Using Fare Elasticities to Predict the Impact of a WMATA Subsidy for DC-Area College Students

Executive Summary

This memo discusses the impact of a subsidized University Pass policy on WMATA Metrorail ridership. By finding the amount of students in WMATA's serviceable area and approximating the specific fare elasticity of college students in the Washington Metropolitan Area, we find that a subsidy equaling approximately $1.90 per ride would increase the quantity of rides demanded per year by students by anywhere from 2.4 to 5.3 million, depending on the elasticity estimate. The higher estimate would constitute a 2% yearly increase in ridership system-wide.

Policy - Subsidized Public Transit for DC-Area University Students

Facing a decline rail ridership, the Washington Metropolitan Area Transit Authority (WMATA) is currently "examining strategies to increase revenues without a broad-based fare increase" (Webster 2015).

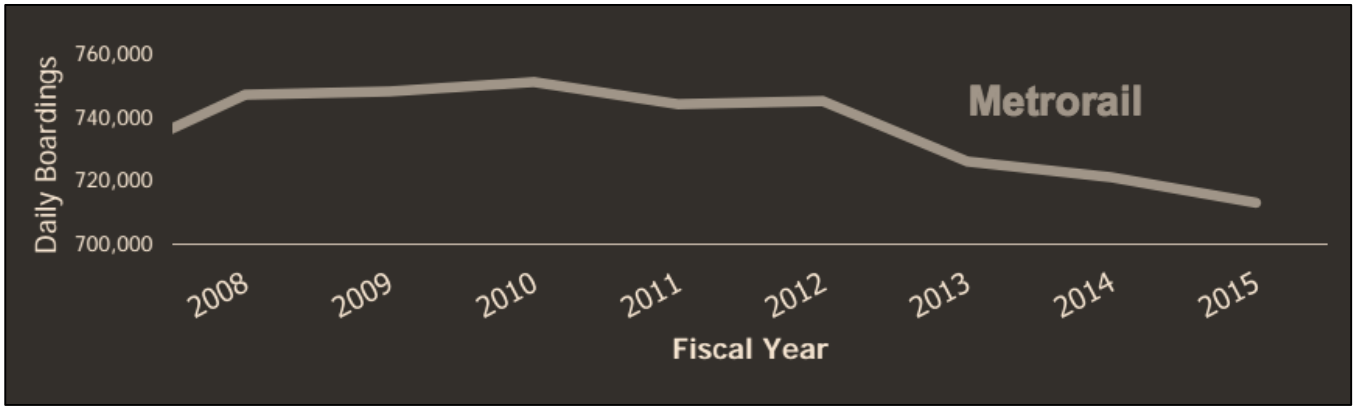

Figure 1: Average Weekday Boardings Since 2008 (Webster 2015, 6)

Among the strategies being considered is a "University Pass" program, which would offer unlimited or subsidized rides for DC-area university students. WMATA is looking to implement such a program in the very near future, with evidence that that the board would like to see it in place by FY 2017.

The University Pass program would require negotiation with local colleges and universities to create a subsidy for student passes. There is precedent at WMATA for similar agreements; since the 1970s, students at DC

public, charter, and parochial schools have had reduced fares, subsidized passes, or special programs like the "Kids Ride Free" pass (Webster 2014, 3-8).

There are a growing number of university/transit agency agreements in the US. The University of Pittsburgh allows all its students to ride fare-free on all Port Authority Transit in Oakland and Pittsburgh (University of Pittsburgh 2015); In 2000, the University of California - Los Angeles negotiated with bus systems in Santa Monica and Culver City to create an unlimited transit pass that students could purchase for $33 a semester (UCLA 2010). The WMATA University Pass program should take heed of the lessons learned from these past implementations: Ideally, pre-existing student ID cards can be used as a student transit pass, creating a more streamlined service. In addition, the best university transit subsidies have applied to all students with an opt-out; this avoids potential problems with adverse selection, where the only students purchasing subsidized unlimited passes are those using the passes far beyond their value (Brown, Hess and Shoup 1998, 10).

A Note on WMATA Passes

A future WMATA University Pass — for obvious reasons — would be purchased to cover bus and rail travel (or perhaps only one of the two) over the course of a semester. This would make it unlike any of the pass products offered by WMATA that are currently available to university students (WMATA 2015). Thus, for the purposes of this analysis, the pass will be treated as a subsidy on the price of individual Metrorail trips. As a hypothetical, the policy will subsidize each student trip by $1.90.

Calculation Summary

The effect of a student transit subsidy on the number of trips taken (quantity demanded) will be calculated as follows:

1. Finding the average Metrorail fare
2. Finding the number of college and university students in a serviceable area — defined as students attending any institution within reasonable distance of the WMATA system (this includes schools outside of the District of Columbia)
3. Calculating an approximate number of yearly trips taken by college and university students (Current Q_D)

4. Finding the fare elasticity of demand for university students
5. Using elasticity to calculate the change in yearly trips taken ($Q_{D\ new}$)

Calculation Details[1]

1. Though the Metrorail system uses distance-based fares, WMATA states that the average fare in FY 2013 was $2.90 (WMATA 2013, 2). The proposed subsidy would thus reduce the average fare for students to $1.
2. The number of college and university students in the serviceable area is an estimate of the maximum user base of a University Pass program. WMATA may have to negotiate with each institution individually, which may leave some schools out of the policy. However, it is assumed that the program will be opt-out, meaning that nearly all students would participate.
    a. Richard Florida (2012) used Census data to estimate the number of college students in the DC Metropolitan Area at around 450,000. On its face, this number appears inflated. Since no methodology was included, this number will be calculated manually [see (b)].
    b. The population of college students in the serviceable area of WMATA is approximately 318,000.[2]
3. To date, there is no subgroup analysis of DC-area college students detailing their transportation habits. Thus, we must approximate the number of WMATA trips taken by college students per year.
    a. From 2013 to 2015, the average number of boardings was 720,139 per day. According to WMATA survey data, 2% of all daily boardings in the system are for "school purposes" (Cambridge Systematics 2009, 27). This would mean that about 14,400 of those daily boardings

[1] See Summary Table (Appendix) for all the values used in the calculation.

[2] This value was calculated by adding the total student populations in 2015 of the following institutions: George Washington University, Georgetown University, Gallaudet University, American University, George Mason University, Howard University, University of Maryland – College Park and University College, Hood College, University of the District of Columbia, Catholic University, Strayer University, Northern Virginia Community College, Marymount University. All population numbers were pulled from each institution's official website.

are for school purposes, or about 52.5 million per year. However, this calculation also includes non-college students.

b. A closer approximation can be had by multiplying the average yearly trips per capita in 2012 (99.6) by the number of college students found in [2b], which results in approximately 31.6 million trips taken by college students per year (Fischer-Baum 2014).[3]

4. The elasticity of demand for public transit can vary greatly by group. It is widely accepted that there is a considerable "kink" in the demand curve, which separates dependent riders (who have a much lower elasticity) with discretionary riders (who have a relatively high elasticity) (Litman 2015, 6).

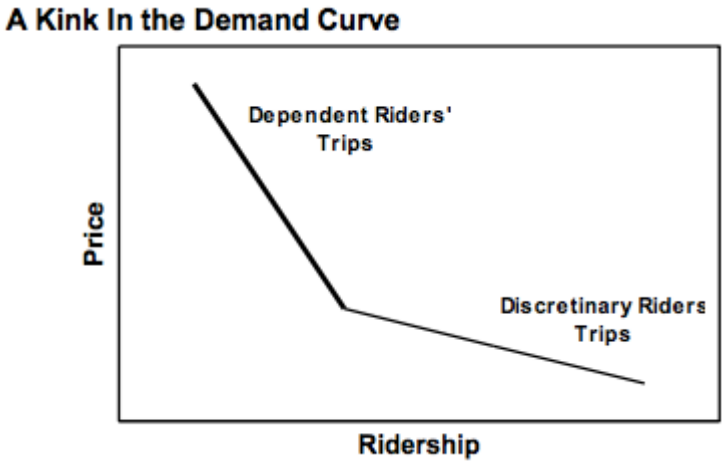

Figure 2: A Simplified Demand Curve for Public Transportation (Litman 2015, 6)

It is a fair assumption to state that DC-area college students are predominantly in the latter category: most students do not need to commute as much as workforce residents, and given the urban character of the region and low earnings of most students, public transportation can be reasonably seen as a normal good for the scope of this analysis.[4]

[3] There is no subgroup analysis of trips per capita in the DC region, so we must make the (admittedly large) assumption that trips per capita for college students are similar to other riders of the system.

[4] These assumptions do not apply equally to commuter students, who naturally are more dependent on any means of transportation (and thus would have more inelastic demand). However, we might still assume that many commuter students have the choice between driving and taking public transit. It should be noted that many schools in the region with high commuter populations, like George Mason, already provide those students with transit benefits.

a. The Victoria Transport Policy Institute estimates that for large American cities (with a metro area population larger than 1 million), the average fare elasticity is -.36 (Litman 2015, 7).
b. A program evaluation that specifically calculated on college student fare elasticity found a value of -.49, which was taken from a transit program at the University of Illinois (Brown, Hess and Shoup 1998, 17). This will be used as the higher estimate (and presumed more likely for this geographic scope).
c. An analysis of UCLA's public transit subsidy, BruinGO, calculated the fare elasticity for students in the program at -.28 (Brown, Hess and Shoup 2003, 73). This will be used as the most conservative possible estimate, but since it is presumed that DC-area students have a higher elasticity that other residents, and given the different urban characteristics of the UCLA area compared to DC, this value is unlikely.

5. The proposed subsidy would decrease average WMATA fares for college students by 34%.
   a. Under the higher elasticity, the policy would result in 5.3 additional trips per year.
   b. Under the most conservative estimate, this would result in 2.3 million additional trips per year by college students on the WMATA system.[5]
   c. This 5.3 additional trips per year would be an increase of 16.7% to the total yearly trips by college students (5.28/31.6 *100), and a 2% increase to yearly trips system-wide (5,277,200/(720,139 * 365) * 100).

Equations

High Estimate	Low Estimate
$\Delta Q_1 = E_{D1} \times \Delta P \times Q$	$\Delta Q_2 = E_{D2} \times \Delta P \times Q$
$\Delta Q_1 = -.49 \times -34 \times 31{,}600{,}000$	$\Delta Q_2 = -.28 \times -34 \times 31{,}600{,}000$
$\Delta Q_1 = 5{,}277{,}200$	$\Delta Q_2 = 2{,}363{,}680$

[5] Note: The actual calculated value—2,363,680—is truncated to avoid the perception of false precision. This is done throughout the memo.

Conclusion

Though this analysis is a necessary simplification of the structure of a possible WMATA subsidy for college and university students, it shows that the potential impact on increased ridership is substantial. Reducing fares to $1.00 would have an estimated effect of increasing yearly trips by college students by almost 17%, and would increase yearly boardings of Metrorail by around 2%.

Most of WMATA's own research shows that a University Pass program might even have additional positive side-effects. A study of WMATA ridership trends shows that most student boardings occur during off-peak midday hours (Cambridge Systematics 2009, 27). According to Brown, Hess, and Shoup (1998), this is ideal: "transit pass programs....achieve a low cost per ride when they attract riders at off-peak hours and on routes that have excess capacity. If transit agencies do not have to increase their system capacity to participate in the programs, they have a very low marginal cost per new rider" (p. 9). Essentially, students using a transit pass tend to be filling already-empty seats.

A University Pass program would be an effective way of stabilizing or even increasing WMATA's ridership trends, and would make the best use of the capacity of the current system.

Bibliography

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Appendix:

Summary Table

Average Metrorail Fare (P_{OLD})	$2.90
Proposed Subsidized Student Fare (P_{NEW})	$1.00
Change in Fare (%ΔP)	-34%
College Student Fare Elasticity (E_{D1})	-0.49
Fare Elasticity (E_{D2}, Most Conservative Estimate)	-0.28
College Students in Serviceable Area	318,000
Trips by College Students per Year (Q_{OLD})	31.6 million
Additional Trips Using E_{D1} (ΔQ)	+5.28 million
Additional Trips Using E_{D2} (ΔQ, Most Conservative Estimate)	+2.36 million
Change in Yearly Trips by College students using E_{D1} (%ΔQ)	+16.7%
Change in Yearly Trips Systemwide	+2%

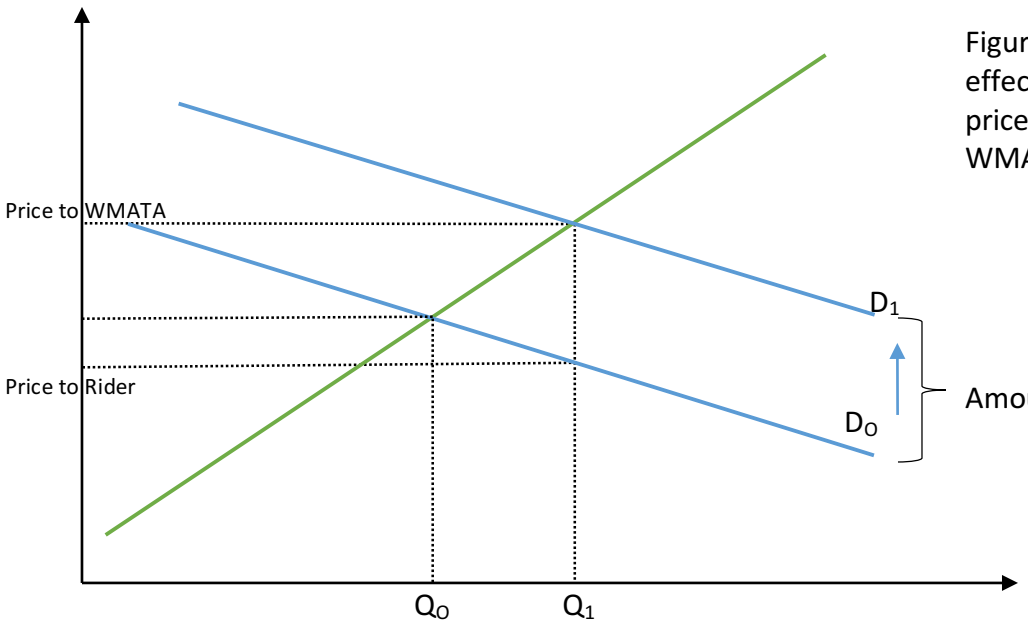

Figure 3: A simplified model of the effect of a consumer subsidy. A shifting price technically still applies because of WMATA's distance-based fares.