dspace.mit.edu/handle/1721.1/129138

Geospatial distribution of inequalities can lead to impacts on access to opportunity. Fare costs and transfer policies lead to measurable inequities, which is an important dimension in fare evasion literature. Although possibly effective in reducing overall incidence of fare evasion, "predictive policing" has potentially discriminatory outcomes and may have no overall effect at all. In one study, "results demonstrate the salience of economic need which cannot be policed away, with no evidence that this heightened enforcement deters other subway crime". "Machine learning fairness" is offered as a solution for enforcement algorithms that draw from arrest records, which may calcify institutional biases and lead to inequitable results in transit policing.

Justice

The over-penalisation of poverty through fines and fees
Jean Galbraith and Rheem Brooks16th October 2023
https://www.penalreform.org/blog/the-over-penalisation-of-poverty-through-fines-and/

A.B. 819 of 2024 offered California the opportunity to decriminalize fare evasion and replace punitive measures with more equitable approaches, but was vetoed by the governor. Research in this area looks at equity and policing through a judicial lens. The inclusion of materials in this PI was not comprehensive, but this is potentially interesting as an inquiry into equity.

Gaps in Findings

Literature review suggests that there is significant and implementable research on the causes of fare evasion and potential interventions. Methods of correcting automated passenger counts are presented, but appear experimental. The review found no survey of transit agencies to determine what methods they use to collect ridership data, or if

there are methods currently in use in California to account for fare evasion in ridership data. Trends in fare evasion for California agencies may be available through a combination of sources, although the financial impact may only be available for the largest agencies. The literature presents methods for automated data collection, correction of data through synthesis of multiple sources, and methods of progressing from older methods such as fare inspection logs to more advanced systems, but no investigation or guidance is specifically targeted to California agencies.

Next Steps

It is recommended that new research in this area focus on specifics of a California case and find a specialized research problem that avoids duplicating the significant work already completed on behavior, enforcement, and interventions. Care should be given to ensure that Caltrans would issue the type of guidance enabled by general inquiry into data collection and adjustment. It is possible that adequate methods already exist and would not need additional research to implement.

Related Research and Resources

1. General

Fare evasion on public transport: Who, when, where and how?
(A. Cantillo et al., 2022)

Transantiago, the public transport system of Santiago, Chile, has one of the highest fare evasion rates registered worldwide. The official statistics for late 2019 indicated that the evasion rate in bus legs was 26.6% while in metro it was almost 0%. This is a relevant issue due to the impacts of fare evasion on finances and quality of service, as budget constraints put pressure on the transit system. Analysing and understanding fare evasion should be the starting point for proposing solutions that could reduce it. Therefore, in this research we seek to answer the question of who are the evaders, when and where evasion happens and how is the fare evaded on public transport. To answer these questions, extensive data was gathered onboard buses of Transantiago for five full days (19 h a day) of operation, including weekdays and weekend. A total of 10,559 individual records were collected. The information considers age and gender of travellers, and fare evasion was measured in zones of Santiago that are characterised by very different economic conditions. Records also differ in terms of bus occupancy, presence of turnstiles in the buses, and types of stops (with and without off-board payment). Based on the collected information, a Binomial Logit model was calibrated to understand and explain fare evasion, quantifying the effect of different types of explanatory variables. Results show that fare evasion is higher for young men, evening and night periods, low-income neighbourhoods, crowded buses without turnstiles, bus stops without off-board payment and weak accessibility to metro stations and fare vending machines. The model does not only allows the identification of these trends, but is also able to quantify them. Based on the results, potential proposed solutions to tackle evasion are discussed.

Fare evasion in public transport systems: a review of the literature
(Barabino et al., 2020)

Fare evasion has become an important issue for public transport companies, especially for those that have adopted proof-of-payment ticketing systems. Recent years have seen strong growth in the publication of studies on fare evasion. This paper reviews 113 studies to identify the characteristics of the research on fare evasion. An overview and classification in five main areas, i.e., fare evader-oriented, criminological, economic, technological, and operational is provided. Next, the status quo of these studies is assessed to support possible unifying research development.

Revisiting the foundations of fare evasion research

Boyd, Colin (2020)

In 1986 the author wrote a paper about tax compliance that theorized that the output of tax inspectors would be constrained by the rate of evasion of tax payments. That paper was never subsequently cited in the literature on transit fare evasion, which presumed that ticket inspection had a simple unidirectional effect on evasion. This current paper argues that all subsequent models of the economic link between fare evasion and ticket inspection overlook the possibility of a bidirectional relationship between the two. The 1986 paper further argued that multiple equilibrium levels of evasion versus inspection might be found to exist, and that evasion could therefore possibly theoretically be tipped from one level to another. This current paper suggests that the periodic concentrated deployment of inspectors might be a novel enforcement strategy that takes advantage of this phenomenon. The paper concludes with suggestions for the deceptive manipulation of passengers' perceptions of the probability of being detected as a fare evader.

Fare evasion in public transport: A time series approach

(Troncoso & de Grange, 2017)

An econometric model is presented that identifies the main variables explaining evasion of fare payment on a public transport system. The model uses a cointegration approach. The model parameters are estimated using data from the Santiago (Chile) bus system, where evasion has been measured at approximately 28%. The main results of the model are that (i) a 10% increase in the fare raises evasion by 2 percentage points and (ii) a 10% increase in inspections lowers evasion by 0.8 percentage points. An increase in unemployment, the third explanatory variable in the model, tends to induce a decrease in evasion, and vice versa. This counterintuitive finding may be explained by the fact that those most vulnerable to job loss, and more likely to evade than the average user due to economic necessity, tend to reduce their use of the bus system when unemployment rises and increase it when unemployment falls. Our results suggest a revision of the evasion control policy in Santiago to improve its effectiveness, and to link inspection efforts to fare increases or to decreases in unemployment.

Fare Evasion in Transit Networks

(Correa et al., 2017)

Public transit systems in major urban areas usually operate under deficits and therefore require significant subsidies. An important cause of this deficit, particularly in the developing world, is the high fare evasion rate mainly due to an ineffective

control policy or the lack of it. In this paper we study new models for optimizing fare inspection strategies in transit networks based on bilevel programming. In the first level, the leader (the network operator) determines probabilities for inspecting passengers at different locations, while in the second level, the followers (the fare-evading passengers) respond by optimizing their routes given the inspection probabilities and travel times. To model the followers' behavior we study both a nonadaptive variant, in which passengers select a path a priori and continue along it throughout their journey, and an adaptive variant, in which they gain information along the way and use it to update their route. For these problems, which are interesting in their own right, we design exact and approximation algorithms, and we prove a tight bound of 3/4 on the ratio of the optimal cost between adaptive and nonadaptive strategies. For the leader's optimization problem, we study a fixed-fare and a flexible-fare variant, where ticket prices may or may not be set at the operator's will. For the latter variant, we design an LP-based approximation algorithm. Finally, employing a local search procedure that shifts inspection probabilities within an initially determined support set, we perform an extensive computational study for all variants of the problem on instances of the Dutch railway and the Amsterdam subway network. This study reveals that our solutions are within 5% of theoretical upper bounds drawn from the LP relaxation. We also derive exact nonlinear programming formulations for all variants of the leader's problem and use them to obtain exact solutions for small instance sizes. \

Evaluating fare evasion risk in bus transit networks
(Barabino et al., 2023)
In Proof-of-Payment Transit Systems (POP-TSs), fare evasion is a crucial issue for Transit Agencies (TAs) and/or Public Transport Companies (PTCs) worldwide. The related research background is based on the standard ratio between evaders and inspected passengers, whereas no research quantified the risk of fare evasion in POP-TSs. The objective of this study is the introduction of a framework covering this gap: it integrates fare evasion factors, prediction models, a risk-based method and returns the risk value on (parts of) routes as a function of the frequency of fare evasion, the related severity and exposure terms. Next, routes are ranked according to the risk value and classified by a 5-level scale, to show the (parts of) routes with the highest risk of evasion. Results show the capability of this framework on about 20,000 real-world data records gathered by a mid-sized Italian bus company through fare inspection logs and passenger surveys. To conclude, this framework is a support tool for TAs/PTCs to improve fare compliance and can be incorporated into any transit managerial system.

2. Fare collection

Investigation into public transport fare noninteractions using large-scale automatically collected data
(Yin et al., 2022)
Fare card data provides an unprecedented opportunity to monitor day-to-day variability of travel demand and its responses to service disruptions and special events. However, when passengers take public transport without interacting with the fare system, demand is usually underestimated, which may cause problems for performance measurement and revenue collection. This research aims to

investigate the fare noninteractions phenomena of the tram network in Melbourne, Australia. According to a prior evaluation, only 37% of boarding passengers validate tickets. This study utilizes large-scale automatically collated data to measure fare noninteractions, including data collected by Automatic Passenger Counting (APC) and Automated Fare Collection (AFC) systems. Compared to previous studies with small samples of on-board surveys, it contributes to the state of the art as these high coverage data enable the study of the impact of different types of explanatory variables, including time periods, routes, stop location, travel demand variability, presence of an inspector on-board, etc. Moreover, a free service zone is located in Melbourne central business district where passengers are not required to validate tickets. We specifically investigate passengers' behavior at the boundary of a free service zone. Results show that fare noninteractions are lower for stops close to train stations, education facilities, stops that have been frequently inspected, and during the peak hours, but are higher for stops with large boarding flows, crowded services, evening periods and weekends. Importantly, conditioning on other variables, fare noninteractions at the boundary of the free service zone are higher in the morning peak but lower in the afternoon peak. The passenger flow diagram demonstrates the reason behind this may lie in the differences between purposes of trips. This investigation provides a starting point for proposing solutions to deal with the missing AFC data due to fare noninteractions.

Estimating Fare Noninteraction and Evasion with Disaggregate Fare Transaction Data

((*Estimating Fare Noninteraction and Evasion with Disaggregate Fare Transaction Data - Gabriel E. Sánchez-Martínez, 2017*, n.d.)

Public transportation authorities rely on electronic fare transaction records for revenue collection, service planning, and performance measurement. When passengers make public transportation trips without interacting with the fare system, demand is underreported and fare revenue is lost. In some cases, this issue is studied through costly manual surveys that cover a small portion of stops and times. Based on disaggregate fare transaction data, this research introduces a framework and stochastic model for estimating fare noninteraction and evasion on systems without automatic passenger counting. The model produces estimates by stop and time of day that could be used by agencies to effectively target fare inspection and off-board validation resources, as well as to improve the accuracy of scaling for inferred origin–destination matrices. Applying the model to morning peak trips originating at inbound surface stations of Boston's Green Line, it is estimated that the authority loses $3,600 per weekday to fare evasion seen in about one-third of noninteractions and 9% of all trips. A card-specific parameter estimated by the model sheds light on personal attitudes toward noninteraction.

Policy Issues in Implementing Smart Cards in Urban Public Transit Systems

(Eguchi et al., 2007)

Many public transportation institutions have been discarding their magnetic strip payment cards or traditional cash-based fee collection systems in favor of automated fare collection systems with smart card technology. Smart cards look like traditional credit cards or ID cards; however, using RFID technology, they allow for contactless payment and identification. Smart cards are becoming increasingly popular among transit agencies primarily because they are convenient for

customers, reduce administrative costs for transit agencies, and have the potential of improving the performance of complex transit systems overall. The increased availability and affordability of contactless cards has also contributed to this trend in adoption.

3. Enforcement

Strategies to Decrease Disorder and Diminishing Transit Ridership Through Fare Enforcement
(Boehm, 2021)

Urban rail transit systems are experiencing a decrease in ridership in part due to the perception of increased crime and disorder. To ensure passengers continue riding rail transportation, agency leaders must develop strategies to decrease crime and disorder caused by fare evasion. Grounded in the Kano model and Lean Six Sigma, the purpose of this qualitative case study was to explore strategies urban rail transit leaders use to reduce declining ridership associated with a perceived disorder caused by fare evasion. Data were collected using semistructured interviews of six urban rail transit leaders who manage fare enforcement efforts and a review of documents associated with fare enforcement. Data were analyzed using thematic analysis, and three themes were identified: (a) hot spot policing, (b) focus on education over enforcement, and (c) investigative follow-up. A key recommendation is for transit leaders to conduct focused fare enforcement to educate transit riders while remaining attentive to criminal activity. The implications for positive social change include the potential to lower urban traffic congestion based on increased rail ridership. Additionally, reducing crime will allow those who rely on public transportation, such as the economically challenged, physically challenged, the elderly, and urban youth, to conduct daily tasks.

Fare inspection in proof-of-payment transit networks: A review
(Barabino et al., 2024)
In proof-of-payment transit systems worldwide, fare inspection is the most widely adopted strategy against fare evasion from transit authorities and public transport companies. Although these actors attempt to make the inspectors' work as easy, effective, and equitable as possible, several issues need to be analysed according to a unifying approach, i.e., "How, where and when to inspect", "Who and why evades the fare", "How many and how to distribute inspectors" as well as improve the inspectors' effectiveness. Since no study exists in the literature investigating all these issues together, this paper aims to fill this gap with a review of several key papers that covered the full spectrum of relevant literature which, whole or partially, focused on fare inspection. Results show fare inspection is a beneficial strategy against fare evasion, but there are still many challenges and research limits that should be overcome in the years ahead. A possible research agenda is provided. It calls for specific options (i.e., data collection and fare evasion risk in hotspot definition, digital support and bottom-up approaches, size of inspection staff and scheduling of inspectors under realistic conditions and follower responses, effectiveness of actions focused on the visibility of fare inspection, managing interactions between fare inspectors and passengers) and integrated approaches

(i.e., linking the planning, organisation, and activities of fare inspection with who and why evade). Nevertheless, even if this review may not be conclusive, these results support a unifying literature development on fare inspection.

Deterrence and fare evasion: Results of a natural experiment
(Clarke et al., 2010)
Before 2005, the city of Edmonton's transit security staff served only its Light Rail Transit (LRT) not its buses. During 2005, the city redeployed the security staff to serve the buses as well. This meant that fewer ticket checks could be made on the LRT, which operates an 'honor' system of fare collection. Subsequently, in early 2007, it was decided to issue more fines and fewer warnings for evading fares on the LRT – a decision that was not publicized. Using weekly data for 163 weeks, this study examined the effect of these two changes on rates of LRT fare evasion. By the end of the period the risk of being checked for fare evasion had declined by a factor of nearly four, whereas the risk of being fined, if caught without a valid ticket, increased by a factor of 15. Despite these substantial changes in levels of enforcement, no clear trends were apparent in weekly evasion rates during the entire period. Possible explanations were explored for these results, including that the changes in levels of enforcement were not perceived by potential fare evaders. The implications of the findings are discussed for situational prevention and for transit authorities using 'honor' fare collection systems.

Fare evasion in proof-of-payment transit systems: Deriving the optimum inspection level
(Barabino et al., 2014)
In proof-of-payment systems, fare evasion represents a crucial topic for public transport companies (PTCs) due to lost fare revenues, damaged corporate image, and increased levels of violence on public transport, which might also have negative economic repercussions on PTCs. Therefore, there is a need to establish the level of inspection (i.e. the number of inspectors) to tackle fare dodgers as a possible option. By building on previous models, this paper develops a formal economic framework to derive the optimum inspection level in a long time window, based on system-wide profit maximization when fare evasion exists. The framework takes into account: (i) the refined segmentation of passengers and potential fare evaders, (ii) the variability of perceived inspection level by passengers, and (iii) the fact that an inspector cannot fine every passenger caught evading. Its implementation is illustrated by using three years of real data from an Italian PTC. Based on 27,514 stop-level inspections and 10,586 on-board personal interviews, the results show that the optimum inspection level is 3.8%. Put differently, it is sufficient to check 38 passengers out of every 1000 to maximize profit in the presence of fare evasion. This outcome is very useful, because it improves the one obtained in previous formulations. Indeed, profit maximization is achieved with a lower number of inspectors, thus reducing inspection costs, which are relevant determinants in proficient PTCs. Finally, the framework is flexible and may be applied to public transport modes other than buses as long as proof-of-payment systems are in use.

Moving Towards a More Accurate Level of Inspection Against Fare Evasion in Proof-of-Payment Transit Systems
(Barabino & Salis, 2019)

This paper proposes an accurate economic framework to determine the optimum inspection level—the number of ticket inspectors—in a long time window, in order to maximize the system-wide profit when fare evasion occurs. This is the first framework that introduces: i) a refined characterization of the passenger demand, ii) a profit function with new constraints, iii) an alternative estimation of the percentage of passengers who choose to evade, and iv) a new formulation accounting for inspectors who cannot fine every passenger caught evading. The implementation of this framework is illustrated by using six years of data gathered from an Italian public transport company. Based on 57,256 stop-level inspections and 21,827 on-board personal interviews, the optimum inspection rate maximizing the profit is in the range of 3.4%-4.0%. This outcome provides more accurate results, which are discussed and compared to previous research. Finally, the framework is flexible, and it may be applied to any urban context in which proof-of-payment systems are adopted.

Big Cities Crank Up Enforcement to Collect Dwindling Transit Fares
(Brey, 2023)
Agencies are spending new money — lots of it, in some cases — to crack down on fare evasion, with new fare gates, updated collection systems and beefed-up policing. But some experts question the cost.

Uncovering San Francisco, California, Muni's Proof-of-Payment Patterns to Help Reduce Fare Evasion
(Lee, 2011)
When transit customers pay fares, they contribute their fair share to help fund service. In San Francisco, California, anecdotal observations had reinforced perceptions that a high percentage of Muni (the San Francisco Railway transit system) riders were not paying, possibly costing the San Francisco Municipal Transportation Agency (SFMTA) tens of millions of dollars annually in lost revenue. In 2009, SFMTA, which operates Muni, conducted a proof-of-payment study to answer longstanding questions about fare payment patterns and identify strategies to improve fare enforcement. The resulting survey of 41,239 customers on 1,141 vehicle runs provided enough samples by time period, route, and vehicle occupancy to identify fare payment patterns at a disaggregated level. The study found a 9.5% minimum systemwide fare evasion rate that varied by route, location, time period, level of enforcement, and door of entry and amounted to an estimated $19 million annually in uncaptured revenue on the basis of 2009 fares. Although surveyors observed that there was no typical violator, the data showed that fare evasion was more prevalent on certain routes and during the afternoon and evening hours. Besides providing base data to measure future progress, the study enabled SFMTA to educate its customers about proof-of-payment requirements and deploy its fare enforcement personnel more efficiently and cost-effectively in an effort to improve fare compliance.

Why Enforcement Can't Be the Only Solution for Transit Revenue Protection
(*Why Enforcement Can't Be the Only Solution for Transit Revenue Protection*, n.d.)

The top 5 reasons why people evade fares and 5 non-conventional options to address fare evasion.

4. Data

Understanding Fare Evasion in Public Transport

(L.-A. Cantillo et al., n.d.)

Fare evasion is one of the main problems of many transport systems around the world. This unethical behavior can reduce the income of a transportation system by millions of dollars, seriously affecting its viability. Common strategies to reduce fare evasion are to increase inspection and fines; however, analyzing the problem in this way is very generic and simplistic. It is necessary to understand fare evasion to effectively address it. This study presents an econometric model for estimating evasion rates, incorporating socioeconomic, accessibility and operational variables to explain the levels of evasion in Transantiago, Santiago's (Chile) public transport system, and its spatial distribution across the city.

Fare evasion correction for smartcard-based origin-destination matrices

(Munizaga et al., 2020)

Origin-Destination matrices obtained from smartcard data are very valuable because they contain vast amounts of information and can be obtained at a very low cost. However, they can only account for trips paid by smartcard. Trips paid by other means, as well as non-paid trips, must be incorporated using additional information. This paper discusses the biases that are introduced due to fare evasion and presents a sequential method to estimate correction factors due to partial evasion in some trip stages, as well as total fare evasion in all trip stages, using external information regarding trips not registered in the smartcard database. We apply this method to the case of Santiago, Chile, where partial evasion (during a bus trip stage prior to a Metro trip stage) and total evasion (during all bus-only trip stages) are relevant fare evasion situations. Information from the Santiago Metro Origin-Destination survey and from external fare evasion measurements is used. The results indicate a 5% partial evasion rate for bus trip stages prior to Metro trip stages, and a 37% total fare evasion rate for bus-only trips. This paper is a contribution towards establishing new methods to feasibly obtain OD matrices through the adequate merging of automatically-collected data with complementary traditional measurements and survey instruments.

Measuring Fare Payment Compliance on MBTA Buses

(Gonzales et al., 2024)

This study presents a method to estimate fare payment compliance within the Massachusetts Bay Transportation Authority bus system using only automatically collected data from the Automated Fare Collection and Automated Passenger Counting systems. Data from over 787,000 passenger boardings were used to identify patterns of fare system non-interaction based on the difference between observed boardings and observed fare transactions. An estimated 22% of bus passengers do not interact with the fare system, but these non-interactions do not all result in lost fare. Some passengers are eligible for discounts and others who hold valid passes or are exempt from fares do not owe any payment at the farebox. Using average fare payments per observed transaction as an estimate of the lost revenue per non-interaction, revenue loss in the bus system is estimated to be

between $6.0 million and $7.4 million for 2019. The number of non-interactions scales with ridership so the busiest parts of the system and times of day (midday and PM peak) also have the highest number of non-interactions and estimated lost revenues. There is no spatial pattern in the non-interaction rate. The proposed method allows fare evasion and lost revenues to be systematically tracked.

Can we estimate accurately fare evasion without a survey? Results from a data comparison approach in Lyon using fare collection data, fare inspection data and counting data

(Egu & Bonnel, 2020)

In a context of worldwide urbanization and increasing awareness for environmental issues, it is undeniable that public transport will play an important role in the cities of the future. This will require increased attractiveness of public transit and adequate funding. In this regard, fare evasion could be considered as a threat that needs to be quantified accurately. To do this, transit operators often rely on on-site surveys that are limited in terms of spatiotemporal coverage. Yet, new data sources such as farebox transactions, fare inspection logs and automated passenger counter are now available and little research examines how they could help in estimating the fare irregularity rate. In this paper, we initiate research in this direction. To do this, we followed the operator's viewpoint and used a comparative approach to analyse the potential of those new data sources. We introduced a classification of fare irregularities and then applied data fusion methods to derive two fare irregularity rates. Results are then compared to a survey and the area of relevance of each data source is discussed. The research is done with data from the public transport network of Lyon which is an interesting case study because different access control types coexist (open and closed environment). The research results suggest that the fare inspection logs might have significant limitations to measure accurately the level of fare evasion. They also suggest that the merging of automated count and farebox transactions is a more promising direction of research. Still, it will probably not be enough to completely replace on-site manual survey. These findings can help operators in identifying the pros and cons of all data sources and implement new measurement methods.

A Synthesis on Data Mining Methods and Applications for Automated Fare Collection (AFC) Data

(Cevallos et al., 2021)

Automated Fare Collection (AFC) systems have been widely adopted by transit agencies around the world. AFC systems can provide a bias-free and low-cost approach to obtaining long-term continuous observations of transit passenger travel behavior. The availability of AFC data can help examine the behavior of passengers and the demand characteristics for public transportation services, which can be useful to support short-term planning and the development of long-term strategies. This research project provides a broad review of existing knowledge and experience in utilizing AFC data, from both the practice and research perspectives. After an extensive review of the literature, it is clear that there is a lot of research material in this area. However, there is still a need for an efficient, comprehensive, and user-friendly system to fully take advantage of the AFC data.

Review of Transit Data Sources: Potentials, Challenges and Complementarity

(Ge et al., 2021)
Public transport has become one of the major transport options, especially when it comes to reducing motorized individual transport and achieving sustainability while reducing emissions, noise and so on. The use of public transport data has evolved and rapidly improved over the past decades. Indeed, the availability of data from different sources, coupled with advances in analytical and predictive approaches, has contributed to increased attention being paid to the exploitation of available data to improve public transport service. In this paper, we review the current state of the art of public transport data sources. More precisely, we summarize and analyze the potential and challenges of the main data sources. In addition, we show the complementary aspects of these data sources and how to merge them to broaden their contributions and face their challenges. This is complemented by an information management framework to enhance the use of data sources. Specifically, we seek to bridge the gap between traditional data sources and recent ones, present a unified overview of them and show how they can all leverage recent advances in data-driven methods and how they can help achieve a balance between transit service and passenger behavior.

Public transport fare elasticities from smartcard data: Evidence from a natural experiment
(Kholodov et al., 2021)
This paper develops a method for analysing the elasticity of travel demand to public transport fares. The methodology utilizes public transport smartcard data for collecting disaggregate full population data about passengers' travel behaviour. The study extends previous work by deriving specific fare elasticities for distinct socioeconomic (e.g., car ownership and income) groups and public transport modes (metro, trains and buses), and by considering the directionality of the fare change. The case study involves a public transport fare policy introduced by the regional administration of Stockholm County in January 2017, where the zonal fare system for single-trip tickets was replaced by a flat-fare policy. The overall fare elasticity of travel funds is found to be −0.46. User sensitivity grows along with the journey distance. Metro users demonstrate the lowest sensitivity, followed by bus and commuter train riders. Low socioeconomic groups, in particular with respect to car ownership, tend to be less sensitive than the high-factor groups. In addition to the direct effect of changed fares, simplification and unification of the fare scheme appears to have substantially contributed to its attractiveness. The flat fare may allow the geographic disparity of public transport travel to be reduced and new users to be attracted from remote areas who are more prone to own cars.

Measuring and Managing Fare Evasion – TCRP 234
(Wolfgram et al., 2022)
Fare evasion is generally defined as a passenger using public transit without paying the required fare or possessing the required fare media or valid proof of fare payment. Fare evasion has significant implications for the financial sustainability of transit systems and must be replaced by another stable source of funding.
The TRB Transit Cooperative Research Program *TCRP Research Report 234: Measuring and Managing Fare Evasion* explores in detail the recent past and emerging future of fare enforcement on transit systems.

A Methodology for Correcting Smartcard Trip Matrices by Fare Evasion
(Cantillo et al., 2018)
It is increasingly common for public transport systems to incorporate Automatic Vehicle Location (AVL) and Automated Fare Collection (AFC) technologies as a source to improve their operation and planning. The information collected from these sources can be used to infer an Origin-Destination trip matrix which becomes a capstone for the system. However, trips or trip stages, evaded by users (not registered by AFC), are not included in these matrices, and therefore can hinder the proper planning and operation of the system. The present work presents a methodology for correcting the public transport travel matrix for evasion, starting from an estimated stop-based evasion rate, and information from an OriginDestination survey and smartcard transactions. An optimization model is used to build the corrected OD matrix, which minimizes the error between observed evasion rates and evaded rate predicted at each stop, while mimicking the travel structure of the Origin-Destination survey and the registered transactions. Finally, a case study applied to the integrated public transport system of Santiago is presented, where the average tax evasion rate for 2017 in bus trip legs is estimated at close to 30%.

5. Behavior

Why do people fare evade? A global shift in fare evasion research
(Delbosc & and Currie, 2019)
Fare evasion is a significant concern for most transit authorities. The traditional approach to fare compliance has focussed on modifying the physical control of ticketing or ticket inspection rates. Yet recently the perspective on fare evasion has begun to shift toward profiling the fare evader or understanding the customer motivations to fare evade. This paper uses a literature review method to document the characteristics of these three perspectives on fare evasion: the conventional transit system perspective, the customer profiling perspective and the customer motivations perspective. We find that the conventional transit system perspective, although straightforward to measure and control, has its limits particularly in "open" transit systems. The customer profiling perspective attempts to identify, based on demographics, which customers are more likely to fare evade. 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 what attitudes, social norms and circumstances motivates them to fare evade. Considering that between 20% and 40% of a city's residents admit to fare evading at some point, understanding these complex motivations can help improve revenue compliance at a time when most governments heavily subsidise their transit systems.

Identification of the determinants of fare evasion
(Cools et al., 2018)
Fare evasion occurs when passengers gain access to public transport by interacting with fare controls in manners that are inconsistent with tariff. Given the considerable economic impact of fare evasion, this study aims at identifying the factors that explain fare evasion. To investigate the socio-demographic correlates and motivations of fare evasion, a stated preference survey was conducted in

Flanders, the northern part of Belgium. In total, the survey collected valuable information of 636 respondents. The result of two logistic regression models, i.e. a model predicting personal fare evasion, and a model predicting acquaintances' fare evasion, indicate that only a very limited number of factors help in profiling the typical fare evader. In terms of socio-demographics, age and gender are uncontested predictors for fare evasion: younger travellers and male travellers have the highest likelihood to evade fares. For public transport operators this implies that marketing campaigns against fare evasion should be especially tailored to this subgroup for maximal impact. Besides socio-demographics, perceptions of ticket prices and perceptions with respect to the control probability are directly impacting evasion rates. To further unravel the motivations of fare evasion a shift towards a more psychological approach or the use of qualitative techniques seems promising.

What is behind fare evasion in urban bus systems? An econometric approach
(Guarda et al., 2016)
Fare evasion is a problem in many public transport systems around the world and policies to reduce it are generally aimed at improving control and increasing fines. We use an econometric approach to attempt explaining the high levels of evasion in Santiago, Chile, and guide public policy formulation to reduce this problem. In particular, a negative binomial count regression model allowed us to find that fare evasion rates on buses increase as: (i) more people board (or alight) at a given bus door, (ii) more passengers board by a rear door, (iii) buses have higher occupancy levels (and more doors) and (iv) passengers experience longer headways. By controlling these variables (ceteris paribus), results indicate that evasion is greater during the afternoon and evening, but it is not clear that it is higher during peak hours. Regarding socioeconomic variables, we found that fare evasion at bus stops located in higher income areas (municipalities) is significantly lower than in more deprived areas. Finally, based on our results we identified five main methods to address evasion as alternatives to more dedicated fine enforcement or increased inspection; (i) increasing the bus fleet, (ii) improving the bus headway regularity, (iii) implementing off-board payment stations, (iv) changing the payment system on board and (v) changing the bus design (number of doors or capacity). Our model provides a powerful tool to predict the reduction of fare evasion due to the implementation of some of these five operational strategies, and can be applied to other bus public transport systems.

Navigating Machine Learning for Travel Behavior Analysis: A Comprehensive Guide to Inferring Trip Purposes Using Transit Survey and Automatic Fare Collection Data Fusion
(Baek & Khani, 2025)
Applying machine learning (ML) to travel behavior analysis can be challenging due to the extensive model selection, feature engineering, and hyperparameter tuning involved. To address these complexities, this study provides a comprehensive, step-by-step guideline, illustrated through a trip purpose inference application that utilizes transit onboard survey (OBS) and automatic fare collection (AFC) data fusion. Two primary stages of experiments are conducted: first, systematically

comparing different feature engineering techniques—including positional encoding and categorical variable encoding methods—across five popular ML models (random forest, XGBoost, CatBoost, neural networks, and support vector machines); and second, examining the impacts of detailed hyperparameter tuning using an automated optimization framework. Results demonstrate that while appropriate feature engineering significantly enhances model performance and stability, hyperparameter tuning remains crucial to achieving optimal predictive accuracy. An adjusted application of positional encoding in a tabular form effectively captures spatial information. In contrast, advanced categorical encoding methods show limited benefit due to the low cardinality of the categorical variables used. Finally, a case study employing the best-performing model validates the feasibility of OBS-AFC fusion, enabling continuous, spatiotemporally detailed tracking of changes in transit travel behavior, particularly highlighting shifts in commute patterns during and after the COVID-19 pandemic. While the proposed methodology demonstrates robustness, practical applications require consideration of dataset limitations, including feature completeness and temporal proximity between surveys and AFC data collection periods.

Determinants of Fare Evasion in Urban Bus Lines: Case Study of a Large Database Considering Spatial Components

(Freiria & Sousa, 2025)

This article presents a large case study of fare evasion on bus lines in the city of Lisbon, Portugal, a common problem in dense urban areas. Focus is put on geographic factors, and an analysis is carried out using a generalized spatial two-step least-squares regression (GS2SLS). The large database, spanning one year of fare evasion reports, made it possible to segregate the analysis according to type of day (workday or weekend) and time period (rush hours, nighttime, etc.). Results show that indeed the type of day and time period lead to considerable differences between the seven models analyzed. It was found that the number of inspection actions is the strongest predictor of evasion, with geographic factors also playing a role in predicting fare evasion. Consideration of this spatial component made it possible to find moderate evidence for dissuasive effects of inspection actions in some models and of pockets of evasive tendencies in other models, which appear in the statistical error term. Interestingly, and contrary to other studies, age was found to have almost no influence on the propensity to evade fares. From a managerial point of view, this study highlights the importance of running inspection actions systematically and closely monitoring their outcomes. From a more theoretical standpoint, it suggests further research on geographic factors is needed to fully understand spatial patterns of evasion.

Fare evasion and information provision: What information should be provided to reduce fare-evasion?

(Celse & Grolleau, 2023)

To fight fare evasion, Public Transport Companies (PTC) mainly use two strategies: increasing inspection to detect fare evaders and enforcing fines incurred in case of being caught. PTC communicate differently on sanctions and inspection probabilities. Little is known about the effects of such a communication on fare evasion. Using a survey-based experiment, we examine experimentally what information (fine or inspection rate) and what framing of that information

(minimum, maximum, average and range) can better refrain people from travelling irregularly on public transports. We found relatively high levels of fare evasion intentions and results on deterrence consistent with the existing literature. We showed that participants are not sensitive to the content of the information delivered nor to its framing when considering to fare evade or not. We found that beliefs about the pervasiveness of fare evasion (e.g., the social norm) seems to be the main determinant to fare evade.

6. Agency impacts

Analysis of Transit Fare Evasion in the Rose Quarter
(Isreal & Strathman, 2002)

Fare evasion in NYC led to increased taxes on New Yorkers in 2024, new report shows
(*Fare Evasion in NYC Led to Increased Taxes on New Yorkers in 2024, New Report Shows*, 2025)
Fare evasion in NYC is leading to taxes and fees on businesses and consumers to pay more for MTA operating budget.

The Blue-Ribbon Report on MTA Fare and Toll Evasion
(*The Blue-Ribbon Report on MTA Fare and Toll Evasion*, n.d.)
In 2022, MTA leadership convened the Blue-Ribbon Panel to develop fresh approaches to reducing fare evasion across the entire MTA system of subways, buses, commuter rails, bridges and tunnels. Read its report or provide feedback.

SFMTA's fare evasion crackdown: Is it paying off amid financial crisis? Here's a look at numbers
(*SFMTA's Fare Evasion Crackdown*, 2025)
The San Francisco Municipal Transportation Agency is catching more people trying to ride for free as fare inspectors are talking to twice as many passengers as they were a year ago. With the agency in a financial crisis- every dollar, every fair, counts.

Fare Evasion: An Economic Necessity for Some, a Burden for the M.T.A.
(Barron, 2023)
Fares eat up much of the income of poverty-level New Yorkers, but the transit agency can no longer afford evasion. And, a sweet deal for developers of Pier 94.

The MTA's False Fare Evasion Narrative
(*The MTA's False Fare Evasion Narrative*, 2020)

Paying Our "Fare" Share: Fare Compliance and Enforcement on Muni | SFMTA
(Culross, n.d.)

Fewer riders witnessing fare evasion as BART rapidly advances installation of Next Generation Fare Gates | Bay Area Rapid Transit
(*Fewer Riders Witnessing Fare Evasion as BART Rapidly Advances Installation of Next Generation Fare Gates | Bay Area Rapid Transit*, n.d.)

How the city plans to tackle Muni fare evasion
(Dickey, 2024)

BART Board Votes to Oppose Bill That Would Decriminalize Fare Evasion | KQED
(Brekke, 2023)

Diversion Program | San Diego Metropolitan Transit System
(*Diversion Program | San Diego Metropolitan Transit System*, 2020)

BART needs to fully understand fare evasion numbers
(Allen, 2019)

Blaming an epidemic of trolley fare-beating, MTS cracks down on scofflaws with $25 fines
(*Blaming an Epidemic of Trolley Fare-Beating, MTS Cracks down on Scofflaws with $25 Fines*, n.d.)

Will Metro's Latest Crack Down On Fare Evasion Help Improve Safety For Riders? ~ L.A. TACO
(*Will Metro's Latest Crack Down On Fare Evasion Help Improve Safety For Riders?*, 2024)

San Francisco sees 30% drop in Muni fare evasion after SFMTA crackdown | KTVU FOX 2
(*San Francisco Sees 30% Drop in Muni Fare Evasion after SFMTA Crackdown | KTVU FOX 2*, n.d.)

Make Sure Riders Pay Their Fare Share
(Petrie, 2014)

Study downplays BART claims on fare evasion
(Khalid, 2025)
A recent study by a non-profit agency has found that BART's efforts to crack down on fare jumpers haven't significantly improved revenues nor reduced fears over safety by riders.

7. **Equity**

The unequal impacts of time, cost and transfer accessibility on cities, classes and races
(Bittencourt & Giannotti, 2021)
Inequalities are structured and reproduced in multiple dimensions and scales. From countries to neighborhoods, socio-spatial structure interacts with urban and public transportation development and results in uneven access to opportunities in manifold aspects. By looking at cities in distinct positions of the globalized world, São Paulo, New York City and London, we demonstrate that travel times, costs and transfers have different impacts on job accessibility of social classes and ethnic-racial groups living in different areas of cities in different parts of the world. At the

global scale, while the monetary cost of travel relative to income has a small impact on accessibility in central and developed countries, it substantially diminishes the access to opportunities of a large share of the population in peripheral and developing countries. Also, social class has a strong influence on accessibility levels among whites, and upper classes are far better than middle and lower classes. Among blacks, however, historical trajectories of development have a major role in explaining accessibility. The analysis of socio-spatial inequalities in multiple dimensions and scales highlights the centrality of the affordability dimension in transport studies and also its importance to the evaluation and formulation of contextualized policies, particularly in the peripheral world.

Discrimination, fairness and prediction in policing : fare evasion in New York City
(Rothbacher, 2020)
Predictive policing has quickly become widespread in the United States. Practitioners claim it can greatly increase police efficiency and base decisions on objective statistics. Critics say that these algorithms reproduce discriminatory outcomes in a biased justice system. In this thesis, I investigate fare enforcement in New York City and what might happen if predictive policing were applied. First I analyze legal precedents on discrimination law to create a framework for understanding whether policy is legally discriminatory. In this framework the fairness of a government policy is judged based on how different groups are treated by the process of carrying out the policy. Three elements must be examined: a comparison group that is treated fairly, discriminatory burden for the disadvantaged group, and government negligence or intent. Next, using this framework, I perform data analysis on fare evasion arrests in New York City, and find evidence of discrimination. Finally, I examine predictive policing to determine what its effect on fare enforcement might be. I conclude that predictive policing algorithms trained on the arrests will be ineffective and seen as unfair due to the institutional practices that impact the data. This examination sheds light on how machine learning fairness could be analyzed using societal expectations of fairness.

Policing Poverty: Evidence from a New York City Subway Fare Evasion Crackdown
(Stolper, 2025)
Public transit systems attempt to deter fare evasion in order to reclaim lost revenue, often relying on police enforcement as a fare evasion deterrence tool. However, police cannot monitor fare evasion at every station, and there is limited evidence on how they enforce it in different neighborhoods with diverse riders and varying ability and willingness to pay. This paper uses a difference-in-differences (DID) design to examine how neighborhood poverty rates influence the intensity of fare evasion enforcement actions during a crackdown on New York City subways, and to explore the policy implications for equitable transit access and racial justice in policing. Results demonstrate that the crackdown resulted in a significant increase in enforcement actions at the highest poverty station areas relative to the lowest poverty quartile stations, with no discernible effects for stations in the second and third quartiles. There is also a significant increase in non-violent subway crimes at the highest poverty stations, with no effects for other station poverty quartiles or for violent crime. These results demonstrate the salience of economic need which cannot be policed away, with no evidence that this heightened enforcement deters other subway crime. Additional descriptive results show that the crackdown

was concentrated at stations in predominantly Black and Hispanic neighborhoods. These findings raise questions about the equity and efficacy of prioritizing police enforcement as a strategy to deter fare evasion and increase fare revenue, particularly at stations where more riders may face binding resource constraints.

8. Justice

Op-Ed: Why Is Fare Evasion Punished More Severely than Speeding? - Streetsblog California
(*Op-Ed*, 2023)
A.B. 819 offers California the opportunity to decriminalize fare evasion and replace punitive measures with more equitable approaches.

Fare Evasion Is a Minor Crime With a Major Impact
(of et al., 2024)
Washington's buses have a free-rider problem, and it has a disproportionate effect on attitudes about public safety.

Ticket Punch: The Consequences of Fare Evasion Enforcement in New York City Subways
(Delgado et al., 2024)
Researchers at the John Jay College Research and Evaluation Center (JohnJayREC) investigated transit fare evasion in subway stations and station complexes throughout New York City between 2018 and 2023. The study was conducted as part of the New York City Police Reform and Reinvention Collaborative Plan, overseen by the New York City Mayor's Office of Criminal Justice (MOCJ). The research team analyzed associations between fare evasion and arrests reported by the New York City Police Department (NYPD) and considered the social and economic characteristics of the neighborhoods surrounding each transit station. The study found no statistically significant associations between fare evasion enforcements and total arrests for felonies and misdemeanors. Fare evasion enforcement, however, was most prevalent in stations whose neighborhoods were characterized by high socioeconomic disadvantage. The statistical interaction of crime rates, fare evasion enforcement, and socioeconomic disadvantage underscores the role of social factors in public safety.

Understanding Fare Evasion Defendant Compliance: An Assessment of Criminal Records - ProQuest

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