Short-Term Transit Ridership and Revenue Forecasting

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presented by
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Background

- WMATA operates Metrorail, Metrobus, and MetroAccess
Objectives

- Short-term ridership forecasts bridge the gap between current ridership trends and regional travel-demand modeling.

- Useful for multi-year budgeting and capacity planning.

Current Ridership Trends: Past to now, end of FY

Travel Demand Forecasting: 5 to 25 years in the future
Previous Work

In-house forecasts developed for budgeting and fare change impacts

![Graph showing observed, estimated, and forecast data over time.](image-url)
State of Practice

- WMATA’s use of the combined distance-based and peak pricing for Metrorail is unique

- Common agency practice does not address WMATA’s needs
  - An elasticity-based approach is limited by its ability to evaluate the impacts of the other drivers on ridership and revenue
  - Direct demand approach addresses the impacts of station area developments (e.g., BART)
  - Others have flat fare

- Many agencies reported they were working to develop models as sophisticated as WMATA’s

- Opportunities for further market segmentation
Modeling Approach

- Econometric modeling approach
  - Monthly ridership
  - Average fare
  - Log-log functional form

- Tested many market segmentations
  - Metrorail (peak weekday Metrorail, off-peak weekday Metrorail, and weekend Metrorail)
  - Metrobus (total Metrobus, weekday Metrobus, weekend Metrobus)
  - Peak, off-peak, peak-of-the peak
Variables

- **Ridership, revenue, and fare variables**
  - By market segments

- **Socioeconomic variables**
  - Employment, population
  - Gas prices
  - Transit subsidy benefit

- **Tourism/business travel variables**
  - Hotel rooms sold
  - Smithsonian visitations
Variables

- Metrorail/Metrobus-related variables
  - Percentage of bus pass trips using SmartTrip
  - Metrorail or Metrobus fare collection system change indicator

- Weather variables
  - Days of extreme cold, hot, rain, snow (weekdays and weekends)
  - Days the Federal Government was closed due to snow

- Special events
  - Inauguration, mall event, peak bloom month, peak bloom days

- Seasonal and month variables
Data

- **Model estimation periods**
  - From FY 2005 to FY 2011

- **Model validation period**
  - From July 2011 to March 2012
Short-Term Ridership and Revenue Forecasting

Ridership
- Metrorail weekday peak
- Metrorail weekday off-peak
- Metrorail weekend
- Metrobus

Average Fare
- Metrorail weekday peak
- Metrorail weekday off-peak
- Metrorail weekend
- Metrobus

Revenue Forecasts
Significant Variables
Ridership Models

- **D.C. Employment** is a strong explanatory variable in all models
- **Cost** (average fare by mode and market segments) was significant
  - Metrorail weekday peak and off-peak, not weekend
  - Metrobus fare
  - Metrobus most elastic, Metrorail weekday peak least elastic
- District/regional population NOT significant in models
Significant Variables

Ridership Models

- **Cost of Alternatives** (gas price, lagged) is significant for the Metrobus ridership model, with a small elasticity
  - Not significant in explaining rail ridership changes

- **Indicators of Tourism and Business Travel**
  - Smithsonian Visitation explains off-peak/weekend rail ridership
  - Hotel rooms sold explains bus ridership as well as off-peak/weekend rail

- **Extreme weather** drives down transit ridership
  - Number of days of extreme weather (cold, rain, snow) had negative impacts on ridership of some sub-models
Average Fares

- Average rail fares are a function of distance, impacted by factors that change the balance of where people ride
  - Tourism/business travel
  - Special events
  - Seasonal factors

- Average bus fare not impacted by external factors
Conclusion

- Fare elasticity values are within the range reported in the literature.

- Gas prices (lagged) elasticity values are in the low end of the range reported in the literature.

- Estimated ridership and revenue values were compared well with the observed values for the model validation period (from July 2011 to March 2012).

- Econometric modeling is valuable to address both internal and external factors driving short-term ridership and revenue, including the WMATA’s unique distance-based and peak pricing structure.