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Decrypting fare-free public transport in Tallinn, Estonia

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ABSTRACT

Among many possible interventions in public transport finance and policy designed to enhance the attractiveness of riding public transport, one of the most extreme, which is seldom implemented, is the elimination of passenger fares, effectively making public transport "free" for riders (with operating costs paid from other funding sources). This article describes a fare-free public transport program in Tallinn, Estonia, launched in 2013, which has exhibited lower-than-expected increases in ridership. Evaluations of Tallinn's fare-free public transport program are presented and synthesized, with a focus on program goals and how goals are met through program performance. Findings suggest certain flaws limit the program's potential success since the program design is misaligned with its primary stated goals, and several program goals relating to external effects of fare reform cannot be evaluated. Although it would be valuable for transport managers in other cities to learn about this experience, the Tallinn fare-free public transport program provides scant transferable evidence about how such a program can operate outside of a politicized context, which was crucial to its implementation in Estonia.

1. Introduction

City leaders, urban planners, and transport managers the world over have sought for decades to reduce the amount of driving in cities (especially solo driver commuting) to lessen the impacts of space-consumptive, energy-demanding, and polluting automobiles. New urgency about the need to curb driving has emerged in the face of growing automobility. While policy change may incrementally produce marginal gains in suppressing driving, large-scale high-profile interventions can, through their visibility, further advance strategy and action that fundamentally changes urban transport mode choice paradigms.

Various policy instruments have been introduced in recent years in cities around the globe to increase public transport ridership (and effect a modal shift from automobiles to public transport) by introducing service and operations changes. For example, public transport ridership gains may stem from service improvements (which make riding buses and trains faster and more convenient); riders and potential riders react according to the theory of fare elasticity to fare changes, and new fare payment opportunities can speed vehicle boarding (reducing dwell times) and make public transport more attractive for passengers.

In the largest example in recent years of significant fare reform, the public transport system in Tallinn, Estonia stopped charging fares to city residents in January 2013. This article articulates the goals for the fare-free public transport scheme and explores the degree to which the explicit and implicit program goals have been met, since previous analyses did not adequately assess the degree to which the program accomplishes its goals. The article also explores reasons why a comprehensive evaluation of this innovative public transport finance reform, which could be highly useful to cities and public transport systems everywhere, has not been conducted, given program design and operating characteristics of this politically-motivated reform of Tallinn's public transport system.

2. Background and context

Although most public transport systems require operating subsidies, a typical budgeting process includes establishing a per-rider cost and passenger fare. The price that each passenger pays toward the cost of his or her consumption of public transport service (the passenger fare) can be paid in one of three ways. First, the passenger can pay the full fare (which is rare in Western countries) to cover operating costs. Second, the public transport system (or "provider") can pay the full passenger operating cost, however "free" public transport systems are uncommon (De Witte et al.,

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2006). Most passenger fares are subsidized to some degree, meaning that the passenger pays a share—representing partial cost recovery—and the balance is subsidized (creating a hybrid of the first two options). Finally, a "third-payer" can pay the full cost, an arrangement in which an external party contributes to the public transport system to cover the fare cost of passengers.[1] This happens, for example, when employers pay costs for employees, when social service agencies pay costs for clients, and when universities pay costs for students (Brown et al., 2001).[2]

Given these various fare payment arrangements, transport managers aim to set passenger fares as low as possible (to maintain existing riders and entice new riders) but high enough to cover necessary operating costs. Occasionally, passenger fares have been completely eliminated, reducing out-of-pocket expense for riding public transport to zero. In such cases, passenger fares are of necessity replaced with another funding source. It is no surprise that the notion of fare-free public transport is highly appealing, due to benefits for riders, for cities, and for the environment. Fare-free public transport transforms local buses and trains from a user fee-based service into a tax-payer-supported "public good" like libraries and parks. Everyone pays to support public transport (through taxes), and benefits accrue to users (directly, by not having to pay a fare) and everyone (indirectly).

Sensitivity of passengers to price in the public transport industry has been well studied (Cervero, 1990) and findings suggest that riders are more sensitive to service change than to price change. That is, service modifications that reduce travel time (including wait time and transfer time) are more likely to positively affect ridership than fare reductions (Hess et al., 2002). Consequently, it would be wise for a public transport agency to introduce significant service changes to retain existing riders and attract new riders. This seldom happens, however, since transport managers often cannot resist the idea of reducing passenger fares even though the practice is known to have less impact on ridership than service enhancements (Cervero, 1990). Furthermore, behavior change comes about more readily in response to price changes in complementary travel modes (automobile driving) more than price changes in public transport.

Fare elasticities, which estimate how price changes affect public transport ridership, can be used to predict ridership impacts on removal of public transport fares (Cervero 1990; Hodge et al., 1994; Litman, 2012). An elasticity function, also known as the Simpson & Curtin rule, expresses the relative change in consumption resulting from a unit change in price (when other factors are held constant) (Hodge et al., 1994). A higher elasticity value suggests that a good is price-sensitive: a small change in price produces a large effect on consumption (and, conversely, a lower elasticity value suggests that a large change in price produces a small effect on consumption) (Litman, 2013). For example, public transport riders who are sensitive to fares, such as university students, may increase their ridership likelihood significantly when fares are lowered (Litman, 2004); conversely, public transport-dependent riders are less price sensitive than discretionary riders. A study in the United States found higher price elasticities in smaller cities (FTA, 2001), while a meta-analysis in Europe found that public transport elasticities are comparable or higher to those in the United States (Nijkamp and Pepping, 1998).

Price elasticity theory can be used to predict ridership and revenue effects of changes in public transport fares, including elimination of fares. A typical fare elasticity predicts that a 3 percent fare increase results in a 1 percent ridership decrease (Hodge et al., 1994). Following this mathematical rule, fare elimination should result in a 30 percent ridership increase (Yaden, 1998), although some researchers argue that traditional fare elasticities cannot accurately predict ridership changes from fare elimination (Chen et al., 2011).

2.1. Experimentation with fare changes

Past experimentation with steep reduction [through "deep discounting" of fares (Nuworsoo 2004, 2005)] or elimination (Perone, 2002) of public transport fares offers insight to the pursuit of fare adjustment strategies to increase public transport ridership and achieve other goals. Fare reform can be motivated by various goals for transport managers related to access, mobility, sustainability, environmental protection, and social equity.

When public transport becomes free for riders through pre-paid fares, significant ridership adjustments may occur. Based on models and previous cases, the elimination of fares on public transport is expected to produce ridership increases of 20 percent to 60 percent within a few months (Hodge et al., 1994; Volinski, 2012). Of new riders drawn to public transport systems with fare removal, 5 to 30 percent are likely to shift from other motorized travel modes and the balance are likely to shift from walking and bicycling (Volinski, 2012). Price sensitive riders (including low income people, students, and older adults) have lower fare elasticities and can be expected to react strongly to the elimination of transport fares; for example, students at North American universities increased their riding by 71 to 200 percent after university fare-free programs were introduced with local public transport agencies (Brown et al., 2001).

2.2. Fare elimination precedents

City leaders and administrators have long considered the possibility of implementing fare-free public transport, and some public transport systems have piloted fare elimination. In the United States, the federal government subsidized a number of pilot programs beginning in the 1970s. The chief motivation for doing so was demand management and travel behavior shift toward public transport and away from automobiles (McCollum and Pratt, 2004). Transport agencies in the United States are considered good candidates for elimination of passenger fares since high operating costs (for labor and maintenance) result in low farebox recoveries (Perone, 2002).[3] ("Farebox recovery ratio" refers to the share of operating costs collected from fares.) A well-known experiment occurred in Austin, Texas in the early 1990s, achieving a short-term ridership increase of 75 percent (Nuworsoo, 2005; Perone, 2002). The Austin fare-free program followed several short-lived attempts at fare elimination in the 1970s, including two in the United States (Denver, Colorado and Trenton, New Jersey) and one in Italy (Rome) (Hoffman, 1971; Perone, 2002). Public transport ridership increased at the expense of walk trips. More examples have occurred in recent years in Europe and elsewhere as climate change emerges as an important part of policy agendas.

In Table 1, characteristics of major fare-free public transport programs are shown in which passenger fares were eliminated systemwide for a period of one year or more.[4] (Only occasionally is fare-free public transport a permanent strategy (and not a demonstration project),

[1] Transit fare reduction for rider subgroups, especially youth, older adults, university students, and people with disabilities, can be effective. In England, people 60 years of age and older became eligible to ride local buses without paying a fare (during off-peak times) (Mackett, 2015). The goal of the "Freedom Pass" was to enhance mobility and increase independence [thereby redressing transport exclusion (Jones et al., 2013)]. Evaluations confirm an increase in ridership and lower obesity odds after this subgroup became eligible for concessionary fares (Webb et al., 2012).

[2] In the latter case, for example, unlimited access programs have been shown to dramatically increase public transport ridership among university students, a subpopulation thought worthy of incentivizing to ride public transport, given the potential benefits of nurturing lifelong travel habits, and as an incentive to experience life and engage with a city/region in a metropolitan area beyond a university campus.

[3] Fare-free travel also removes the transaction cost of fare collection, and savings can be significant.

[4] Not included in Table 1 are free shuttle buses, transit systems that are fare free only at select times, on select services, or for select rider groups, bus systems in remote towns or resort areas, and short-term fare-free pilot programs. Consequently, fare-free public transport programs that operated only during off-peak hours (Denver, Colorado and Trenton, New Jersey) or on select services (Chengdu, China) do not appear in the list. Also absent from Table 1 are fare-free public transport programs in resort areas and rural communities, because these are usually not replicable in other settings. In some cases, college or university campus bus systems have been intertwined with public transport for small cities and towns, where campus bus systems (with subsidized fares for students) also serves the public, who also do not pay a fare (Brown et al., 2001; Hodge et al., 1994).

Table 1
Characteristics of Fare-Free Public Transport Programs, Including Goals.

Location (Operation of Program) Population	Goals	Outcomes	References
Aubagne, France (2009–present) 100,000 population	Enhance mobility for all	Ridership doubled	Brand (2008); Cats et al. (2014)
Austin, Texas (1989–1990) 500,000 population (1990)	Promote public transport Educate potential riders	75% ridership increase	Hodge et al. (1994), Nuworsoo (2005), Perone, (2002)
Changning, China (2008–present) 53,000 population	Conserve energy Protect the environment Improve public transport service Improve quality of life	550% ridership increase	Beijing Review (2008), Volinski (2012)
Hasselt, Belgium (1996–2012) 72,000 population	Enhance mobility for all Efficiently allocate road space Improve quality of life	900% ridership increase 63% more public transport trips 16 to 40% mode shift	Brand (2008), Olsen (2007), van Goeverden et al. (2006)
Templin, Germany (1997–present) 17,000 population	Reduce automobile dependency Reduce automobile externalities (pollution, noise, risk of crashes)	Ridership increased 13 times	Brand (2008), Cats et al., (2014), Storchmann (2003)

therefore the number of precedents is small.) Goals of eliminating fares focused on promoting and educating people about public transport (in United States programs during the 1970s to 1990s, perhaps reflecting a related objective to address urban decline), improving mobility and quality of life (Belgium and China), and reducing driving demand (Germany). Outcomes suggest that all public transport systems that eliminate fares experience initial (and occasionally sustained) ridership surges—usually at the expense of walking trips and bicycle trips more than driving trips—however there is little evidence that, as a result of fare elimination, there is less automobile traffic, significant mode shifts to public transport, or less traffic congestion (Perone, 2002; Storchmann, 2003). Major goals of fare-free public transport, therefore, are seldom met on a sustained basis.

A fully fare-free public transport system—in which passenger fares are not collected at all times, for all routes, and for all riders—is assumed to be a highly effective approach to making significant change to people's travel habits, but it is seldom realistic or achievable. More prevalent than fully fare-free public transport systems—which is inherently a difficult policy change, politically and fiscally—is fare-free travel on certain routes or in specific zones (such as central business districts) or during limited service hours. Fare-free travel is also available in some cases to target subpopulations (such as students, youths, older adults, low-income people, and job seekers). In fact, the Austin, Texas farebox recovery was only 15 percent before a 1990 fare elimination experiment (which lasted 15 months) (Perone, 2002). Cost savings for passengers is an important consideration; where "unlimited access" programs allow university students to enjoy pre-paid public transport fares, students can save $2000 USD annually by foregoing automobile ownership (Brown et al., 2001).

2.3. Empirical inquiry

The decision to eliminate public transport fares in Tallinn, an historic medieval city that was a member state of the Soviet Union until 1991, was accompanied by high-profile articles in *The Guardian* (Shearlaw, 2016) and *The Atlantic* (Pinsker, 2015). To date, however, the fare-free program has not been evaluated by the municipal government or public transport agency, *Tallinna Linnatranspordi Aktsiaselts*; two independent evaluations have been published.

Previous research about fare-free public transport has emphasized a critical need to "clearly identify the objectives addressed by the fare-free policy" and "set in place processes to assess the extent to which objectives are met" (Hodge et al., 1994, 3). Consequently, this article elucidates the goals of fare elimination in Tallinn and assesses how the goals have been met, a topic which has not been thoroughly addressed in previous studies (Cats et al., 2014, 2016). Information about the goals of the Tallinn program is derived from published reports and interviews, and data about the program performance is drawn from assessment and published evaluations (Cats et al., 2014, 2016). The remainder of this article is structured as follows. The evolution of fare elimination in Tallinn is recounted, and evaluations are synthesized vis-à-vis program goals. Key takeaway messages precede concluding comments about the goals (and goal achievement) of fare elimination in Tallinn and the political context in which it occurred.

3. On the move with public transport in Tallinn

Tallinn, Estonia [population 445,000 (Estonian Census, 2017)] is currently the largest world city to offer fare-free public transport to residents. Since Estonia regained Independence in 1991 after an occupation of more than 50 years by the Soviet Union, there has been a dramatic adjustment to a new market economy. Public transport ridership decreased by 30 percent between 1991 and 2012 (Cats et al., 2014), likely related to the acquisition in Estonia of a market economy (which replaced a command economy); as salaries rose and lifestyles adjusted after the disintegration of the Soviet Union, people with means acquired automobiles and reduced their use of public transport. [Automobile ownership was purposely low during the Soviet Union and people had few options for everyday travel beyond walking and riding buses (Hess, 2017).] Automobile ownership in 2012—425 automobiles per 1000 people—had doubled since the end of state socialism due to, among other reasons, new opportunities for Estonians to relocate to suburbs (Poltimäe and Jüssi, 2017). Data from the 2003 and 2015 Tallinn Household Survey reveals that driving rates and automobile ownership increased rapidly in the 2000s: mode shares in 2003 for driving (24 percent) and riding public transport (41 percent) in 2003 exchanged places by 2015 [driving (41 percent); public transport (23 percent)] (Põldemaa, 2016).,[5] Despite decreasing public transport ridership, prior to the advent of fare-free public transport, buses and trams captured a significant share (in 2013) of daily travel in Tallinn (40 percent), followed by walking (30 percent), and driving (26 percent) (Cats et al., 2014).

The public transport system in Tallinn—consisting of 73 bus routes, 4 trams lines, and 5 trolley bus routes—is operated by the municipal government. The three goals of fare elimination in 2013 were to: (1)

[5] The 2015 Tallinn Survey of Residents' Satisfaction with City Services similarly found that 61 percent of people mainly used public transport in 2008, but this figure had reduced to 49 percent in 2015 (Saar Poll, 2015).

enhance mobility for all Tallinners, (2) stimulate consumption of local goods and services, and (3) reduce the number of automobiles in the city center (communication with Allan Alaküla, 04 September 2017).

3.1. Fare-free public transport originates with city administrators

A fare-free public transport intervention was first discussed in Tallinn in 2005. Public satisfaction surveys in 2010 and 2011 suggested that fares were an obstacle for passengers using public transport, a complaint attributed to the 2008 economic crisis (communication with Allan Alaküla, 04 September 2017).[6] In 2012, renewed and relatively spontaneous attention to fare-free public transport resulted in a municipal government-directed public opinion poll in which more than 75 percent of voters supported fare elimination (BBC, 2012). Although this was not a legally binding referendum and was not ratified (and only a 20 percent participation rate was achieved), the city council improbably approved fare-free transport (Aas 2013; Jüssi and Tuvikene, 2016).[7] (The vote can be considered a public consultation and not a referendum, and other projects—involving the expenditure of public funds for various projects—were also subject to public vote under this consultation protocol.)

The administration of populist then-Mayor Edgar Savisaar led the promotion of fare-free public transport prior to local elections which occurred 18 months later. (Tallinn is controlled by the Central Party, the opposing party at the national level.) It was interpreted by many people as a populist strategic move to ensure re-election. An initial announcement was made in a tabloid newspaper, and many people assumed fare-free public transport was a publicity stunt and not realistically implementable (Jüssi and Tuvikene, 2016).

Fare-free public transport was designed by the mayoral administration without consulting the expertise of urban planners and transport managers. In fact, the Public Transport Development Strategy, a 10-year visionary plan, was nearing completion and in its consultation phase; the strategy did not reference fare-free public transport, since fare elimination did not originate from mobility management or urban sustainability strategies (Tuvikene, 2015).

During the lead-up to the vote, the city administration urged people to vote to support the initiative; critics argue that politicians *created* demand for fare-free public transport—demand which previously did not exist (communication with Mari Jüssi, 14 November 2016). This was accomplished via a widely-publicized "come and vote yes" campaign. The public voting process cost €260,000 (BBC, 2012). It has even been said that the administration believed that tax revenue was unimportant and that political support for the administration and Central Party, which already enjoyed a comfortable position, was of utmost importance. In this way, fare-free public transport in Tallinn is an administratively created "tax incentive scheme" (Cats et al., 2014, 89); offering financial relief to citizens while suggesting that the relief comes without costs or penalties is likely to be warmly accepted.

Following the public vote, the mayor's office directed city planners and transport managers to implement the scheme. Drivers' groups unsuccessfully attempted to challenge the addition of bus priority lanes (based on compromised freedom of movement).

According to many observers, the primary objective of public transport fare elimination—which overwhelmingly overshadows all publicly stated goals—is to increase the municipal tax income of Tallinn by encouraging people to register as city residents (Aas, 2013). (In Estonia, a large share of local government budgets is derived from municipal taxes.) In this way, fare elimination for registered Tallinn residents was a politically-driven strategy by the political administration of a populist mayor: key factors driving the implementation of the program, according to Tallinn spokesperson Allan Alaküla included "boosting the popularity of the mayor's office" (Shearlaw 2016, 1) and reducing the costs for Tallinners of urban travel. Before public transport fare elimination, officials estimate conservatively that 20,000 to 30,000 Tallinners were not officially registered as city residents; taxes for these citizens were allocated to other municipalities (Swope, 2014).[8] City officials argue, however, that while increasing the municipal budget was *not* the goal of the fare-free public transport program, increasing the municipal budget was the method by which fare elimination was achieved (communication with Allan Alaküla, 04 September 2017).

People tend to react strongly and positively when they no longer are charged for something for which they previously paid a fee., since the change translates to real savings. Savisaar himself pointed out that "zeroing out commuting costs was for some people as good as receiving a thirteenth month of salary" (Vedler, 2014), reinforcing the populist motivations for fare-free public transport and its political underpinnings which help maintain the support of tax-payers and voters (i.e., potential supporters) for those in elected offices.

3.2. Incentivized citizen registration and fare-free public transport implementation

Since early 2013, the fare-free public transport program permits people with a registered home address in Tallinn (according to Estonia's mobility reporting system) to ride city-operated public transport (including its network of buses, trolley buses, and trams) without paying a fare. The only investment required to participate is purchase of a *ühiskaart* (or contactless fare-card) costing €2. The card must be presented along with government-issued identification to roaming fare inspectors, and riders must validate the card upon vehicle entry using an electronic validator.[9] People who are not eligible for fare-free transport can add cash value to the *ühiskaart,* and cash is deducted from stored value upon fare validation.

Many newly registered inhabitants of Tallinn had already lived in Tallinn as unregistered residents, and usually they were unregistered (1) due to inertia toward citizenship registration, (2) to avoid certain fees, such as an automobile registry tax, (3) because they rented an apartment and did not own property, or (4) as a result of allegiance to another municipality in Estonia, where they preferred their local tax to be assigned (Swope, 2014). (A citizen can only register his or her residence in one place.) When people reassigned their registration to Tallinn (no matter their *actual* place of residence), tax revenue in Tallinn increased while the municipal budgets of other municipalities were lessened because there were fewer tax-paying residents.[10] Municipalities adjacent to or near Tallinn were the most heavily affected (Jüssi and Tuvikene, 2016; Luica, 2013).

3.3. Expansion of public transport service

An expansion of public transport capacity coincided with the beginning of fare-free public transport (although some transport improvement projects had already been in progress before the referendum occurred). When fare-free public transport was launched, 70 new buses, 15 new trams, and a real-time information system (at key stops and

[6] Despite the reasonable fares, a 2010 rider satisfaction survey determined that riders were more dissatisfied with fares (49 percent) than with crowding (29 percent crowding) or service frequency (21 percent), suggesting that public transport fares restricted mobility for some people (Cats et al., 2014).

[7] Electronic voting was disallowed; only on-site voting was permitted.

[8] Previously, the number of registered residents had decreased during the 2004 to 2008 economic boom (Jüssi and Tuvikene, 2016).

[9] Riders do not validate their fare payment upon exiting public transport vehicles. But if riders transfer from one route to another, they must validate at the beginning of each segment of a public transport trip (with the previous ticketing system, riders could transfer for free to another route within one hour).

[10] The address registry is used to track domestic migration. University students often fail to register in a city in which they live temporarily while studying, keeping their official registration with their family home.

stations) were added (Andrews, 2013).[11] After 2012, priority bus lanes, which previously did not penetrate the city center, were expanded, and new priority signalization schemes were installed (the project to add bus priority lanes was already in the works before the 2012 campaign for fare elimination.) Tram lines were reconstructed and new park-and-ride facilities were installed. These improvements amounted to a 9.6 percent increase in public transport supply capacity around the time fare-free public transport was established (Cats et al., 2014). A new ticket system included contactless fare cards, lowering operating costs. Automatic passenger count equipment was installed in vehicles. However, despite service enhancements that accompanied fare elimination in 2013, the service level in 2017 (measured in seat kilometres) is 25 percent lower than the 2008 level (Jüssi and Tuvikene, 2016).

3.4. Financing fare-free public transport

Before Tallinn's fare elimination occurred, a ticket for a single ride cost €1, and the cost of an unlimited monthly public transport pass (€20) was only 2.5 percent of the average monthly after-tax salary (Cats et al., 2014). In Tallinn, the farebox recovery rate in 2012 was 33 percent [a low farebox ratio compared to other European cities (Cats et al., 2014; Nielsen et al., 2005), where 40 to 50 percent of operating costs are typically subsidized (Swope, 2014)]. The low farebox ratio in Tallinn can be attributed to inexpensive cash fares, already reduced fares for residents[12], and generous fare concessions.[13]

Identifying and securing a funding stream can be one of the greatest challenges of public transport finance reform. It was determined that €12 million was needed annually to fund the fare-free program as replacement for foregone farebox revenue (Cats et al., 2014; Luica 2013). Fare elimination was optimistically intended to be self-financing, without need for additional subsidy sources beyond an enhanced municipal tax base. That is, a loss in ticket revenue on buses and trams after fare elimination would be compensated by a tax base increase. Fare elimination in Tallinn did not *create* new tax revenue; it merely redistributed income tax revenue in this small nation.

4. Evaluations of fare-free public transport

Fare-free public transport in Tallinn is challenging to evaluate, since many aspects of transport service changed simultaneously at the beginning of 2013—including a new ticketing system, fare in-vehicle payment validators, permanent passenger counters in buses, fare-free public transport—making it difficult to attribute ridership change to specific initiatives. Two independent evaluations were conducted by experts and are summarized here (Cats et al., 2014, 2016).

4.1. The first evaluation: modest ridership gains within four months

An initial evaluation, conducted using data for the first four months of program operation, suggests more modest impact of fare-free public transport in Tallinn than anticipated as a result of complete fare elimination. The evaluation used sampled automated vehicle location (AVL) and automatic passenger count (APC) data for several months before and several months after program inauguration (Cats et al., 2014). Results are depicted in Table 2.

Ridership increased by only 1.2 percent for the first four months of operation (from January to April 2013). [A 3.0 percent ridership increase (and 2.5 percent increase in passenger miles) during this time was corrected to account for simultaneous public transport supply expansion including service improvements, especially service frequency enhancements and the addition of bus priority lanes (Cats et al., 2014)]. Riders exhibited greater sensitivity to frequency than to fare elimination; that is, service improvements outperformed fare reduction in raising ridership (Cats et al., 2014), consistent with previous research (Cervero, 1990). Ridership hotspots include Kesklinn (or the city center, already the site of 40 percent of citywide public transport demand) and Lasnamäe (the largest socialist housing estate, home to nearly 25 percent of Tallinn residents).[14]

Table 2
Four-Month Evaluation Results Derived from Sampled Vehicle Data and Passenger Counts, January to April 2013.

Characteristic	Before	After	Change
Public Transport Supply			
Capacity	NA	NA	+ 9.6%
Public Transport Demand			
Passenger boardings	NA	NA	+ 1.2%
Average trip length	2.72 km	2.43 km	- 10.6%
Travel Network Operation			
Average travel speed	19.14 km/hr	19.14 km/hr	No change

There was no change in motor vehicle network speed; that is, fare-free public transport did not aid the entire motorized transport system in moving more efficiently. (Average public transport vehicle speed remained the same, while certain gains occurred where priority bus lanes were installed.) Average public transport trip length decreased by 10.6 percent (from 2.72 kilometres to 2.43 kilometres), suggesting a strong substitution effect and unintended consequence: with fare elimination, many people replaced nonmotorized trips with public transport (Cats et al., 2014).[15] More public transport rides substituted for non-motorized trips than for automobile trips. Public transport riders versus car drivers increased by 8 percent, but a 31 percent increase in average automobile journey suggests that there were more, not fewer, cars on the road after fare-free public transport was implemented (Cats et al., 2014).

The evaluation produced mixed evidence about mobility and accessibility change for low-income and unemployed residents and no suggestion that employment opportunities changed as a result of fare elimination (Cats et al., 2014).

4.2. Second evaluation: fare-free public transport fails to increase employment opportunities

A second evaluation, measuring changes almost one year following the inception of fare-free public transport, used travel diaries for 1500 Tallinn households: a November 2012 "before" survey (two months before fare elimination began, although it was announced and forthcoming) and a November 2013 "after" survey (following 11 months of program operation). Measuring broad satisfaction with services and daily life, regular municipal surveys (via face-to-face interviews) were

[11] Funding for capital expenses occurred outside the budget for the fare-free public transport program. The cost of new trams, for example, was paid through the national budget of Estonia courtesy of greenhouse gas emissions quota sales.

[12] Ten years earlier (in 2004), fares for registered residents had been reduced by 40 percent compared to regular cash fares. There was already a fare differential for Tallinn residents compared to other riders (including tourists from other countries and Estonian citizens from other towns).

[13] In Tallinn, 36 percent of public transport riders were already exempt from paying public transit fares based on employment or socio-economic status. An additional 24 percent of riders received special discounts.

[14] An analysis of passenger demand suggests that, at the public transport stop level, ridership is positively correlated with the number of stops located nearby (reflecting a density of public transport service), the share of older adults, unemployment rate and average real-estate prices, and negatively correlated with motorization rate (Cats et al., 2014). Consequently, places with higher shares of older or unemployed residents and lower shares of car ownership experienced higher demand compared with other areas (Cats et al., 2014). These rider groups are expected to be more sensitive to fare changes and benefit from greater accessibility to potential activities due to reduced transport costs. This is consistent with scholarship supporting higher elasticity associated with higher income due to higher income travelers' position as less captive public transport users possessing stronger response to fare changes (Cervero, 1990).

[15] Traffic counts were collected at 11 key intersections at entrances to the city center.

augmented with targeted questions about fare-free public transport; participating households were weighted based on age, sex, ethnicity, and geographic location (Cats et al., 2016; Hillep et al., 2013). Although the sample is weighted, it is unclear how representative it is of the city population.[16] Since socio-economic and demographic data about interviewees was collected, the second evaluation permitted study of the characteristics of passengers (the first evaluation did not allow this). Results are summarized in Table 3.

Public transport's share of all trips increased by 14 percent and even more for younger and older age groups. (The share of trips on public transport *decreased* for the wealthiest Tallinners.) Because the length of automobile trips increased by 31 percent during the first year of operation of fare-free public transport, the authors again conclude there are *more* cars on the road after fare elimination (Cats et al., 2016). Like the first evaluation, the second evaluation found inconclusive evidence about whether fare-free public transport actually improved access and mobility for low-income residents and unemployed people.[17]

4.3. Fare-free public transport finance

Between March 2012 (when the referendum was staged) through December 2015, approximately 24,000 new residents registered in Tallinn.[18] These newly registered residents help to increase state resources for the Tallinn municipal budget. In 2013, new registrations in Tallinn occurred at three times the usual rate (Pinsker, 2015).[19] Each additional resident produces an annual tax increase of approximately €1000 (the income-based average annual payment is lower for low-income residents) (Cats et al., 2016). Only a portion of this tax payment—approximately 10 percent—funds public transport operations, and the balance funds other programs sponsored by local governments that are calculated on a marginal-cost basis (or dependent on the number of registered residents) including salary replacement during maternity leave, day care centers, children's programs, and community enrichment (Jüssi and Tuvikene, 2016).

The first four years (2013 to 2016) of Tallinn fare-free public transport was funded by €60 million in public tax expenditure (Jüssi and Tuvikene, 2016). Officials now report that €12 million annually in ticket revenue was lost was while €20 million annually in municipal finance was gained with the fare-free public transport program, and a portion of the €8 million annual surplus is used to finance public transport capital improvements while the balance is used to support non transport-related aspects of the municipal budget (communication with Allan Alaküla, 04 September 2017; Shearlaw, 2016). The public transport budget has grown from €53 million in 2012 to €63 million in 2017 and now represents about 2.5 percent of the annual municipal budget (Aas, 2013; Niitra, 2013).[20]

4.4. Goal achievement

As depicted in Table 4, fare elimination in Tallinn has been only moderately successful at achieving goals stated by the program designers (Kravis, 2014). The program goals are not easily traceable to official documents released by the Tallinn municipal government *before* fare-free public transport began, but they can be found in presentations given *after* fare-free public transport began by Savisaar and other municipal officials to audiences of experts (Aas 2013; Savisaar, 2013), suggesting that goals were employed retroactively to justify the program. Note that the first goal is intrinsic to the public transport system and the other three goals relate to external dimensions. The evaluations suggest that the most strongly met goals relate to increasing the number of registered residents (and associated tax increase). Other goals are met only marginally (guaranteeing mobility and increasing public transport ridership) and most are inconclusive or have not yet been evaluated (Kravis, 2014). A significant travel mode shift has not occurred, calling into question the effect of fare-free public transport on sustainability and congestion reduction.

Table 3
One-Year Evaluation Results Derived from Sample Surveys, November 2012 and November 2013.

Characteristic	Before	After	Change
Travel Demand			
Average daily travel distance	7.98 km	9.07 km	+ 13%
Trips per person	1.98	1.96	- 1.0%
No daily travel	18%	13%	- 28%
Public Transport Demand			
Ridership	NA	NA	+ 14%
Public transport mode share	55%	63%	+ 24%
Walking Demand			
Walking mode share	12%	7%	- 42%
Walking trip distance	NA	NA	No change
Driving Demand			
Vehicle miles traveled (cars)	NA	NA	+ 31%
Automobile ownership	0.307	0.273	- 11
Travel Mode Shifts			
Public transport replaces driving trips	NA	NA	- 10%
Public transport replaces walking trips	NA	NA	- 50%
Perception and Satisfaction			
Satisfaction with public transport[a]	3.20/5.0	3.35/5.0	Positive
View public transport service as poor	12.0%	5.4%	- 55%
Public transport has changed for better	23.8	44.3	+ 86%
Opinion of fare free effect on Tallinn[a]	3.30/5.0	3.72/5.0	Positive
Opinion of fare free effect on own travel[a]	3.18/5.0	3.63/5.0	Positive
Opinion of fare free effect on traffic[a]	3.09/5.0	3.5/5.0	Positive

Note: (a) response to survey question on a 5.0 scale.

5. Findings

This study extends literature about fare-free public transport schemes by producing four key findings about fare elimination in Tallinn.

1. **Evaluations produced to date of Tallinns fare-free public transport are inadequate for understanding the costs and benefits of the program.** There have been no official reports or systematic evaluations conducted by *Tallinna Linnatranspordi Aktsiaselts*, and city officials have not officially commented on the independent evaluations that have been published or explained how the program has or has not met its goals. Officials argue that they can only evaluate outcomes that relate to *direct* effects of fare elimination (using measures such as public transport ridership and service quality, number of cars entering the city, and air quality) and that all other outcomes relate to *indirect* effects for which there are no reliable data or assessment methods (communication with Allan Alaküla, 04 September 2017). [Recent surveys suggest that passengers in Tallinn choose public transport for convenience more frequently than for fare-free travel (Poltimäe and Jüssi, 2017).] Fare-free public transport in Tallinn is not an experiment: it is a

[16] It is also unclear how multi-adult households were dealt with in the interview process and *who* in a household was interviewed.

[17] Although 40 percent of unemployed people reported a belief that the fare-free public transport program enhanced their employment potential (a stated opinion), the evaluation produced no concrete evidence that employment opportunities were enhanced (Cats et al., 2016).

[18] Tallinn "gained" 4,000 residents in 2012, 10,000 residents in 2013, and 10,000 residents in 2014 and 2015 combined. It is estimated that 10 percent of people who reside in Tallinn are registered residents elsewhere. Even before the fareless public transport program was announced, annual residency registrations had been increasing.

[19] As of 2016, the annual number of registrations has returned to its pre-2013 rate (Jüssi and Tuvikene, 2016).

[20] Fare-free public transportation in Hasselt, Belgium consumes 2 percent of the city budget (Verachtert, 2013).

Table 4
Goals and Goal Satisfaction of Free–Free Public Transport in Tallinn.

	Goal	Outcomes	Goal Satisfaction
Social	Enhance mobility for Tallinners.	Public transport boardings increased (although average public transport trip length decreased) (Cats et al., 2014). More people engaged in daily travel but walking rates decreased (Cats et al., 2016).	Mobility on public transport is enhanced, but mobility on all travel modes is not enhanced. Fareless public transport supported public transport mobility by removing cash fares. The program did not necessarily advance equity mobility [a related goal mentioned by Aas (2013) and Savisaar (2013)] because equity mobility was already satisfactory prior to 2013 [diverse income and ethnic groups rode public transport (Kravis, 2014)].
Economic	Stimulate the consumption of local goods and services.	Not evaluated.	It is not possible to evaluate if this goal has been met. We do not know if fare-free public transport has stimulated consumer activity or encouraged people to spend more locally (using their savings from not pay public transport fares). Fareless public transport has not enhanced labor mobility in Tallinn [a related goal mentioned by Aas (2013) and Savisaar (2013)] because it has not improved people's readiness for employment.
Environmental	Reduce the number of automobiles in the city center.	Automobile ownership declined while vehicle miles traveled in automobiles increased (Cats et al., 2016). Public transport mode share increased (Cats et al., 2016).	This goal has not been met. While travel mode change to public transport (6th goal) occurred, the effect was only marginal and the targeted mode shift (commuters changing from driving to public transport) did not occur, since more walk trips were replaced by public transport trips. Goals to produce cleaner air, less noise, and more urban space are not evaluated, beyond simulated results based on the relationship between passenger miles on public transport and pollution (Ligi, 2013).
Fiscal	Increase the municipal budget.	The number of registered residents increased and the municipal budget was enlarged (Cats et al., 2014, Cats et al., 2016).	The goal to increase the number of people who register Tallinn as their place of residence has been met, since people were strongly incentivized with the promise of fareless public transport with citizen registry (however this occurred at the expense of other municipalities). Today, more citizens are registered in Tallinn than actually live in Tallinn (Jüssi and Tuvikene, 2016). An increase in personal income tax for the city budget is related to the number of registrations, but dependent on the actual income of residents (since 11.6 percent of taxable income is earmarked for local governments) and data has not been released.

permanent policy change, and "possible future power shifts in the Council are not able to change it easily," according to Tõnu Karu, who represents Tallinn in the European Union (Luica 2013, 5). Since it is large-scale, long-term, expensive, and consequential, it demands an evaluation that produces a rational system for measuring its merit and significance.

Evaluations can help demonstrate if programs meet goals and should be continued. The Tallinn fare-free public transport scheme (prior to the introduction of fare-free public transport) does not have equivalent data collection provision, and, comprehensive "before" passenger counts on public transport were not made before fare elimination (Cats et al., 2014). Other public systems and governmental programs in Estonia that replaced manual systems with electronic (and even virtual) systems have been the subject of extensive scrutiny and evaluation—such as Estonia's e-voting system (Alvarez et al., 2009)—aided by a culture of high-quality data in this small and relatively homogeneous country known for innovation (Ellis, 2016).

Given the political context and motivations for establishing fare-free public transport in Tallinn, the deficiencies in the evaluations are not surprising, and it may be impossible to produce the comprehensive evaluation that the program warrants. For example, baseline walking was not measured, making it impossible to determine the effects of fare-free public transport on walking mode choice (Jüssi and Tuvikene 2016).

2. **Flaws in the design of fare-free public transport in Tallinn limit potential success**. The ticket control system in use does not lend itself to accurate passenger counts. Validation on entering the bus is not compulsory for a large share of Tallinn residents who are eligible for fare-free travel. Riders over age 65 who are residents of Tallinn ride without paying a fare, and they are not required to validate fare payment with a *ühiskaart*. Riders who are not older than age 65 who fail to present valid fare payment to ticket inspectors could be issued a citation.

   It has been estimated, through passenger surveys at bus stops, that fewer than 50 percent of riders do not regularly validate their fare payment (communication with Dago Antov, 26 September 2016).[21] Consequently, ridership data from ticket validations considerably underestimates boardings and cannot reliably used in evaluations without first overcoming data limitations. *Tallinna Linnatranspordi Aktsiaselts* may become a system with no passenger fares (for a majority of riders) and unvalidated trips (for a majority of riders), challenging transport managers to keep control of the system and possess reliable ridership for accurately planning for passenger flows.
3. **Since its inception, fare-free public transport in Tallinn has been poorly aligned with stated goals.** Advertised goals of the program—to improve transport and improve mobility for certain social groups—are more publicly acceptable than an underlying goal of the political administration to win popular support.[22] It would have been unpopular and perhaps deceptive to discuss this implicit goal publicly. Non-residents were strongly incentivized to become registered because it made them eligible for fare-free public transport. But the re-assignment of local taxes does not in itself enhance urban sustainability.

   Public transport fare adjustment is a second-best scheme; a

[21] In a 2015 survey of Tallinn residents' satisfaction with city services, 6 percent of respondents reported that they never validated their entry on public transport (Saar Poll, 2015).

[22] For example, a fare-free public transport program in the Netherlands, in operation for one year, was specifically designed to test the relation between removal of public transport fares and congestion reduction (Egeter and Versteegt 2004; van Goeverden et al., 2006).

change in the costs of driving—congestion-based road pricing, fuel cost increase, insurance cost increase, and especially parking fee increases—could more effectively limit access to the city center for private vehicles and address other goals, especially travel mode shifts. Making driving more expensive, rather than making public transport free, could more greatly reduce general traffic levels (Shearlaw, 2016). But it is more difficult to raise prices in the transport sector (for driving and for parking), and especially charge people for something that they previously perceived for free, than it is to erase charges for a fee-based service.

4. **The future financial viability of fare-free public transport in Tallinn is not guaranteed.** Local income tax allotments of newly registered Tallinn residents represent a windfall gain (lasting for the first several years of the program) for public transport finance, but in the future such large increases in residency are unlikely in this small country with declining population. Tax revenue for public transport will remain at relatively consistent levels but not increase substantially. A danger with free services is that people are less likely to expect high quality service delivery if they do not pay, and service and equipment may start to deteriorate without pressure for improvement from fare-paying passengers. Fewer investments in public transport systems may result from an absence of an income source that is direct, independent, and guaranteed (Cats et al., 2014).

A public vote on an important matter such as the elimination of passenger fares for public transport should include a sunset clause, requiring periodic approval. A comprehensive evaluation should be publicly released prior to a re-vote, providing sufficient information for people to consider continuing to fund the program given other opportunities for tax expenditures. Such a sunset clause was not employed: fare elimination in Tallinn is permanent. Lacking convincing comprehensive evaluations and recent voter approval, a new political administration could disrupt or suspend fare-free public transport, despite high political costs for doing so. The fare-free public transport program in Tallinn is vulnerable to budget cuts if a new political administration re-prioritizes public expenditures. Also, an external shock, such as a spike in oil prices, might disrupt finance for the fare-free public transport program, returning to pre-2013 fiscal environment and requiring passengers to 'subsidize' their fares with cash payments.

There may always be a temptation among politicians to consider public transport fare elimination, especially when fare elimination can help a politician win political will. It can be made easier when justifications can be found. For example, the 2014 Eurobarometer found that 49 percent of respondents across Europe are dissatisfied with the price they pay for public transport (European Commission, 2014). The decision to eliminate fares is almost always well intended, but few fare-free public transport programs in the past have been sustainable in the long term (van Goeverden et al., 2006).

6. Conclusion

Since 2013, fare-free public transport in Tallinn has marginally helped to arrest declining ridership. It has not been successful in attracting large numbers of *new* public transport riders or shifting drivers to public transport (since many new public transport trips were previously walk trips). Expected ridership changes from fare erasure are well documented (Brown et al., 2003; Perone 2002; Redman et al., 2013; Volinski 2012), but the politically-charged program in Tallinn—based on a public consultation but not a legally-binding referendum—falls short of expectations. Ridership gains from fare elimination in Tallinn are modest compared to other places in Europe, and this can be attributed to pre-existing low public transport fares (with many riders already enjoying free public transport or special fares) and a high public transport mode share (40 percent). Fare-free public transport did not increase the number of commuters using public transport (adults between university age and 65 years old).[23] This was a target group of the fare reform, since older adults (65 or more years) were already eligible to ride public transport without paying a fare. Outcomes in Tallinn have also been attributed by researchers (Cats et al., 2014, 2016) to a good level of service provision and high public transport usage. The most price-sensitive group of riders—people over age 65—were already eligible for fare-free public transport before the citywide program began in 2013 (Jüssi and Tuvikene, 2016).

Findings from this article highlight a need for a comprehensive evaluation. Many groups—riders and potential riders, transport officials, city government, public transport riders, business community, institutions, universities, advocacy groups—have a stake in access and mobility, especially public transport. Any city with a public transport system can transform itself from a fare-based to a fare-free system, as it requires relatively low technological intervention (compared to, for example, a road pricing or congestion charging scheme require new equipment). Fare elimination can take advantage of sunk investments; the main challenge to be solved is to introduce practical methods to forego fare collection. Enduring challenges for starting a fare-free public transport program include: high political start-up costs, public approval, and cost-revenue balance (and case fare revenue replacement).

Public transport fare reduction or elimination schemes are fundamentally less effective than programs which adjust the cost of driving so that drivers assume the costs of externalities (reflective the disincentive versus the incentive approach). But this does not stop officials from including external effects as program goals, even when they cannot be evaluated (as in Tallinn). The Tallinn fare-free public transport scheme could have been more effective—by enticing drivers out of cars and onto *free* public transport—if it simultaneously introduced road pricing and higher parking charges. Fare-free public transport in Tallinn, and the evaluations of it produced to date, fails to provide evidence that public transport fare elimination can be implemented and survive outside a politicized context.

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[23] There are only limited possibilities for continuing to increase ridership, since Tallinn Mobility Research found that 60 percent of Tallinners who regularly use automobiles for commuting are unwilling to change their travel mode, and only 5 percent of Tallinners are open to changing their travel mode to public transport (Tallinn Mobility Research, 2015).

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