University of North Carolina Asheville
Journal of Undergraduate Research
Asheville, North Carolina
December 2015

Redefining 'ART': Examining Ridership Attitudes Toward Asheville Redefines Transit by Income Level

Lauren Noto
Mathematics
The University of North Carolina Asheville
One University Heights
Asheville, North Carolina 28804
USA

Faculty Advisor: Dr. Steven Patch

Abstract

Many studies in transit related research suggest that access to quality transit directly influences the economic mobility of communities. Southern poverty, particularly in the Mountain South, is hard to remedy without access to affordable transit options that allow people to keep jobs and tend to their personal needs. Most small transit services exist as social welfare systems for residents who are too poor to own private transportation or who are too young or old to drive. According to the U.S. Census Bureau, between 2009-2013 20 percent of Asheville residents were below the poverty level. The City of Asheville maintains a bus transit service called **ART: Asheville Redefines Transit** and helped collect a survey feedback in 2013 from bus riders. Respondents were asked demographic information and then asked to categorically rate the importance of system aspects and their level of satisfaction with 2012 system changes. The purpose of this study is to use this data to look at the relationship between income and ridership priorities. As a rider's income increases, importance of transit system changes decreases. This study also finds that low-income riders tend to place more importance on all aspects of the transit system, and higher income ridership is more satisfied with the system as a whole than lower income ridership. The findings from this study suggest that given the comfort level of high income ridership with ART services, ART should place low-income, non-elective ridership priorities first as the system is necessary for these riders.

1. Introduction

Economists Raj Chetty, Nathaniel Hendren, Patrick Kline, Emmanuel Saez, and Nicholas Turner authored a study mapping the influence of geography on economic mobility. Saez et al found that the likelihood of a person from Asheville reaching the top fifth of income distribution from the bottom fifth are only 6.3 percent[1]. The top ten cities include areas with significant transportation systems and transportation investment, including Salt Lake City, New York City, Seattle, Boston, and Washington, D.C[2]. NYU's Rudin Center, a leader in transportation policy and management, completed a study in 2015 of New York City neighborhoods, looking at the links between the employment rate and access to public transit. Keeping a commute threshold of an hour, Rudin reaffirmed that the more jobs commuters were reasonably able to access, the lower the unemployment level would be[3]. In relation to this report, the Rudin center's director, Mitchell Moss, was quoted saying, "It's far more important to have a MetroCard than a college degree"[4].

Private vehicle access is a large barrier to economic mobility for many poor families, with public transit having to fill in the gaps. A report focused on Los Angeles transit from the University of Southern California School of Policy, Planning, and Development, noted that the largest portion of ridership in the Los Angeles metropolitan area was the lowest income quartile[5]. The elderly, poor, and female are mostly dependent on transit[6]. As Garrett and Taylor note in the *Berkeley Planning Journal*, public transit has become "first and foremost a social service", where continued availability is "vital for access to jobs, schooling, medical care, and other necessities of life"[7].

There is a dearth of contemporary, thorough analysis on small metropolitan area transit systems. In these areas, people particularly need a basic transit system to make their lives easier and to fulfill their basic needs. One such small metropolitan area is the City of Asheville. The City of Asheville has a bus transit system, called ART: Asheville Redefines Transit. Asheville Transit serves the city's 87,000 residents, with a central hub located in downtown Asheville. ART provides basic services to City of Asheville residents on routes that run with frequency around every half hour to one hour along main city corridors within the city limits.

The City of Asheville commissioned a survey in 2013, in partnership with the nonprofit Just Economics of WNC, to solicit rider feedback on services offered by ART and services or improvements desired. A preliminary report compiled by Daniel Matchar in May 2014 looked at survey demographics, use of buses, and most desired improvements[8]. The purpose of this study is to take the preliminary analysis one step further to look at relationships between a commuter's income level and ridership priorities. This study looks at the low-income ridership of the Asheville Redefines Transit system and presents a case for transit operations to focus on the needs of these riders.

ART serves as a social welfare system for the City of Asheville to help low-income residents meet their basic needs. Although there is a portion of elective ridership, the majority of ART commuters are low-income. Forty nine percent of ridership reported a yearly household income lower than the federal poverty level of $11,770, and 78 percent of ridership reported household income lower than $24,999. Thirty three percent of survey respondents considered themselves disabled, and 63 percent of respondents identified the bus as their only transportation option. Ridership is relatively stable, with 59 percent of ridership utilizing the bus at least 5 days a week and 63 percent of commuters using ART for over two years.

Just Economics of WNC founded a group called The People's Voice for Transportation Equality, an organization designed to make sure that "there is proper representation in decision-making from non-elective riders" and that planning prioritizes the needs of the people who use public transit out of necessity[9]. The City of Asheville Transit Master Plan Committee has been exploring options to widen the bus' market share of riders since funding is limited and depends on the number of trips made per year on ART. As debate in the city around the future of ART continues, there is room for concern that courting elective, higher income ridership might overshadow the needs of low-income ridership. This study aims to look at these needs of non-elective, low-income riders in the frame of total ridership so that they may be more carefully and equitably considered.

2. Methodology

In the spring of 2013, Just Economics and other members of its transportation group wished to gauge rider information about changes to the ART system and general sense around the system. Just Economics designed the survey in partnership with several other organizations, including the Asheville Homeless Network and Children First: Children in Schools. Just Economics distributed the survey in May of 2013 and passed out copies at the transit station, public housing areas, buses, downtown Asheville, and at events/meetings where bus riders are known to frequent. 227 unique copies were collected on paper, and in a few instances when the survey taker was unable to complete the form themselves, questions were asked verbally and responses were recorded on behalf of the rider.

Later that summer, the City of Asheville Transportation Department requested the data from Just Economics. The City of Asheville collected 282 unique paper responses between November 18-23, as well as 156 unique responses online through SurveyMonkey, for a total of 655 unique responses. Survey collection methods remain unclear, although there were multiple attempts made to ask about the method of data collection.

The original analysis notes that the survey responses between the Just Economics and City of Asheville survey groups were fairly cohesive. However, there were some differences between online and paper responses. Online surveys present challenges in collecting unbiased data, particularly because of the response bias. It is also worth noting, and the original analysis does as well, that the respondents of the online survey had incomes above the poverty level at a significantly higher portion than the respondents on paper.

However, the online data had importance to this project, mainly because a majority of the online respondents had much higher income than the paper respondents and this data was necessary to do a proper logistic regression. Both paper collections were done in an unbiased manner and most bias is minimized, with over two-thirds of the data coming from these paper collections.

The primary method used to analyze the data was logistic regression. Logistic regression was chosen because of the desire to look at the relationship between income and ridership preferences. Income was used as the predictor variable; with each response category used as the categorical variable. Separate logistic regressions were run for every response

category. Figure 1 shows Question 22, which shows the income categories on the original survey. Figure 2 shows the income breakdown in survey respondents.

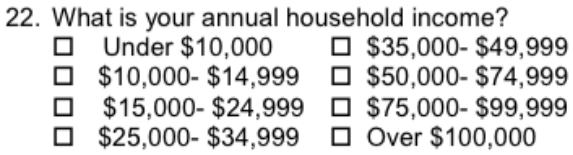

Figure 1. Question 22: what is your annual household income?

Income was broken into median income levels for each response category and logged for consistency. With a large cluster of low-income respondents it is important to make sure that all incomes are accurately represented for the analysis. A change in income from $5000 to $11000 makes a larger difference in behavior than a change in income from $75000 to $80000.

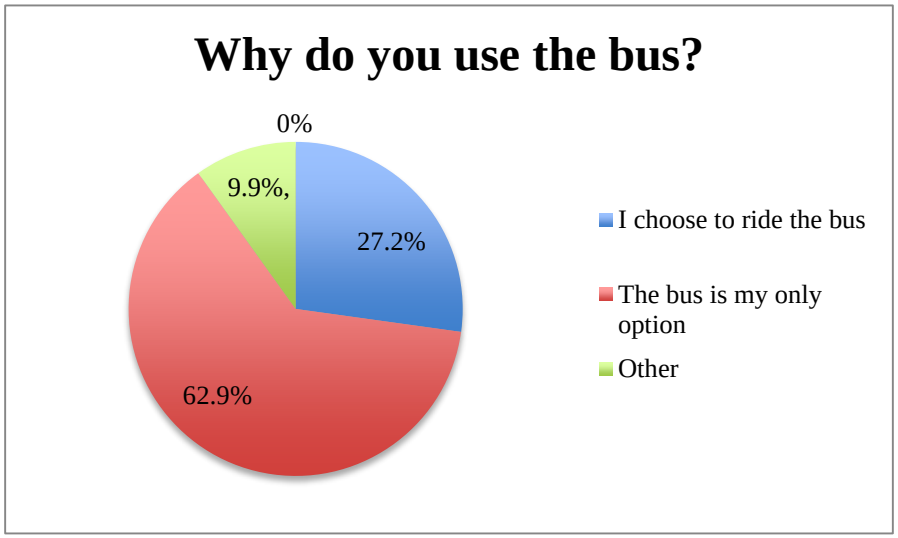

Figure 2. Income breakdown of survey respondents, adapted from the preliminary analysis

Two main questions were picked to analyze the hypothesis that low-income riders assign more importance to the transit system as opposed to high-income riders -- to determine if ART should focus on equitable planning principles. The first is Question 9, where respondents were asked to "evaluate the changes in ART service last year" on a scale of 1-5, with 1 being the lowest value. The second question was 13, which asked how important a series of transit system changes were to the respondent, with values from 1-3, again with 1 as the lowest value. These two questions are a direct way to test the null hypothesis that there is no difference between priorities in low-income and high-income ridership, or elective versus non elective ridership. Figures 3 and 4 show the original phrasing used to collect this data from respondents.

9. Evaluate the changes in ART services made last year:
(1=Worse, 5=Greatly Improved, ?=Don't know)

	1	2	3	4	5	?
Overall Service	☐	☐	☐	☐	☐	☐
Route lengths	☐	☐	☐	☐	☐	☐
Destinations served	☐	☐	☐	☐	☐	☐
Transfer points/times	☐	☐	☐	☐	☐	☐
Schedules	☐	☐	☐	☐	☐	☐
On Time	☐	☐	☐	☐	☐	☐
Frequency	☐	☐	☐	☐	☐	☐
Start times	☐	☐	☐	☐	☐	☐
End times	☐	☐	☐	☐	☐	☐
Safety	☐	☐	☐	☐	☐	☐
Sidewalks	☐	☐	☐	☐	☐	☐
Cleanliness	☐	☐	☐	☐	☐	☐
Operator Courtesy	☐	☐	☐	☐	☐	☐
Quality of Info	☐	☐	☐	☐	☐	☐

Figure 3. Question 9, asking respondents to evaluate changes in service made in the last year

13. How important are the following transit system changes to you? (1=Not important; 2=somewhat important; 3=Very important)

	1	2	3
Maintain existing service	☐	☐	☐
Sunday service	☐	☐	☐
More bus stops	☐	☐	☐
More frequency	☐	☐	☐
More routes	☐	☐	☐
More sidewalks	☐	☐	☐
More shelters	☐	☐	☐
An all night bus	☐	☐	☐
Easier way to report problems	☐	☐	☐
More enforcement and separation of smokers/nonsmokers	☐	☐	☐
Safety for riders traveling with children	☐	☐	☐
More riders who HAVE to ride the bus on the Transit Commission	☐	☐	☐
Create additional stops	☐	☐	☐

If so, where? _____

Other changes? _____

Figure 4. Question 13, asking respondents to rate transit system improvements by priority level

Three statistical measures were used to evaluate the data: The p-value at a significance level of 0.05, the odds ratio, and the confidence interval for the odds ratio. The p-value is used in this analysis to assess whether the null hypothesis can be accepted or rejected, i.e. null hypothesis being there is no difference in importance of the transit system to low-income versus high-income riders. A p-value below the threshold confirms significance and rejects the null hypothesis; a p-value above the threshold fails to reject the null hypothesis.

The odds ratio was chosen as a second interpretative measure because it is a way to measure the relationship between two categories in a population, i.e. a survey respondent with a one unit increase in income would have a one unit increase or decrease in importance category on survey responses. In this research it is the ratio of the odds that Y is in a given category or lower category when x is increased by one unit divided by the probability when it is at the lower level.

The odds confidence interval examines the tightness of the measurement. The odds ratio confidence interval here is at 95% confidence and is included to look at whether the interval overlaps the null value (OR =1), which would invalidate the results. A larger confidence interval indicates a lower level of precision, and a smaller interval indicates a higher level of precision.

The regression coefficient was also looked at while evaluating regression output. If the coefficient is positive, that means that as the predictor increases and so does the likelihood of being in a lower response category increases. For

this model, the interpretation is that if the regression coefficient is positive, then as survey respondents move into a higher income category, they tended to rate system changes as less important and were more satisfied with the system as a whole.

3. Results

Logistic regression analysis confirmed that as income increases, more people choose to ride the bus instead of the bus being their only option which validates low-income ridership's dependence on ART for basic needs. The overall results of this analysis highly suggest that lower income people tend to see everything as more important, therefore necessitating the need to listen to the needs low-income ridership first. The results of the logistic regressions ran on survey questions 9 and 13 are presented here in table format with discussion afterwards.

Table 1. Logistic regression results for question 9: "evaluate the changes in ART services made last year: (1=worse, 5=greatly improved, ?=don't know)"

Variable	P-Value	Odds Ratio	Confidence Interval for Odds Ratio	Statistically Significant
DestinationsChange	< 0.0001	0.705	0.595-0.835	Yes
TransfersChange	< 0.0001	0.707	0.597-0.838	Yes
SchedulesChange	0.0008	0.751	0.635-0.888	Yes
OnTimeChange	0.0024	0.773	0.655-0.913	Yes
FrequencyChange	0.0217	0.825	0.698-0.974	Yes
StartChange	0.0014	0.760	0.642-0.900	Yes
EndChange	0.0039	0.781	0.660-0.923	Yes
SafetyChange	0.0001	0.710	0.599-0.842	Yes
SidewalkChange	0.0374	0.835	0.706-0.988	Yes
CleanlinessChange	0.0134	0.837	0.682-0.956	Yes
CourtesyChange	0.0002	0.725	0.612-0.859	Yes
InfoChange	0.0090	0.798	0.674-0.945	Yes

Every logistic regression done was significant at all three measures. The data shows that as a respondent's income increases, they are less likely to assign a high level of importance to transit system improvements. As income decreases, riders tend to find everything more important. The findings from the logistic regression tests for Question 9 support the premise that transit planning decisions should be made around the needs and wishes of the low-income and marginalized ridership.

All p-values on the Question 9 tests are lower than 0.05. Because of the logistic regression's positive slope (i.e. the higher income gets, the lower importance level a rider would assign to a hypothetical transit system improvement), a significant odds ratio would be less than one. A low-income rider would not also exhibit a lower importance level in general towards transit system changes and improvements. All odds ratios are less than one. A "good" confidence interval for an odds ratio would not contain a value higher than one, because of a "good" odds ratio being less than one. All of the confidence intervals for the odds ratio are significant as well.

The highest odds ratios represent the changes with the upmost level of importance to low-income ridership. The top three important changes ART has made to low-income ridership are changes in cleanliness (CleanlinessChange), changes in sidewalks (SidewalkChange), and changes in frequency (FrequencyChange). Sidewalks are an issue in many areas of Asheville, especially in busy commercial corridors like Tunnel Road. Some bus stops are on the side of the road without a sidewalk, and people who need to catch certain buses have to walk up the side of the road in order to get to their stop. The frequency of buses is another improvement that is important to both elective and non-elective ridership. Many stops are only served about once every half hour to an hour, providing long wait times to people getting off work or doing errands if they are not able to finish them in the explicit time between their bus and the next bus.

Two additional changes important to low-income people are changes in how people receive information (InfoChange) and changes in the end time of service for buses (EndChange). A common complaint by many bus riders is that information on the system is not transparent and is not easy to find. The introduction of NextBus software and GPS trackers on the bus last summer is an important solution to a problem that is overwhelmingly crucial to low-income ridership. The addition of GPS trackers allows the transit system to not have to rely on estimations from bus drivers as to where they are and what the time to a certain stop is. Users can either call the ART station or use text messaging to figure out what bus will be coming to the stop they are at and when it will be coming. This change is something important to both elective and non-elective ridership as well, as it solves the needs of riders who ride out of necessity to get to work or school and also incentivizes ridership of high-income riders because they perceive the bus as more reliable.

Table 2. Logistic regression results for question 13: "how important are the following transit system changes to you? (1=not important, 2=somewhat important, 3=very important"

Variable	P-Value	Odds Ratio	Confidence Interval for Odds Ratio	Statistically Significant
ImportantSunday	< 0.0001	1.360	1.105-1.674	Yes
ImportantSTOPS	< 0.0001	1.717	1.433-2.056	Yes
ImportantFrequency	< 0.0001	1.252	1.042-1.504	Yes
ImportantRoutes	< 0.0001	1.340	1.119-1.604	Yes
ImportantNight	< 0.0001	1.495	1.248-1.791	Yes
ImportantReport	< 0.0001	1.473	1.232-1.760	Yes
ImportantShelters	< 0.0001	1.520	1.264-1.829	Yes
ImportantSafeChild	0.0004	1.393	1.160-1.672	Yes
ImportantAddStops	<0.0001	1.414	1.171-1.707	Yes
ImportantCommission	0.0001	1.209	1.005-1.453	Yes

Once again, all of the regressions performed are significant, providing more evidence that transit changes should be made based on the wishes of low-income ridership. All p-values are significant at the alpha level of 0.05, with most being less than 0.0001. Since there is a negative relationship between income increases and importance placed on the transit system, significant odds ratios will be greater than one. Every odds ratio is greater than one, and no confidence interval for the odds ratio contains a value less than one which reinforces the significance of these results.

Because everything is significant again, it will be most valuable to this analysis to look at the categories with the highest level of significance. Looking at the highest odds ratios as evidence of a high level of importance, the three

most important changes for low-income ART ridership are re-evaluation of stops (ImportantSTOPS), more bus shelters (ImportantShelters), and increased night service (ImportantNight).

The location and scope of bus stops is a common complaint of ridership, both elective and non-elective. Many destinations that bus riders would want to reach are limited by ART's size and funding, such as some shopping centers and more places in in townships close to Asheville, like Woodfin. The bus is only funded to run within city limits and has to allocate its funds to figure out how to serve the most corridors with the least amount of money. One solution as evidenced by the results here is to prioritize stops that service low-income ridership. There are commonalities in both low-income and high-income ridership, as most bus riders regardless of income use the bus to commute to work, shop, or go downtown[6]. Because the elective ridership of ART is a minority and the market share of elective ridership is small, it makes sense to prioritize the needs of low-income ridership.

Bus shelters are first and foremost a comfort and safety issue. Because of funding issues, many bus stops do not contain shelters or are by the side of the road with no barrier between riders and cars. Bus shelters have been allocated to stops that seem to have a high incidence of riders, like the Asheville Mall, the Village at Chestnut (which contains several grocery stores and is next to a residential neighborhood), and on Patton Avenue by Goodwill (by the DMV and Goodwill's job training). Increasing the amount of bus shelters among routes is a high priority of low-income ridership, and any additional funding should be diverted accordingly.

Night service is another issue that particularly affects low-income ridership. Most low-income service jobs have non-traditional work schedules that run either early in the morning to midday or from the afternoon until the night. Many low-income riders are left without a way to get home after finishing their shifts and have to either walk or coordinate alternate and more expensive transportation. Currently, the latest route that ART runs is subsidized by UNC Asheville, as N1 runs through the university campus, and only operates until midnight Thursday through Saturday. Otherwise, the last trip leaves from the ART station downtown at 8 PM. Most other routes have a last trip leaving either before or at 8 PM, with few exceptions. Increased night service would not only benefit low-income ridership but would also attract elective ridership, which would appreciate the increased schedule flexibility that later routes would allow them. Later night service would also allow riders to use their time more efficiently to grocery shop or run other errands that have late night business hours.

Although over 50 percent of riders indicated Sunday service as the most important change ART could make, it interestingly enough did not make it into the top 3 changes most desired by low-income ridership[6]. Sunday service may bleed into other categories, such as increased routes and increased off-peak service hours. The City of Asheville's implementation of Sunday service on January 1, 2015 was in line with the priorities from Just Economics' People's Voice for Transportation Equality, but is still on a limited schedule because of funding. Some routes to low-income communities do not run on Sundays, such as the route to Klondyke Homes in Montford. It will be important to look at the scheduling and stop needs of low-income riders to ensure the needs of low-income riders are being met.

Another result to consider is the importance to low-income ridership of having proportional representation on the Asheville Transit Committee (ImportantCommission). Even though this variable had the lowest odds ratio of the table, it still had a P-value of 0.0001. The perceived lack of proportional representation necessitated groups like Just Economics' group the People's Voice for Transportation Equality. Even today, the majority of the transit committee makeup is elective riders, with few low-income riders. The integration of the 19 Point Agenda of the People's Voice for Transportation Equality is important to consider within the framework of the transit master plan and the Transit Committee's priorities. Much confusion in April 2015 surrounded the elimination and then quick reinstallation of the Free Fare Zone downtown, with many feeling like they were left out of the loop and not given information by the County Commission and the Transit Committee[10]. The proportional integration of low-income, non-elective ridership into the makeup could alleviate this issue and also make it easier to equitably plan changes to ART.

4. Conclusion

Overall, Asheville's bus transit provides a basic social service that low-income city residents desperately need. A strong case is made for listening to non-elective riders first when planning future changes to ART service, as the importance of past changes and the importance of future changes were more significant to low-income riders. Access to high quality and affordable transit is paramount for alleviating poverty in Asheville. As Asheville evolves, access to public transportation is necessary for the working class to remain employed and maintain their daily routines. Low-income neighborhoods are continually being pushed to the fringe of the city as "walkable" neighborhood areas such as central West Asheville and Montford gentrify.

An opposite conclusion can also be made that since high income riders are more satisfied with the system, ART should primarily focus on courting these riders. Many transportation grants are awarded based on the quantity of trips taken per year on a system, so increasing market share means that there will be more funding available for all riders. However, the priorities of low-income ridership demonstrated here like better frequency and on-time percentages would increase market share by making the system more attractive to elective riders while also greatly benefiting those who have ART as their only viable transportation option. A multi-modal transportation system will appeal to the high income riders from an environmental justice perspective as well. Projects that help Asheville become a "sustainable city" will likely be supported by the socially and environmentally conscious citizenry of Asheville.

More proportional representation of non-elective riders on the Asheville Transit Committee like the People's Voice for Transportation Equality recommends would be a good start to prioritizing low-income ridership. It is important to give these riders a seat at the table so that their voices may be heard when policy is formed. It is more than likely that these findings from Asheville would be the same for other similarly sized cities with bus transit systems, and it would be worth conducting similar surveys and analysis to see whether the results in Asheville hold at large. In 2015, ART began to offer bus services on Sundays and several new routes have been created. A second survey of how bus ridership diversity and frequency has changed since the extension of service days could provide a clearer understanding of the best ways to improve the ability of the bus to adequately serve low income riders and also improve the appeal of a multi-modal transportation system to high income riders.

Asheville Transit's management company, First Transit, has come under fire for improper management of resources, personnel, and poor bus maintenance. Drivers allege abuse of unscheduled overtime and that up to seven buses out of commission at one time[11]. The City of Asheville's transit staff is very attentive to public opinion and implements smart fixes, but not everything can be tended to when the Transit Department operates under extreme funding constraints. In 2014, only 0.002 percent of the North Carolina Department of Transportation budget was allocated to public transportation[12]. Outside of large cities, public transit funding is not a priority in America. As of April 2015, several proposals are currently in congress to cut transit funding by 43 percent, which would directly affect small and rural counties[13]. However, transit ridership national numbers are up: a record 10.7 billion trips were taken on public transit in 2013, the highest ridership in 57 years[14]. As transit continues to reclaim its market share, special care should be taken to ensure that the voices of elective riders do not drown out the voices of non-elective riders.

5. Acknowledgements

This project was funded with a 2014 grant through The Interdisciplinary Distinguished Professorship of the Mountain South. The contents of this paper do not necessarily reflect the views of the City of Asheville, Asheville Redefines Transit, First Transit, or Just Economics WNC. This project uses data from a 2013 survey collected through a partnership between Just Economics of WNC and the City of Asheville. The author would also like to acknowledge the City of Asheville Transit Master Plan Committee, Mariate Echeverry, Emily Lindesmith, Daniel Matchar, Dr. Lyndi Hewitt, Julie Mayfeld, Dr. Leah Greden Mathews, Yuri Koslen, and Just Economics WNC.

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