
Transit Fare Policies, Including Fare-free Transit

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Project Description

This project reviews and summarizes empirical evidence for a selection of transportation and land use policies, infrastructure investments, demand management programs, and pricing policies for reducing vehicle miles traveled (VMT) and greenhouse gas (GHG) emissions. The project explicitly considers social equity (fairness that accounts for differences in opportunity) and justice (equity of social systems) for the strategies and their outcomes. Each brief identifies the best available evidence in the peer-reviewed academic literature and has detailed discussions of study selection and methodological issues.

VMT and GHG emissions reduction is shown by effect size, defined as the amount of change in VMT (or other measures of travel behavior) per unit of the strategy, e.g., a unit increase in density. Effect sizes can be used to predict the outcome of a proposed policy or strategy. They can be in absolute terms (e.g., VMT reduced), but are more commonly in relative terms (e.g., percent VMT reduced). Relative effect sizes are often reported as the percent change in the outcome divided by the percent change in the strategy, also called an elasticity.

Summary

Free and reduced fare (FAR) programs reduce or remove transit fare payment for passengers. These programs may increase transit ridership and reduce car use and/or car dependence, as they lower the transactional cost and improve the convenience of using public transit. The impacts of these programs are typically measured in terms of ridership or mode shares. In some cases, individual behavior change is evaluated. FAR programs can improve mobility for those who are most transit reliant.

Strategy Description

FAR programs remove or reduce cost as a barrier for using transit while also improving convenience by removing the steps of fare payment. Other mechanisms include discounts for particular user groups, such as “unlimited

access” or “eco-passes” which are prepaid transit passes purchased by universities or employers and income-based discounts.

Behavioral Effect Size

FAR programs have a small overall effect on both transit ridership and on VMT though they may result in large changes for some individuals. Changes in ridership or VMT related to fare changes may come from increased use among existing transit travelers or mode switching to or away from transit. A small number of studies evaluate how much driving changes as a result of the changes in fare but find limited effect. There is some evidence that higher starting fares (Cats et al. 2014) and fare changes in smaller cities (Shimek 2015, Keblowski 2019) may lead to greater changes in ridership. Some university-based programs have large increases for the specific samples.

Strategy Extent

Fare policies may be implemented throughout an entire transit system, for one specific mode of service (e.g., light rail service), or for a geographically defined area. Discounts and passes may alternatively be offered to particular user groups, such as K-12 or university students.

Strategy Synergy

Key synergies occur when increases in service correspond to free transit (van Goeverden et al. 2006) and when university programs generate income that allows service expansions (e.g., Brown et al. 2003).

Strategy Description

As a VMT reduction strategy, free and reduced fare (FAR) transit may increase ridership by lowering the price of transit and removing cost as a barrier, thereby making transit more attractive to potential passengers. At the same time, removing the steps in fare payment may make transit more convenient. There are a number of formats that free and reduced fare transit may employ (Kebrowski 2019). One may also distinguish between subsidies, where fares are not changed but partially or wholly paid for by someone other than the traveler, versus policies that set the fare amounts (King and Taylor 2022). Both are considered here. Some of the most common FAR programs include:

Completely fare free: May be available to a specific set of users (typically as a pilot program), or the entire system. No fares are paid. A pass may or may not be required.

Unlimited access: Provides free passes or discounts to particular user groups, for example through a university or an employer. These programs may be administered by the agency or through the relevant university or employer.

Equity Effects

FAR programs allow more frequent transit use among those who rely on transit most, thereby improving mobility equity and allowing better access to work, school, shopping, healthcare, and other locations. Similarly, where fares are completely removed there is no need for fare-payment verification, which can reduce racially-inequitable fare enforcement. FAR programs can result in lost revenue and subsidize travel for those who can afford to use transit regardless of the cost. However, these outcomes can be reduced through planning, through income-based discount programs, and by providing free or reduced fares to particular groups such as youth and students.

Youth programs: Provide fare-free or reduced fares to travelers under the age of 18 (or a few years older) or enrolled in K-12 school.

Income-based: Provide discounted fares to those with qualifying levels of income. Passes or accounts can take varying forms (Darling et al. 2021).

Use-based: Discounts for frequent transit use, including *discounted passes* (e.g., 20 rides for the price of 25) or low-fare unlimited monthly passes. Discounted passes require an up-front investment by the traveler. An alternative is *fare-capping* where passengers pay fares as they go, but once a maximum amount is reached within a specified period of time (a day, a week, a month) the traveler pays no additional fares until the period ends.

In addition to these FAR programs in the US, seniors, veterans, and some other groups receive discounted transit access. Because there is less flexibility in the provision of these discounts and they are not anticipated to have large impacts on ridership or VMT (because the travelers are more likely to be transit reliant and make up a small portion of the population), these types of reduced fares are not covered in detail here.

Strategy Effects

The impacts of FAR programs are measured in terms of transit ridership, transit mode share, and/or individual travel behavior changes.

Ridership elasticities range from a low of -0.1 up to -1.1 based on price increases and decreases. Mode share changes vary based on the type of program, but the research generally finds that mode shares increase with reduced fares or free passes.

Behavioral Effect Size

There are few studies that estimate the VMT impacts of fare free transit. Much of the research on fare changes evaluates impacts to ridership or individual travel behavior changes.

Two of the early instances of fare-free transit in the US were in Mercer County, New Jersey, and Denver, Colorado. Though neither was continued, demand increased by 49% in the NJ case and by 30% in the Denver case (Kebrowski 2019). These cases occurred nearly 50 years ago but demonstrate the potential impact of FAR programs. Another long-time standard for transit fare elasticity is the “Simpson-Curtin” rule, established by John Curtin in a 1968 study conducted during planning of the Bay Area Rapid Transit (BART) system. While Manski (1979) cites this elasticity as -0.33, Curtin’s original equation includes a slightly different slope of 0.30 (the inclusion of *percent reduction* in ridership makes the coefficient positive). All other studies included in this brief report negative elasticities; change in ridership takes the opposite sign of change in fare.

The Simpson-Curtin rule and a number of other elasticities are estimated for fare increases rather than fare decreases. There is not conclusive evidence that the impacts of increases and decreases are/are not symmetric (see King and Taylor 2022, Chen et al. 2011). However, there is consensus that increasing fares will reduce ridership and decreasing fares will increase ridership. The aims of this project are to evaluate strategies for increasing transit

use. Therefore, the remainder of the discussion presented here is centered on the effects of decreases (or removal) of fares.

Ridership elasticity: Studies looking at changes to both fare increases and decreases have found elasticities in the range of -0.1 to -0.6 (Oum et al., 1992), and -0.33 when service is treated exogenously versus -0.60 when service is endogenous (Holmgren, 2007). Looking at fare increases among 198 operators in the US, Schimek (2015) finds an elasticity of -0.34 in the short run and -0.66 in the long run. The elasticity for larger urban areas is estimated at -0.48 and smaller urban areas, with fewer than 1 million residents, is estimated at -0.73. Finally, using a dynamic panel model, Li et al. (2020) estimate a long run elasticity of -1.1 using data from 99 Canadian transit agencies.

Multi-city studies: Considering outcomes other than elasticity, among 39 agencies in the US with different types of fare-free programs, agencies in small urban and rural areas reported ridership increases ranging from 39% to 205%, university programs reported 53% to 125% increases and resort areas 21% to 200% (Volinski 2012). In a survey of 59 California agencies with various discount programs, 2 out of the 8 with income-based programs reported positive ridership impacts. Most of the remaining agencies reported they don’t know the impact (Saphores et al., 2020).

Fare-capping: Turning to fare-capping impacts, only four out of the 50 largest US transit agencies had implemented this kind of program during the time covered by one study. Of those that employed monthly fare capping, two agencies reported 3.6% and 4.1% increases in ridership and about 3.1% increase after one year and a 5.8% increase after two (Ziedan et al. 2024). Lastly, one study employing simulations finds a 10% reduction in fares could increase transit trips by up to 5.03%, while a 50% reduction could increase trips by 28.38%. These correspond to 0.71% and 4.00% increases in the

probability of choosing transit, respectively (Boarnet et al. 2024).

University programs: “Unlimited access” programs (typically for university students) may have the largest effects. In an interview-based study of university fare free programs, among the 35 universities interviewed the reported ridership increases were within a range of 71% to 200% (Brown et al. 2001). The authors also evaluated the BruinGO! program in Santa Monica benefiting UCLA faculty, staff, and students (Brown et al. 2003). They find an elasticity of -0.28 (lower fares led to higher ridership) for ridership in response to a fare-free program and a cross-elasticity of 0.1 (lower fares led to less driving) for driving. These programs may reduce parking demand and vehicle use, though the population with access to such programs may be small. As a result of the unlimited access program at University of Wisconsin, Milwaukee, it was estimated that the driving share to campus decreased from 54% to 38%, then 41% while the bus share increased from 12% to 25% then 26%. In addition, the authors estimated round trip VMT reductions were 5,084,265 over the 1994–1995 academic school year (Meyer and Beimborn 1998). This estimate is based on survey data collected before and after the program was implemented.

In one study covering multiple types of unlimited access programs, of the 34 with K-12 discounts, 13 reported positive impacts. Of the 32 with university/post-secondary programs, 19 reported positive impacts, and of the 31 with employer-based programs 12 reported positive impacts while few to no agencies in all three program types reported no or negative impacts (though some reported they did not know) (Saphores et al., 2020).

These unlimited access programs may also lead to positive feedback loops whereby the income generated from these programs allows for service expansions and further increases ridership and potentially income. Last, in their

evaluation of four European case studies van Goeverden et al. (2006) found offering all students in the Netherlands free transit access increased the share of students from 11% to 21%, with 34% of those who started using the bus switching from car. A second program in the Brussels area resulted in about half of the students using the program and, of those, 60% had switched to bus from car.

Completely fare-free: Fare-free programs may also be implemented broadly, but in these cases have lower impacts or present more difficulties in measuring impacts. Cirillo et al. (2023) compare pre- and post-fare-free traffic volumes for areas with and without fare free transit in the Alexandria area outside of Washington D.C. They find no significant change in traffic volumes following fare-free implementation. There is increased transit use in the fare-free area which is attributed to increased travel and increased use of transit rather than reductions in private vehicle use. “Regarding awareness of the policy, a majority of respondents were uninformed, while the policy's impact is more pronounced among those who were aware. Around 32% of respondents increased their bus usage following Fare Free Public Transit (FFPT) implementation, with approximately 80% of this subset [those that were aware] utilizing buses more frequently than before.” (Cirillo et al., 2023 p. 18).

Focusing on the entirely free system in the city of Tallinn, Estonia, Cats and coauthors (2014) find an increase in transit demand of 3% with fare free implementation, but attribute only 1.2% of that change to the introduction of fare-free travel. They suggest that the remainder is due to service improvements. In a follow-up study, one year after implementation they find a 14% increase in transit use associated with a 10% decrease in private vehicle use and a 40% reduction in walk trips (Cats et al., 2017).

Van Goeverden et al. (2006) evaluate four fare-free case studies in the Netherlands and Belgium; two are route-specific and two are

student programs (see above). The first aimed to reduce congestion over a longer distance route connecting to the Hague region. The result was “so small it could not be measured” (van Goeverden et al. 2006, p. 9), though 45% of new passengers had previously used cars. In the second case, annual ridership increased by a factor of ten from 331,551 to 3,200,000, 16% of which was trips previously made by car.

Case study experiments: A study of a special discount for older individuals in Seoul, South Korea, found a 16% increase in transit use resulting from a fare free program for those over the age of 65 (Shin 2021).

Thogerson and Moller (2008) evaluate the use of free transit passes given to 575 car drivers with random assignment to treatments of a free pass, a personalized timetable and/or a planning exercise. The study did not estimate ridership or mode share changes, but the passes did increase transit use in the short term. However, changes were not maintained.

Another experiment designed to compare the effect of a free pass uses travel diary data from 200 workers in Santiago, Chile, over two weeks. They find the free pass did not affect private vehicle travel (Bull, Muñoz, & Silva, 2021).

In a study of ridership changes on New Jersey Transit commuter rail trips in the New York City metropolitan area, Chen et al. (2011) use a time series analysis of ridership and find that the demand elasticity for transit with respect to fare increases is between -0.40 in the short term and up to -0.80 in the longer term. This is perhaps the only study that finds a greater fare elasticity than the elasticity for service: 0.13 in the short run and 0.27 in the long term. They also test for asymmetry, and their results suggest there is an asymmetry in the effects of a fare increase versus a decrease. One study employing regression to estimate the impact of fare subsidies across 41 cities in various parts of the world finds that fare subsidies did not change private vehicle use, nor affect transit

ridership (de Grange et al. 2012). These results are in contrast to much of the other work on fare changes. King and Taylor (2022) point out that across a number of studies changes in fare do have an effect on ridership, but they also suggest service improvements may be more effective at increasing ridership than reducing or removing fares.

Extent

Starting fare value: There may be a larger fare elasticity related to fare increases when the initial fare is lower than when it is higher (Shimek 2015). The results for higher fares are statistically insignificant.

A related example is Tallinn, Estonia, where the fare free program resulted in very small changes. The authors suggest it is due to the high transit mode share and high share of riders effectively accessing transit fare-free through discount programs that were available prior to the city-wide fare-free program (Cats et al. 2014). The initial very low fares limited the effects of the system-wide fare-free program.

Scale of Application: University programs in the US are likely the most impactful, though limited to specific groups (see Saphores et al. 2020, Brown et al. 2006, and Meyer and Beimbom 1998). The impacts of other free or reduced fare programs impact ridership within wide ranges: 32% to 205% in one study (Saphores et al. 2020, Volinski 2012, Chen et al. 2011, Brough et al. 2022, Hirsch et al. 2000). International examples also have large ranges of impacts (Cats 2014, van Goeverden et al., 2006, Holmgren 2007).

Location Within the Region: Meyer and Beimbom found that residents living outside of Milwaukee County had a very small shift in mode use compared to those living within the county. They note that “Over 83 percent of the out-of-county respondents who reported driving to UWM in spring 1994 continued to drive during spring 1995. Only 3 percent of out-of-county respondents indicated that they had

shifted from driving to using MCTS during spring 1995.” (Meyer and Beimborn 1998 p.133).

Efficiency or Cost: FAR programs can have both positive and negative impacts on efficiency and costs. Efficiency improvements can come from the removal of fare payment and processing for both travelers and agencies. This includes quicker boardings, shorter dwell times, and the removal of ticket vending, fare validation and enforcement, payment reconciliation, etc. However, they may introduce other areas of enforcement such as unhoused individuals using transit as a form of shelter.

Reduced fare programs, particularly means-based programs, can introduce administrative burdens for both the agency and travelers as a result of eligibility verification processes.

Free and reduced fare programs may result in lost revenue that can lead to various impacts, perhaps most notably service reductions (see King and Taylor, 2022 for more detail).

Time / Speed of Change: Most of the studies included here do not differentiate between short- and long-run changes. Those that do suggest that the elasticity of fare increases likely increases over time; i.e., ridership decreases more as time passes (Chen et al., 2011, Shimek 2015), though there is likely a limit to this change. The impact of fare-capping (a method of providing discounts for frequent users) also increased over time (Ziedan et al. 2024). Li et al. (2020) look at fare increases and decreases and find an elasticity, -1.1, in the long run (no short run is reported).

Differences between Regions: There is evidence that fare increases in larger urban areas (greater than 1 million residents) lead to smaller changes in ridership than in smaller urban areas (fewer than 1 million residents) (Schimek 2015). Koblowski (2019) also notes that the programs implemented around the world are primarily in “2nd or 3rd tier cities” with fewer than 100,000 inhabitants. On the other hand, Ofusa-Kwabe et al. (2024) find larger increases in ridership in

larger urbanized areas than smaller urbanized areas resulting from fare-free transit implementations over the period 2011-2021.

Time of Day: Reduced or free fares may be more effective at increasing ridership during off-peak times rather than peak periods (Bull, Muñoz, & Silva, 2021).

Program coverage: Unlimited access programs, provided to only a specific set of users such as college students, are likely have larger impacts per individual than programs that remove fares for all travelers. However, their extent is limited. In other words, while individuals taking advantage of these programs may make large changes, the smaller scale of these programs mean that their impacts are likely small overall. Programs that offer completely fare-free service to all passengers do result in modest increases in ridership. Ridership changes may occur, but there are very limited changes in driving, i.e. ridership changes are not matched by substantial reductions in driving.

King and Taylor (2022, p. 1) discuss a number of these factors impacting the extent of FAR programs:

On systems with higher farebox recovery rates, especially those serving large downtowns, the opportunity cost of fare-free programs is much higher, and such systems tend to (though they do not always) carry proportionally larger shares of non-poor riders. On these latter systems, targeted fare-reduction programs aimed at particular rider groups (low-income, students, etc.) are a less costly way of directing fare reductions for those riders who need them most. But in either case, the costs and benefits of FAR programs should be weighed against the costs and benefits of improving service quality (King and Taylor 2022 p. 1). Although in recent years there have been shifts in where people live and work, past trends have followed a pattern such that transit-reliant populations are more likely to be located in denser, more central areas and more likely to use transit for more frequent, though shorter, trips. Transit

commuters tended to live in wealthier and often suburban areas and primarily use transit for commuting; these individuals are less sensitive to transit fares except when they rival parking costs at or near their workplace (King and Taylor 2022). Though the geographic distribution of income groups has changed over time, it is still probable that transit-reliant individuals are more price sensitive than more affluent transit users and thus the impacts of FAR programs would be greater among these groups.

Passenger Heterogeneity: “The majority of households in our sample report having one or two members. Overall, we find that smaller households (those with one or two members) have larger treatment effects than larger households. Consistent with our data validation exercises using follow-up travel surveys and geolocation information (see the Appendix), this suggests that intrahousehold transit card-sharing is likely not a major contributor to the size of the overall treatment effects.” (Brough et al. 2022 p. 9).

Transit-reliant individuals are also likely to increase ridership as a result of FAR programs, but this would not necessarily correspond to reduced private vehicle use. Even those who are transit reliant may not continue to use transit if they have the opportunity to purchase a vehicle and drive (Manville et al. 2023), whether or not a change has been made in fares.

Equity

Fare-free systems can improve transportation and mobility outcomes as well as wellbeing by allowing improved access to healthcare, grocery shopping, employment, school, and social and recreational activities (Kirk et al. 2023).

When FAR programs result in service reductions, the impacts are greatest on those who are most transit reliant.

Fare-free programs can improve equity outcomes because they remove the burdens of

discount eligibility verification which are experienced by lower income passengers when means-based discounts are provided. Means-based discounts may have numerous steps and require those seeking discounts to travel to specific locations in order to verify eligibility as well as provide sensitive personal and financial information. Another equity benefit of fare-free transit is the removal of the need for fare enforcement which may be racially inequitable (readers are referred to Delbosc and Currie 2019 for additional information).

In the interest of reducing the cost of transit for lower income groups, one alternative to discounted fares is fare capping. Fare capping may be more equitable as it does not require eligibility verifications and enables lower income individuals to pay lower fares without the high up-front costs of multi-ride or monthly passes (Darling et al. 2021 and Ziedan et al. 2023). Fare capping has not been implemented widely (Ziedan et al. 2023), though it is increasing with the implementation of account-based ticketing and open-loop payments.

If equity is considered in terms of the cost-per-mile monetary benefits received to travelers, some argue (e.g., Cervero 1981) that any flat fare is inequitable. Past residential patterns typically divided transit travelers such that those who commute longer distances tended to be wealthier suburban residents who benefited more in that they paid less per mile than residents in more central locations who use transit for shorter distances (King and Taylor 2022, Cervero 1981), even if they have a greater trip frequency. Residential patterns have shifted over time; greater numbers of wealthier individuals and households live in urban cores. As lower income households are displaced and must travel further distances to urban centers, these groups face greater transportation burdens. And suburban and low-density areas cannot be as efficiently served by fixed route service and so the transportation burdens faced

by lower income groups continue to be inequitable.

Unlimited access programs have the potential to level the costs of transportation since, at least historically, universities and other institutions typically subsidized parking but did not offer financial support for other transportation modes (Brown et al. 2001).

Similarly, these programs provide agencies with guaranteed funding that can be used to support service improvements that benefit all riders.

Finally, an often-cited equity impact of FAR policies is the potential for anti-social behavior of unhoused individuals seeking refuge on transit. This may impact transit reliant passengers more, however there is limited evidence that this occurs (Taylor et al. 2022).

Synergy

FAR programs may increase the use of non-motorized modes as public transit is used to travel to a destination, and another mode such as walking might be used on the return, or when one walks to access transit (Bull, Muñoz, & Silva, 2021); though the Chilean context is very different from California, it is plausible that increased use of transit may lead to increased walking either as an access mode or as the single mode used for other trips during the day. Unlimited access programs can delay the need to construct parking facilities which may in turn curb driving to particular locations, i.e., universities (Brown et al. 2003). These unlimited access programs can also reduce parking demand on campus (or other sites) thereby allowing funds to be diverted to other uses (transportation or not).

Fare-free programs allow for more efficient vehicle boarding. This can reduce localized emissions and contributes to service improvement as vehicles do not lose time during boarding (King and Taylor 2022) and may have the added benefit of removing vehicle operators from the fare validation and enforcement process. FAR programs also

improve awareness of transit and can lead to increased transit use. In the longer term, this could lead to reduced household vehicles and/or changes in household location (Brown et al. 2003). It may also lead to increased transit use through information sharing as passengers share experiences, fare, and route information or travel together (Brown et al. 2003).

The introduction of fare-free transit in Tallinn led to increased satisfaction with transit due to reduced reporting of “poor” and “very poor” in the survey responses from 12.5% to 5.0% (Cats et al. 2017). Improved perceptions can potentially lead to further increases in use.

Confidence

Evidence Quality

Studies are mixed in terms of sample size, timing, and representativeness. The smaller scale studies that more precisely estimate elasticities tend to have very small samples and may not be generalizable. Many of these studies also evaluate ridership changes rather than VMT or other measurements of private vehicle use. The relationships between ridership, mode share and VMT are not known and likely vary by region.

Studies using aggregate effects such as ridership and traffic counts provide estimates of the overall effect of the programs, though they do not determine how individuals are changing transit use and/or private vehicle use, or the extent to which changes are attributable to increased travel or to mode-switching.

Even when ridership impacts do occur, the effect of fare-capping can vary by agency and/or time of implementation (Ziedan et al. 2024). The authors also note that the number of agencies implementing fare-capping in their study is very small. They also point out, “Also, the impact of daily capping might be short term and potentially could not be captured in an annual model” (Ziedan et al. 2024 p.256).

There is some difficulty in determining elasticity when considering a conversion to a price of \$0, as compared to a less-than-100 percent change in price. Similarly, studies that do estimate elasticities are often based on fare increases (which are more common than decreases), the effects of which may not be symmetrical with decreases (as discussed by Chen et al. 2011).

There is a need for additional research on the co-benefits of FAR programs, specifically for disadvantaged and low-income communities; research should continue to study improvements in well-being, school attendance, financial and employment outcomes, etc. There are potentially very large mobility and accessibility benefits from these programs.

Caveats

While changes in fares do lead to changes in ridership—and here the focus is on ridership increases—there are a number of other factors that also impact ridership and to a greater extent than changes in fares.

Factors impacting transit ridership can be categorized as internal, those that an agency can control such as schedules and fares, versus external, including fuel prices, parking availability, etc. (Taylor and Fink 2009). In a more recent study, Erhardt et al. (2022) explore these long-standing factors and consider new impacts such as the role of TNCs.

Chen et al. (2011) point out that the asymmetry in response to a rise in fares as compared to a decrease in fares and the impacts of gasoline prices suggests that increasing gasoline prices might have more impact on transit ridership than reducing fares. Others also point out that the impacts of fares and service only account for about one quarter of changes in ridership when considering other factors such as land use, parking, economic factors, etc. (King and Taylor 2022, Taylor et al. 2009)

Fares are one source of revenue for transit agencies and farebox revenue's contribution to agency budgets varies greatly. Fares could be based on a number of financial considerations including capital costs, labor, and other operational expenses. However, this is rarely the case. The financial impacts affect the viability of FAR programs. If programs are not sustainable there are potential impacts to service that could result from lost revenue (see Yoh et al. 2015).

It is not clear and there is not strong evidence one way or another as to whether FAR programs result in mode switching from driving or alternatives or greater trips by those who already use transit, i.e., “encouraging current transit users to ride more versus encouraging new travelers to begin riding.” (King and Taylor 2022, p. 15).

Technical & Background Information

Study Selection

This policy brief focuses on ridership changes resulting from free and reduced fare transit. However, the majority of the literature on transit fare changes covers fare increases. This is also true for meta-analyses and syntheses (e.g., King and Taylor 2022, Schimek 2015, Holmgren 2007). There is inconclusive evidence that elasticities for fare decreases are symmetric with elasticities for increases. At the same time, only decreases in fare are expected to result in ridership increases and/or reductions in VMT. Therefore, the studies included here are those that evaluate decreases in fare or both decreases and increases. Excepting a few examples (e.g., Curtin 1968), studies that solely cover fare increases are not included.

Studies considered for inclusion were drawn from past scholarship with exceptionally thorough literature reviews or synthesis of past work. As a starting point, King and Taylor's (2022) review of FAR

programs, Volinski's (2012) evaluation of past work, and Holmgren's (2007) meta-analysis of ridership elasticities were reviewed. The studies covered in these papers were assessed for potential inclusion in this brief. All cited works that evaluate the ridership or travel behavior impacts of free or reduced fare programs were included if they met the following conditions: 1. evaluated the removal or reduction of fares and 2. estimated travel behavior or ridership outcomes. To identify any additional studies not within the connected citations noted above, a search was also conducted using Google Scholar using the search term "fare free transit". Additional studies that evaluated programs not included previously and met the above criteria were included.

Methodological Considerations

The studies included here largely do not evaluate changes in VMT directly but evaluate changes in transit ridership (at the agency level) or in transit use (at the individual level). Similarly, some studies evaluate changes in traffic counts, parking demand, or changes in individual car use. Finally, some of the works included here use reports (through interviews or surveys) from agencies and universities (or similar entities) that describe changes in transit use, parking use, and other outcomes that may serve as proxies for increases in transit use and/or reductions in driving for specific destinations. These studies are primarily centered on the Unlimited Access type of program.

The primary challenge with using ridership changes is associating those changes with corresponding changes in VMT and/or car use. Specifically, increased ridership occurs when *new* trips are made (that would not have been made otherwise). Ridership also increases as a result of mode shifts away from private vehicles (or other modes) and to transit. Without detailed user data or travel diaries it is difficult to attribute ridership changes to these two (interrelated) occurrences. Some of the studies included here (e.g., Cats et al. 2014) try to break down ridership changes to corresponding changes in the use of other modes (or not).

Where studies draw on ridership, traffic counts, or parking demand changes, the impacts of the FAR programs on these outcomes are uncertain and require some effort to track.

From a researcher's perspective, there is a tradeoff between getting somewhat accurate estimates of changes in transit use (or even individual changes in VMT) but needing to generalize these changes to the population. This contrasts with the benefits of tracking systemwide changes in ridership and traffic counts that pinpoints the high-level change but not the individual behavior changes contributing to that change. Other studies that estimate elasticities do so with fare increase information, which provides an elasticity with the underlying concept being how much would transit use decline with a 1% increase in the fare cost. This is in the wrong direction for what we are considering here; however, it may provide an estimate for the amount that travel might increase with a corresponding price reduction. There are additional challenges when trying to estimate elasticities based on completely removing fares, as the percent change in fare as it relates to the percent change in ridership may not be meaningful.

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Table 1. Effects of Free and Reduced Fare Transit

Table 1A: Studies with Multiple Locations

Study	Study Location	Sample Selection and Size	Study Years	Discount Type - overview of program	Results (elasticity of ridership)
Curtin, 1968	Various US	77 US Cities	Cases from 1952 to 1966/67	Fare increases	Slope: 0.30, Manski (1979) reports -0.33
Oum et al., 1992	Various global	12 Studies	Studies from 1980 to 1991	Fare changes – mostly increases	Most values between -0.1 & -0.6
Holmgren, 2007	Various US, Europe and Australia	Up to 81 models (including multiple models from one study in some cases)	None specified	Fare changes – mostly increases	-0.6 when service (miles) is treated as endogenous (i.e., determined in part by demand); -0.33 when service (miles) is treated exogenously
Volinski, 2012	Various US	39 agencies interviewed	Likely 2010-11	Completely free; agency reported ridership changes	Small urban: 32% to 205%, University: 53% to 125%, resorts: 21% to 200%
Schimek, 2015	Various US	198 US transit operators	1991 to 2012	Fare increases	Short run: -0.34, Long run: -0.66, Larger urban areas: -0.48, fewer than 1 million residents: -0.73
Saphores et al., 2020	Various California	59 agencies	October to December 2019	Various discounts; report of “positive” to ridership impacts for each type	K-12: 13 (out of 34) reported positive ridership impact, post-secondary: 19 (out of 32), employer-based: 6 (out of 9), elderly: 12 (out of 31), income-based: 2 (out of 8)
Li et al., 2020	“Canadian Ridership Trends Research” project	Annual data for 99 Canadian transit agencies	2002 to 2017	Adult fares entered in the model; no discussion of decreases in the paper (dynamic panel model)	Long run: -1.1 and results do not indicate asymmetry, but not confident in this outcome
Boarnet et al., 2024	Various US	MTC travel diary, NHTS, and ACS data	2017 NHTS, 2019 MTC, 2015-19 ACS	Simulated fare and travel time changes	10% reduction in fare estimated to 5.03% trips increase (0.71% probability increase), 50% reduction: 28.38 % trip increase (4.00% probability increase)
Ziedan et al., 2024	Various US	50 largest transit agencies	2011 to 2015	Fare-capping	3.6% and 4.1% increases for each of two agencies monthly fare capping; also, monthly fare capping impact increases over time from ~3.1% after one year to 5.8% after two years
Ofusa-Kwabe et al., 2024	Various US	516 transit agencies (NTD and US Census data)	2011 to 2021	Fare free transit	34% increase in transit ridership for small UZAs and 28% increase for medium UZAs

Table 1. (continued) Effects of Free and Reduced Fare Transit
Table 1B: Single or Few Location(s)

Study	Study Location	Sample Selection and Size	Study Years	Discount Type - overview of program	Results (elasticity of ridership)
Chen et al., 2011	New Jersey Transit New York, NY	NTD and US census data	January 1996 to February 2009	Fare increases; test for asymmetry	Short run: -0.4; long run: -0.8, likely asymmetric
Cats, 2014	Tallinn, Estonia	22 routes: 3 tram, 12 bus, 7 trolley	Fall 2011 to spring 2012 and January to April 2013	Completely free	1.2% ridership increase
Cats et al., 2017	Tallinn, Estonia	1,500 randomly selected	2012 to 2013	Completely free	14% increase in transit trips (attributed to 10% reduction in car trips, but 40% reduction in walk trips); one year after introduction
van Goeverden et al., 2006	Belgium and the Netherlands - four case studies	Fare free programs on specific routes/for student populations	Varies: 1991 to 2004; no original data collection	Percent of new users making modal shifts	From car: 16-60%, bike: 5-52%, walk: 9-19% other transit: 15-30%, new trip: 16-63%, mode share in students: increased 10-22%
Thogerson and Moller, 2008	Copenhagen, Denmark	1,000 car drivers participated with final sample 575 total; with random assignment to treatments: free pass, personalized timetable, and planning exercise	2002 to 2003	Free travel card for one month	Public transit use increased in short term, but changes were not maintained
Meyer and Beimborn, 1998	Milwaukee, WI	Students - 1 in 10 randomly contacted (out of 20,000 to 24,000) with 20-30% response rate ~ 400 to 720 (N = 651 for all trips; Figure 2)	Fall 1994 to spring 1995	Free student pass U-PASS	Driving share decreased from 54% to 38% then 41%, bus share increased from 12% to 25% then 26%
Shin, 2021	Seoul, South Korea	659,000 individuals from 225,500 households	2010 Seoul Metropolitan Area Household Travel Survey	Fare free subway for adults over 65 years old	16% increase in transit use among older adults
Brough et al., 2022	Seattle area	1,797 study participants; 2,675 LIFT cards (study locations), and 14,832 LIFT cards (all locations)	2019-2021	Up to six months free transit: low-income travelers through fare payment card	3.5 times as many (approx. 1 additional) daily boardings and trips among treatment group
Hirsch et al., 2000	New York City	ridership data	1995 to 1997	Free transfers and unlimited passes (day, week, 30-day)	40% increase on bus (mostly attributed to fare changes) and 12% on subway (about half attributed to fare changes)

Table 1. (continued) Effects of Free and Reduced Fare Transit

Table 1C: Unlimited Access Programs

Study	Study Location	Sample Selection and Size	Study Years	Discount Type - overview of program	Results (elasticity of ridership)
Brown et al., 2001	Various US universities	35 universities with transit pass	1997-1998 (interviews)	Unlimited access passes	Year 1: 71% to 200% ridership increase in target population (among 5 universities), subsequent years: 2% to 10% increase; Elasticity: -0.26 to -0.50; agency ridership increase of 7.6% two years into program
Brown et al., 2003	UCLA	4,565 in 2000 and 3,614 in 2001	2000 to 2001	Unlimited access pass	Ridership: -0.28, cross-elasticity for solo-driving: 0.1
Boyd et al. 2003	UCLA, Santa Monica Big Blue Bus, BruinGO! program	1,500 students	2001 and 2002	Unlimited access program for students: BruinGO!	Share of students taking the bus rose from 17% to 26% (51% increase); solo driving changed from 36% to 32%

Table 1D: Small sample and Experiments

Study	Study Location	Sample Selection and Size	Study Years	Discount Type - overview of program	Results (elasticity of ridership)
Cirillo et al., 2023	Washington DC area	997 survey participants, and traffic count data from VDOT	Survey: June and July 2022, traffic: 2018-2021	Free bus policy in Alexandria, VA	Small increases in frequency of use; 32% of all users increased bus use but 80% of those who knew about it increased bus use; but statistically insignificant; and no statistically significant change in traffic counts
Bull et al., 2021	Santiago, Chile	160 participants	2016 to 2017	Free pass experiment	Increased off-peak travel; do not find substitution effect