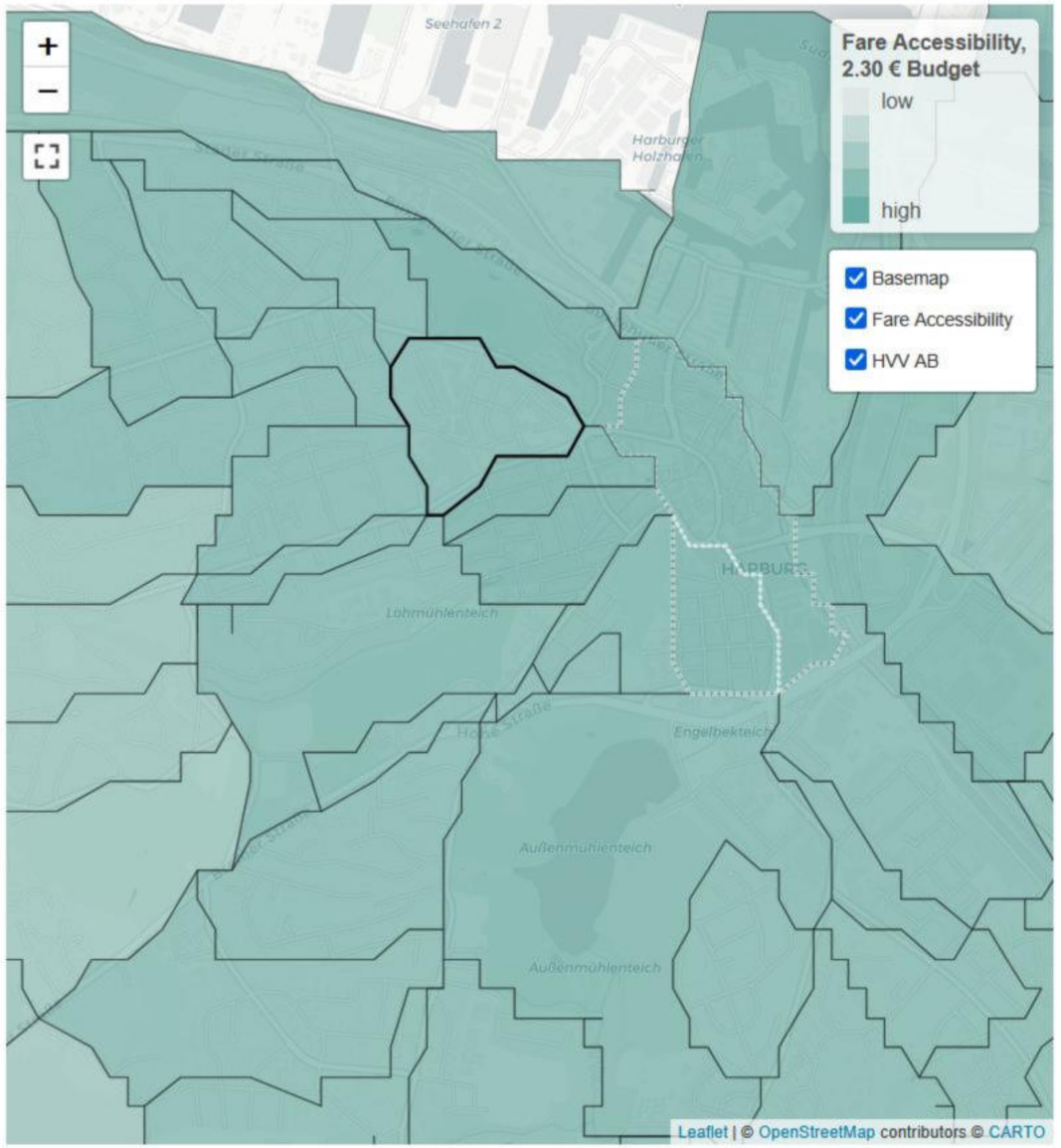
Choose the Map area here!

HVV

Map: Fare Accessibility

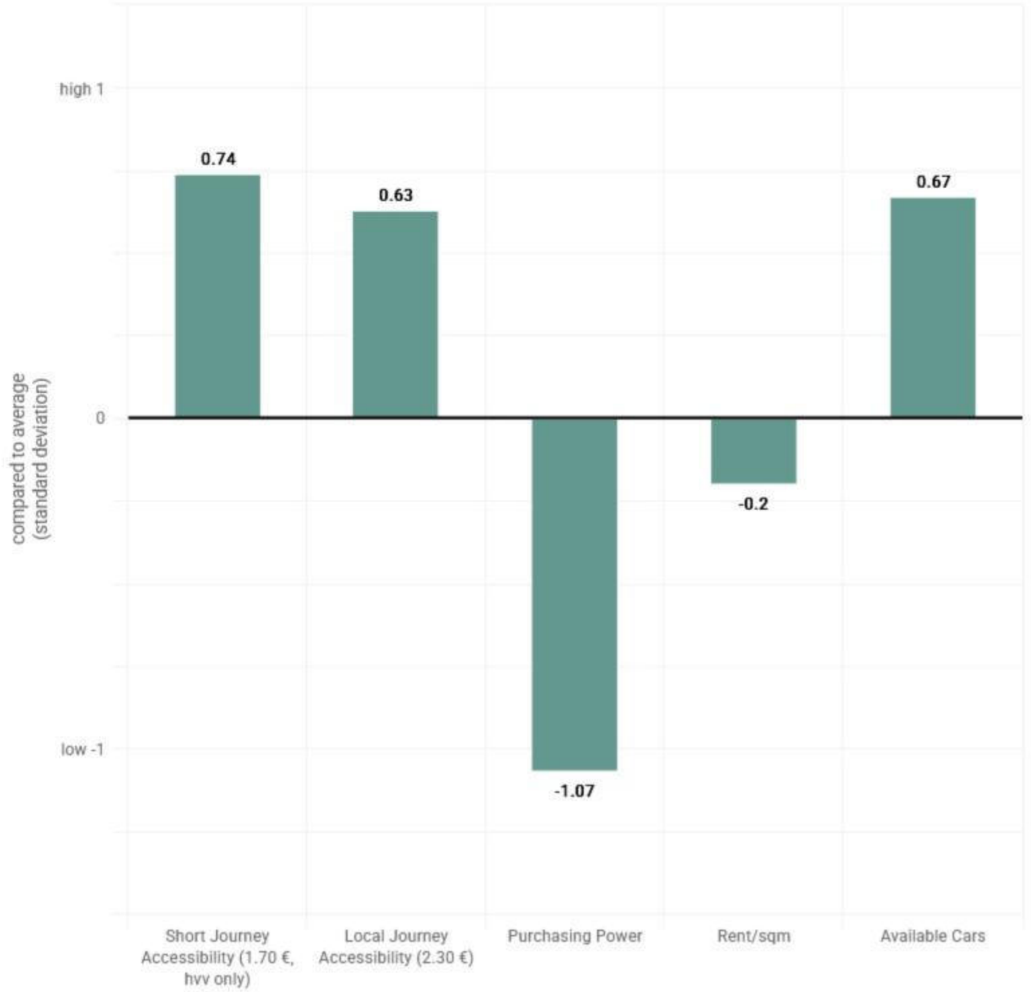
Here you can explore fare accessibility of each municipality in the whole service area. Outliers with exceptionally high/low values (beyond ± 1.5 IQR) are tagged.



← Click on the map!

Hamburg-Harburg

AGS: 2988004, spatial type: urban



This dashboard is a part of my dissertation project in transport engineering at Hamburg University of Technology.

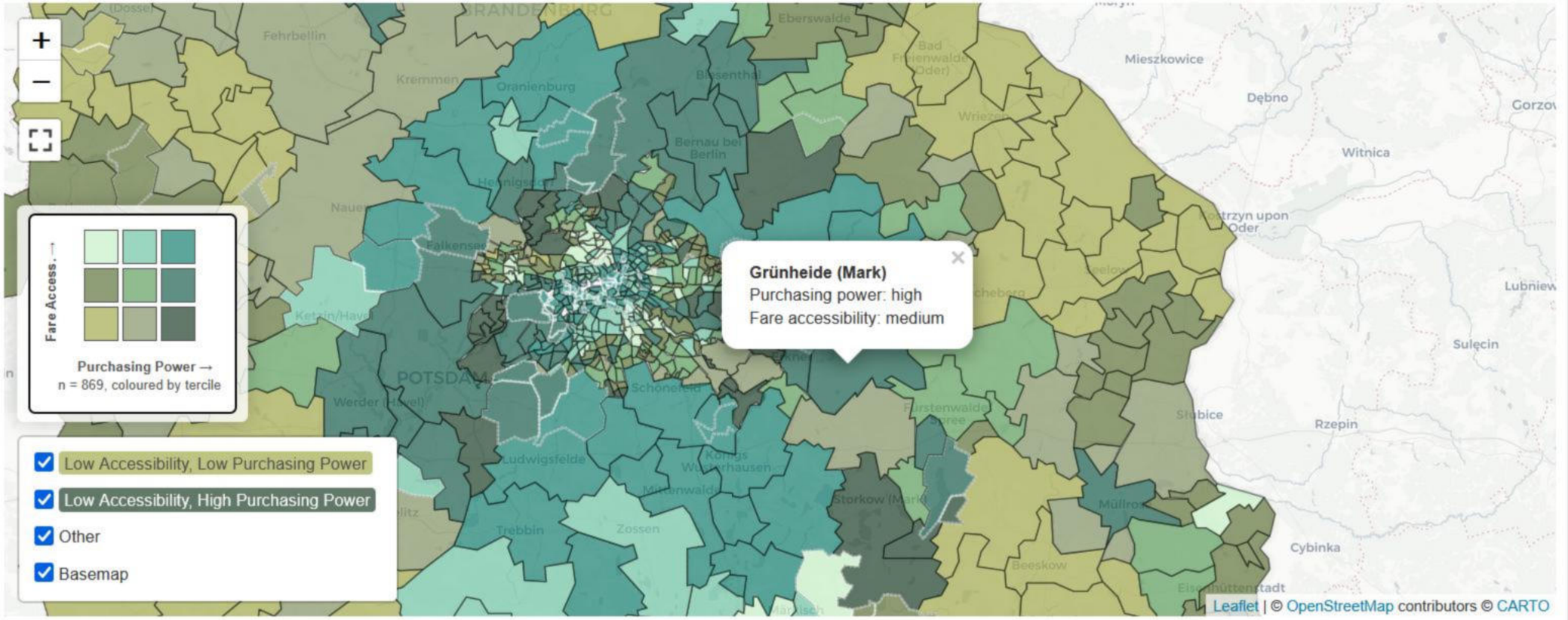
– *Christoph Aberle, in summer 2025*

Map: Fare Accessibility ↔ Purchasing Power

The bivariate map shows how purchasing power and fare accessibility interact. Outliers with exceptionally high/low values (beyond ± 1.5 IQR) are shown, but they were not included in the statistical models.

The VBB distribution is significantly more decentralised than that of HVV. Particularly in the low-density areas south of Berlin, high fare accessibility coincides with medium to low purchasing power. At first glance, this may seem surprising, but it can be explained by the availability of various welfare tickets, for example in the Teltow-Fläming and Dahme-Spreewald districts.
In addition, the VBB area also shows large clusters of low income and limited fare accessibility. Approximately 6% of the population lives in such areas – significantly fewer than in the HVV region.

For a full interpretation of this map, see section 4.2 of my PhD thesis (in German).



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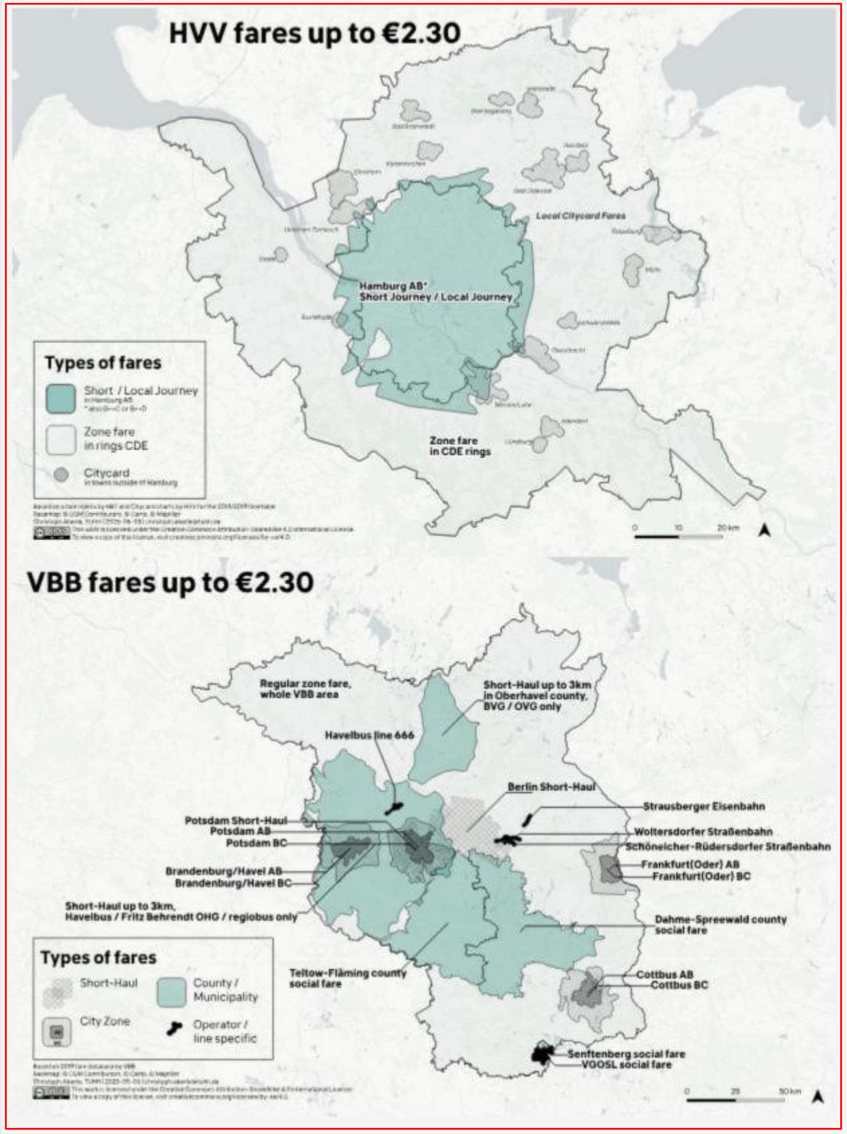
– Christoph Aberle, in summer 2025

Choose the Map area here!

VBB

Map: All fares of HVV and VBB

It was tricky to *find* all the fares for my dissertation. But it was even trickier to *map* them. As Leaflet doesn't like dashed and dotted patterns, I'll leave you with the static files here:



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Choose the Map area here!

VBB

Input data: Fare Accessibility

I used these variables as input data for my regression models. Fare accessibility is a weighted indicator of the accessibility of amenities for a low-income population. It basically counts **how many amenities can be reached for a given fare**. For an introduction to the method, see my blog post or the archived PDF of said blogpost. The density plots give you an overview of the dataset. They show the distribution of values across all 500m grid cells in a tangible way.

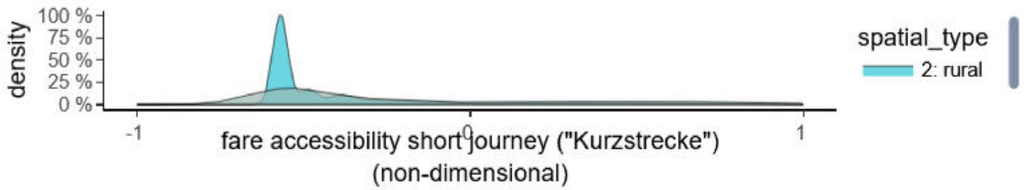
Note that the plots are estimated by KDE. Especially in the rural setting, KDE is a bit biased by many grid cells with a very low fare accessibility (visible as blue spikes in the plots). Hence, the KDE estimate of −100% for the spike is not plausible. The picture, however, gives a decent summary of the data at one glance.

n = 9,073 populated grid cells (HVV) / 15,869 populated grid cells (VBB)

hvv

VBB

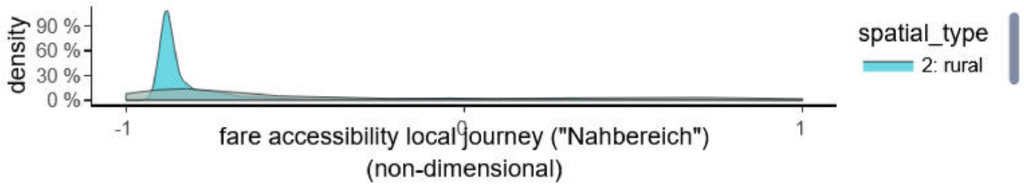
1.70 € Short Journey



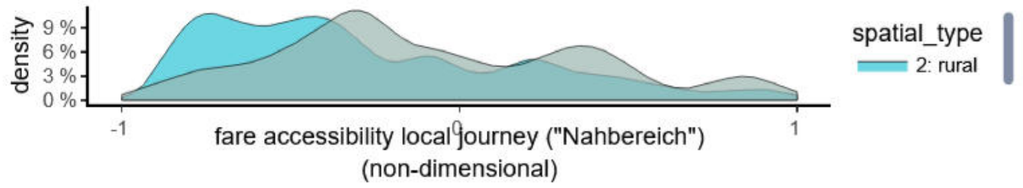
€1.70 Short Journey

(not available for VBB)

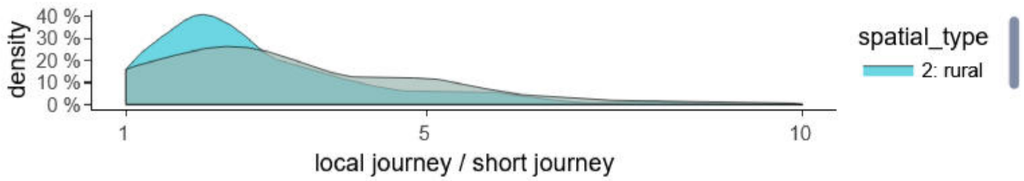
€2.30 Local Journey



€2.30 Local Journey



Ratio of Short and Local Journey (HVV only)



Ratio of Short and Local Journey

(not available for VBB)

This dashboard is a part of my dissertation project in transport engineering at Hamburg University of Technology.

– *Christoph Aberle, in summer 2025*

Choose the Map area here!

VBB

My Doctoral thesis in three sentences

1. Public Transport fares are critical for low-income populations.

↪

Since the 1960s, dozens of researchers have studied the role of public transport systems for low-income populations. From the early times on, researchers have described spatial accessibility as a determinant of social inclusion.
Scholars agree that **fares strongly influence everyday mobility**. On average, poor people spend a higher proportion of their disposable income on meeting their transport needs. Some researchers even argue that low-income passengers subsidise middle-class PT commuters: In general, poor persons travel less often and less far and use buses rather than trains. When buying single tickets, they can not benefit from concessionary fares and pay a high price per trip, despite the low operating costs they incur. By contrast, a large number of middle-class workers commute long distances by train. Their flat fares do not reflect the operating costs of building and maintaining a rail system. Many poor, in turn, face a problem related to the Boots Theory of of socioeconomic unfairness: They depend on affordable local transport, but are priced out by the fare system.

Recently there have been two major fare interventions in Germany. The 9-Euro-Ticket made it possible to travel by public transport throughout Germany for a monthly flat rate of €9. Its successor, the Deutschlandticket, costs €58 per month. According to several qualitative studies, the 9-Euro-Ticket has particularly benefited the needy. However, **the Deutschlandticket may exclude many people on low incomes** who consider €25-30 an affordable fare. As of 2025, there exist about 31 subsidies for the Deutschlandticket as well as >200 local and regional welfare tickets. Hence, depending on where they live, many people on low incomes do find a considerable financial relief. Around 48 percent of "Bürgergeld" welfare recipients are entitled to a subsidized Deutschlandticket where they live. However, especially passengers in other areas are likely to stick to the single ticket on a daily basis.

For a full account of the relationship between poverty, public transport accessibility and social inclusion, see chapter 2 of my PhD thesis (in German).

2. Fare Accessibility helps to pinpoint disadvantage.

This dashboard is a part of my dissertation project in transport engineering at Hamburg University of Technology.
– *Christoph Aberle, in summer 2025*

Choose the Map area here!

VBB

My Doctoral thesis in three sentences

1. Public Transport fares are critical for low-income populations.

2. Fare Accessibility helps to pinpoint disadvantage.

I have developed **fare accessibility** as an indicator that combines spatial accessibility and public transport affordability. For each PT stop in HVV and VBB it sums up the destinations that can be accessed on a given pay-as-you-go fare. Please find interactive webmaps that illustrate the methodology in my research blog (archived PDF). To investigate my indicator in a context of other indicators of urbanity, I different spatial auto-regressive models to predict fare accessibility on three different levels. The regression results are described in chapter 5 of my dissertation.

While most researchers have relied on travel time or distance, **my work expands the established metrics to include financial costs**. At a large spatial scale, the indicator resembles existing measures of urbanity. In small-scale transport and social planning in particular, however, it can help to identify deficits and eliminate them in favour of the participation of low-income passengers.

3. HVV and VBB show different spatial patterns of fare accessibility.

This dashboard is a part of my dissertation project in transport engineering at Hamburg University of Technology.

– *Christoph Aberle, in summer 2025*

Choose the Map area here!

VBB

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My Doctoral thesis in three sentences

1. Public Transport fares are critical for low-income populations.

2. Fare Accessibility helps to pinpoint disadvantage.

3. HVV and VBB show different spatial patterns of fare accessibility.

With a variety of pay-as-you-go fares, The VBB offers greater accessibility than HVV. With a €2.30 budget, passengers in Berlin/Brandenburg can reach a median of 91 stops, compared to 74 stops in the HVV. The spatial distribution of fare accessibility is also different. In the HVV it clearly follows centrality, whereas in the VBB, with several district-wide social and special fares, financial accessibility extends into low-density decentral areas. This is also reflected in the different regression parameters for two out of nine independent variables. In the HVV, high fare accessibility is associated with low purchasing power and low car availability, while the opposite is true for the VBB. The other regression estimators are largely similar, with positive associations with rent and the public transport index, and negative correlations with travel time, dwelling area and distance to the city centre. Population density plays a smaller role in the multivariate model than I assumed. Meanwhile, the model estimates confirm my expectation that the spatial level of analysis has an influence on sensitivity. Analysing fare accessibility at a stop level offers a compromise between the need for precision and the available computing capacity (compared to the municipality and the grid level).

Further reading

Glad that you've enjoyed my Fare Accessibility Dashboard so far! If you are keen to explore the depths of accessibility and equity, let me recommend some literature:

Resources for exploring Fare Accessibility

- A summary of the method in my research blog (archived PDF)
- A *JTranGeo* paper on the methodology behind this dashboard: Does a Short Journey get me to the Food Bank? An empirical study on Fare-based Public Transport Accessibility and its Implications for Social Equity
- The full text of my thesis: DOI 10.15480/882.13161
- **The Fare Accessibility Datasets for HVV and VBB**

and more

- An outstanding dashboard paper on fare-based accessibility of different ethnic groups in North America: TransitCenter Equity Dashboard There's also a good *JTranGeo* paper on that case!
- A great conceptual study that puts accessibility into the context of Planetary boundaries: Measuring just accessibility within planetary boundaries
- A dataset of all >200 social tickets in Germany: Welfare Ticket Atlas (In German, with an English summary)

This dashboard is a part of my dissertation project in transport engineering at Hamburg University of Technology.

– *Christoph Aberle, in summer 2025*

Acknowledgements

Friends

I would like to express my thanks to the friends and colleagues who have provided me with data on the Public Transport systems in and around Hamburg and Berlin:

- The researchers and students at the TUHH Institute for Transport Planning and Logistics
- hvv - Hamburger Verkehrsverbund
  HBT - Hamburger Berater Team
- VBB - Verkehrsverbund Berlin-Brandenburg
  CNB - Center Nahverkehr Berlin
- civity Management Consultants

FOSS

Moreover, my work would not be possible without the thousands of people who spend their spare time writing and maintaining Free Open Source Software. I would like to highlight the following projects:

- OpenStreetMap
- QGIS
- PostgreSQL
- Leaflet
- The R project, ggplot2, plotly and flexdashboard, also Kyle Walkers Neighbourhood Diversity Dashboard that inspired me
- LibreOffice

"It was a revelation, a liberation. Physicists, mathematicians, astronomers, logicians, biologists, all were here at the University and they came to him or he went to them, and they talked, and new worlds were born of their talking. It is of the nature of idea to be communicated: written, spoken, done. **The idea is like grass. It craves light, likes crowds, thrives on crossbreeding, grows better for being stepped on.**"
Ursula K. Le Guin (1974/2002): The Dispossessed, p. 63. London: Gollancz (SF masterworks)

Impressum

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– *Christoph Aberle, in summer 2025*