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Handling Student Mobility in Educational Research: Practical Examples from Maryland

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Overview

- Introduction and background
- Rates of student mobility in Maryland
  - Student characteristics
  - School characteristics
- Approaches for handling student mobility in educational research
- Summary
- Questions

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Introduction and Background

Introduction (1)

- Researchers using state longitudinal data systems are often interested in examining predictors of student outcomes
  - *What is the relation between early disadvantage and later academic achievement?*
- Predictors of interest may be at the student- or the school-levels
  - Student-level: student disadvantage
  - School-level: school concentration of disadvantage
- What % of the variance in student outcomes is due to the school level?

25-60%

Introduction (2)

- Education data are inherently clustered (e.g., students are nested within schools)
- Analyzing predictors at one level without the other will produce misleading results
- Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002) is the traditional statistical approach for correctly adjusting for clustering of students within schools
- However, analyses become complicated when students attend more than one school over time (i.e., the student mobility problem)

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The Student Mobility Problem

- Student mobility - when students change schools either within the academic year or between academic years (Rumberger, 2015)
- Mobility rates are high in the United States
  - Estimates range from 15% - 45% of students
  - Varies by student subgroup
  - Higher rates for minority students, low-income students, and lower performing students
  - Higher rates in urban schools and lower performing schools

(Rickles et al., 2018 ; U.S. Government Accounting Office, 1994)

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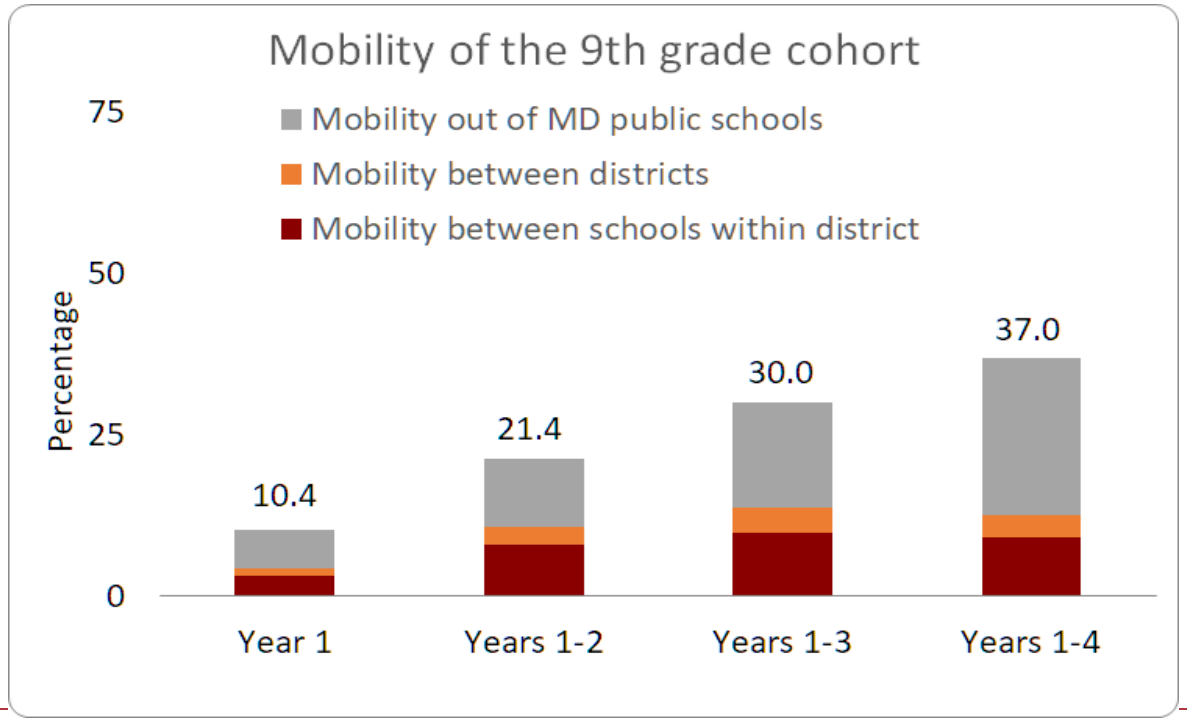
Rates of Student Mobility in Maryland

Student Mobility Rates in Maryland (1)



- By the end of 4 years, 37% of the 9th grade cohort experienced mobility out of the school where they started 9th grade.
- Most of this mobility was out of MD public schools altogether.

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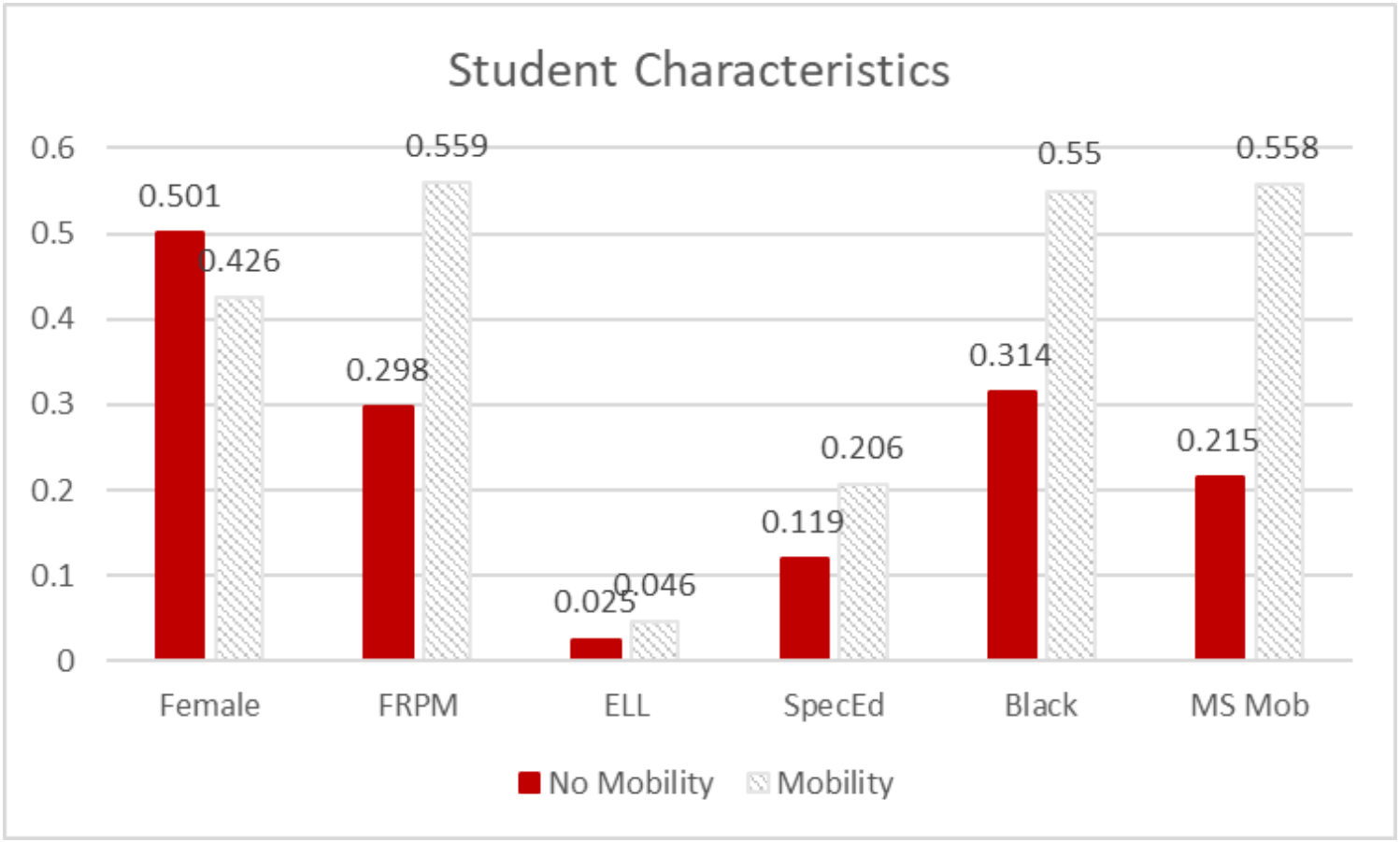
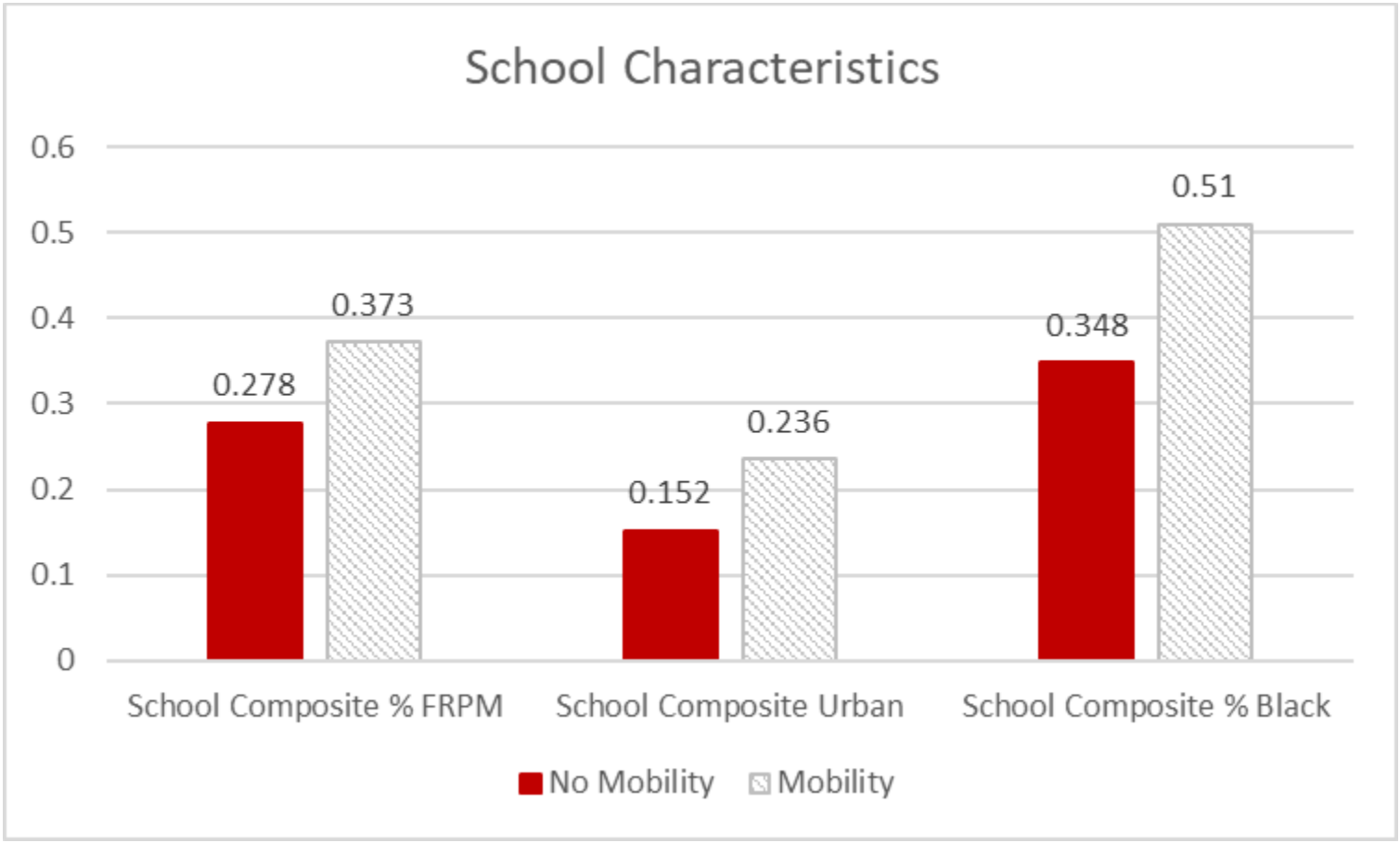
Student Mobility Rates in Maryland (2)



Student Mobility Rates in Maryland (3)



Questions?

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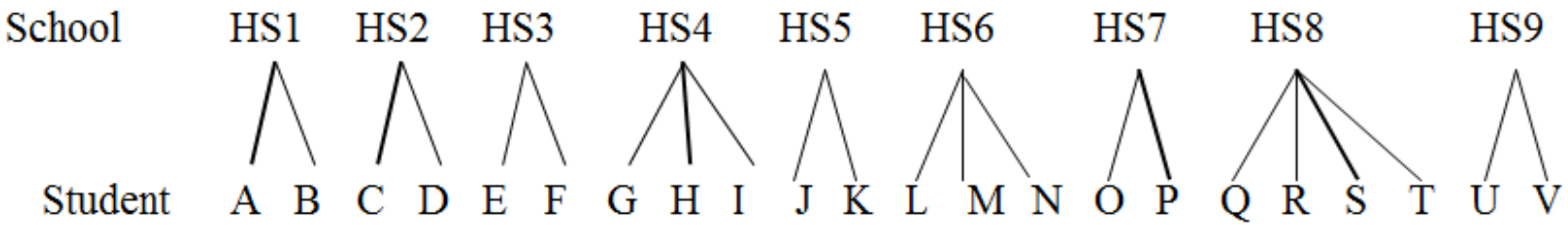
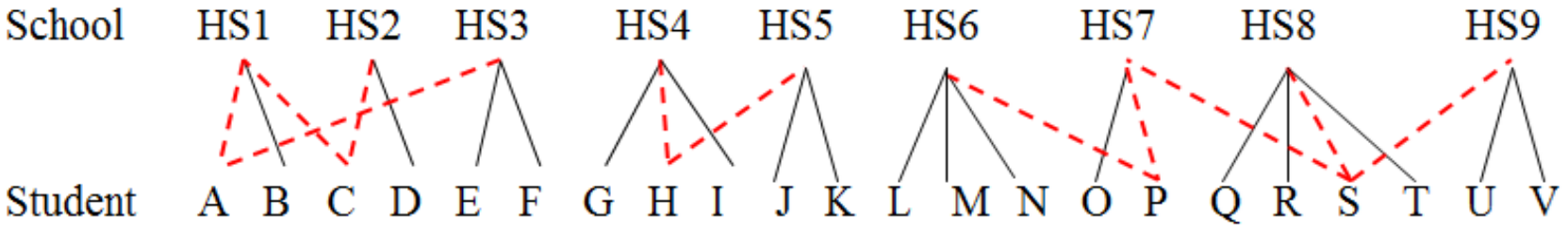
Approaches for Handling Student Mobility in Educational Research

Hierarchical Linear Modeling (HLM)

HLM is appropriate when each student is nested within *only one* school (HS=high school):



… but real-world data aren't purely hierarchical!

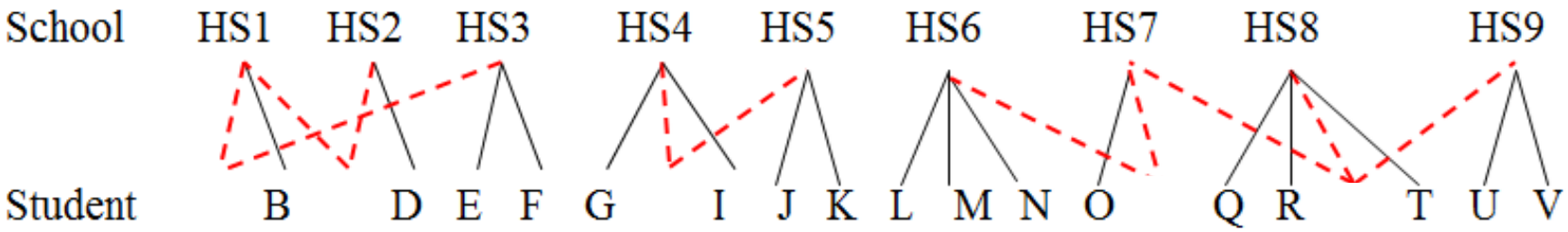


(Beretvas, 2010; Chung, 2009; Chung & Beretvas, 2012; Goldstein, Burgess & McConnell, 2007)

Comparison of Three Approaches

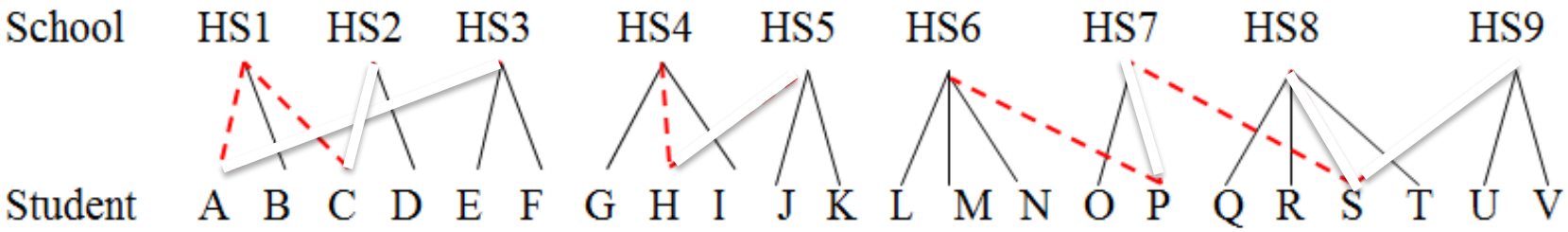
- HLM with deletion
- HLM with first school assigned
- Multiple membership modeling

HLM with Deletion



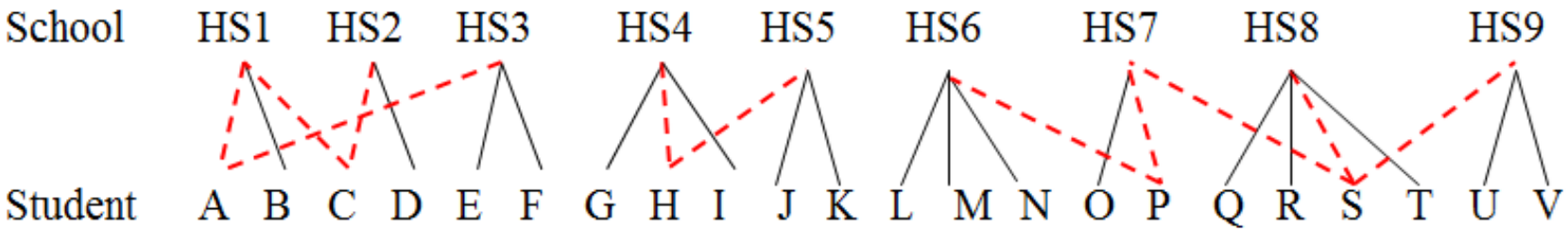
- Deletes mobile students before conducting statistical analyses
- Reduces statistical power (fewer students in the sample)
- Limits external validity (generalizability) b/c now the sample is only representative of non-mobile students

HLM with First School Assigned



- Assigns mobile students to their first school attended before conducting statistical analyses
- Reduces internal validity
- May lead to misattributing some of the school-level variance to the student-level (see Chung & Beretvas, 2012)

Multiple Membership Modeling



- Accounts for each school attended by mobile students by creating weights for each school
- Example:
  - Equal Weighting – Student A attends HS1 and HS3; each school is weighted 0.50
  - Proportional Weighting– Student A attends HS1 for 75% of the year and HS3 for 25% of the year; HS1 is weighted 0.75 and HS3 is weighted 0.25

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Comparing Approaches for Handling Student Mobility

What is the relation between early disadvantage and later academic achievement?

→ Traditional HLM model - delete mobile students

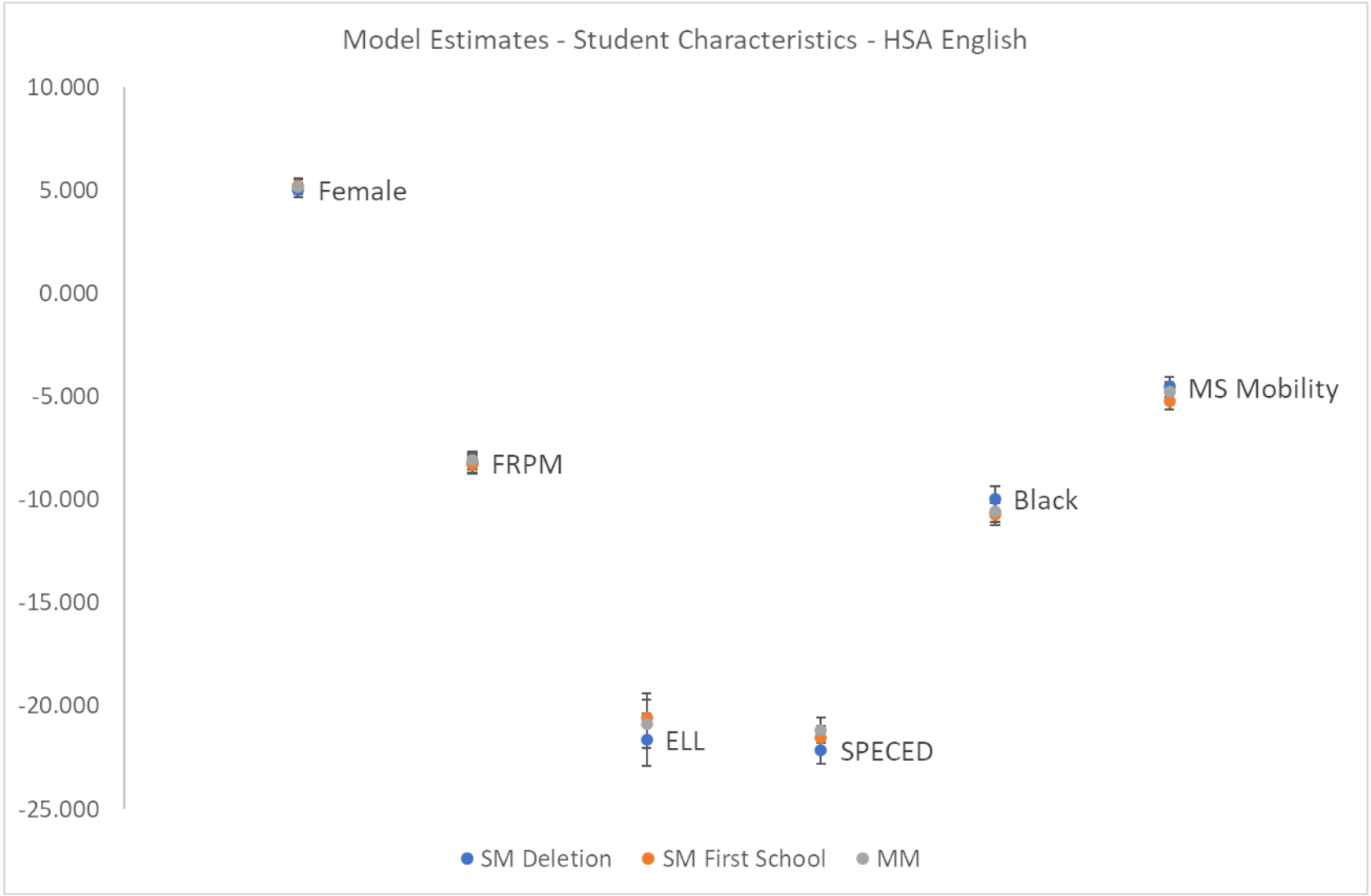
→ Traditional HLM model - assign mobile students to their first school

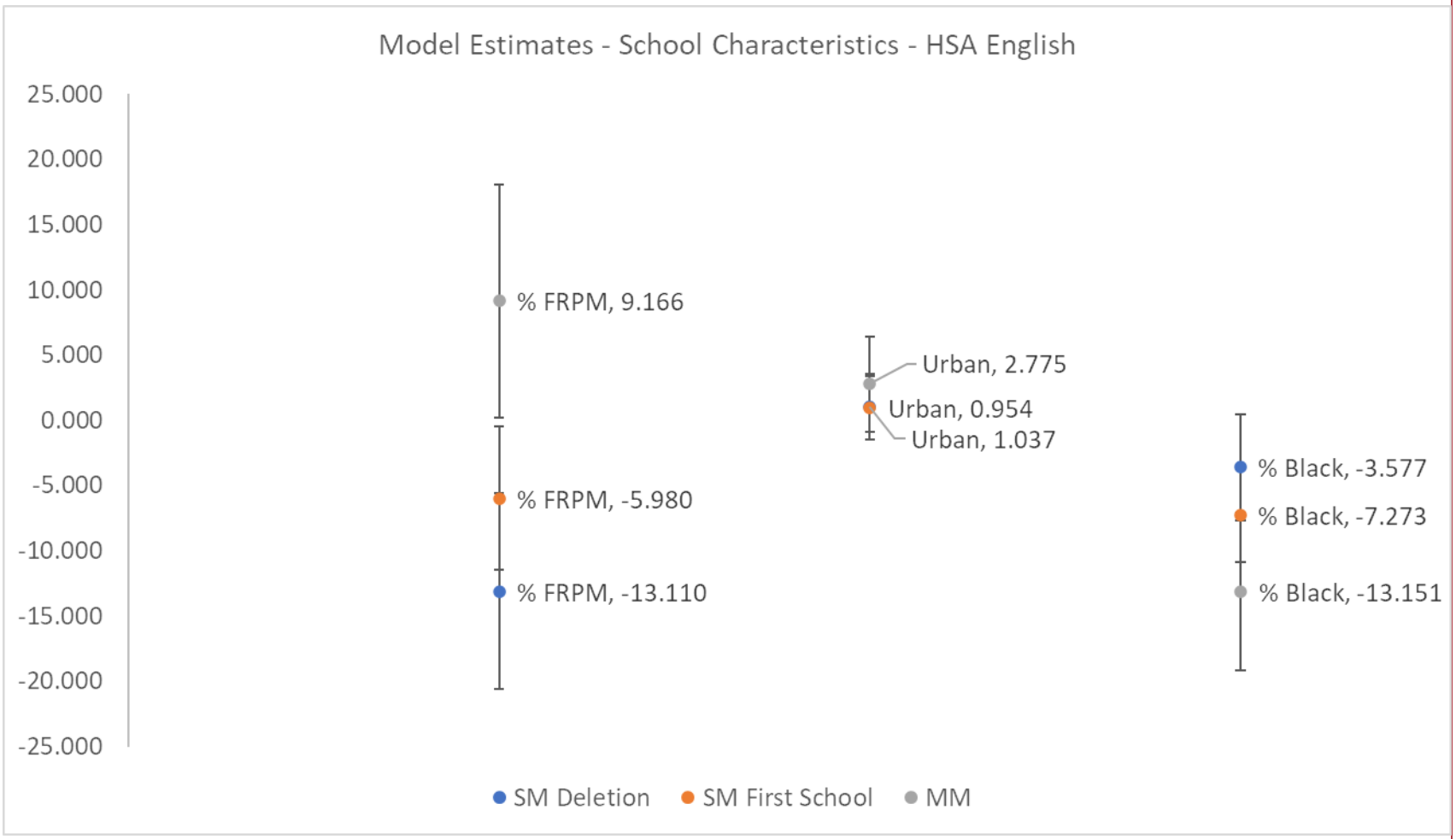
→ Multiple membership (MM) model

→ Compare the results

HSA English Models (N and Variance)

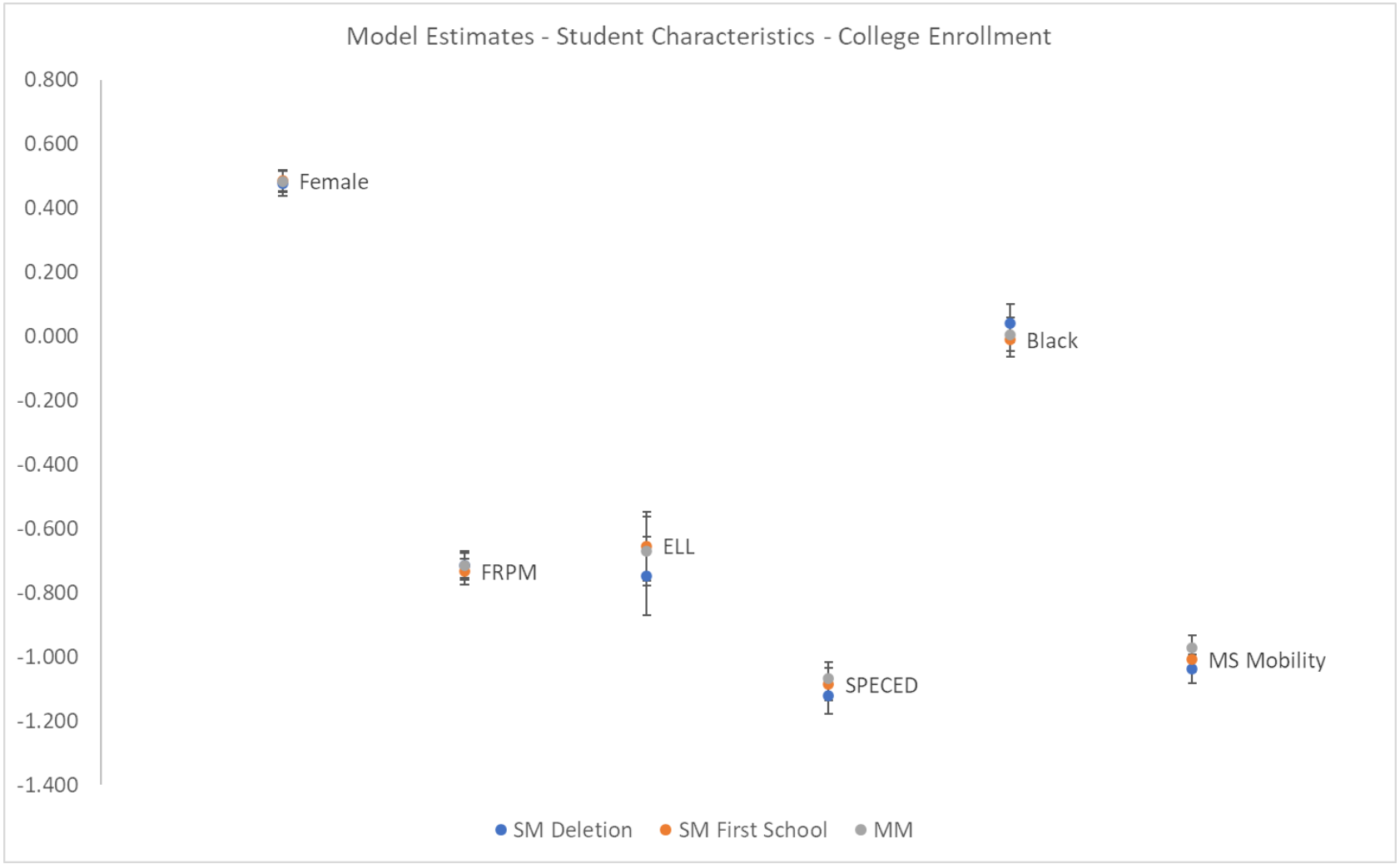
	SM Deletion	SM First School	MM
N Level 1 (student)	53,954	63,011	63,011
N Level 2 (school)	225	265	265
ICC	0.29	0.30	0.47

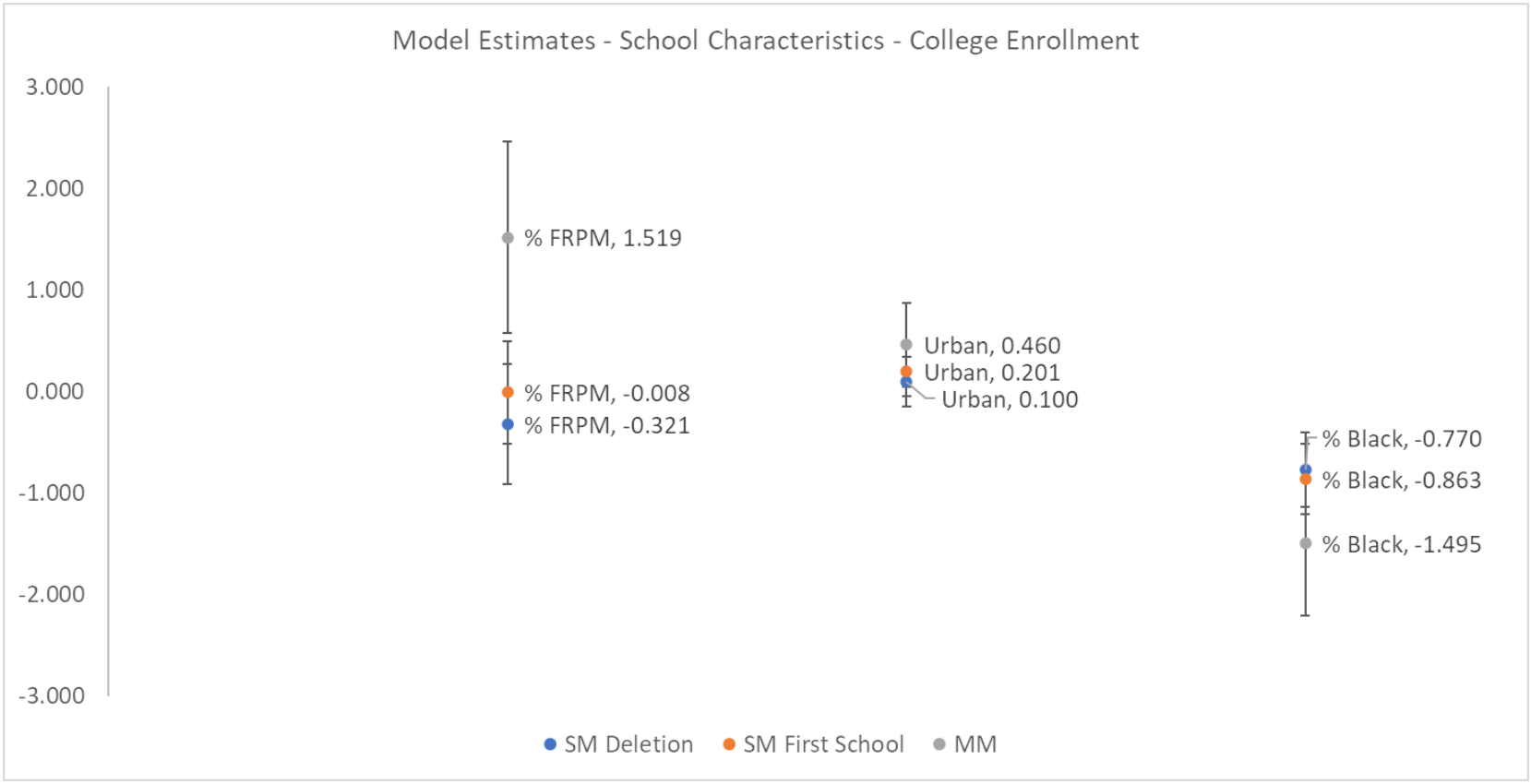

Model Estimates - Student Characteristics - HSA English
10.000
5.000
0.000
-5.000
-10.000
-15.000
-20.000
-25.000
Female
FRPM
ELL
SPECED
Black
MS Mobility
SM Deletion
SM First School
MM


Model Estimates - School Characteristics - HSA English
25.000
20.000
15.000
10.000
5.000
0.000
-5.000
-10.000
-15.000
-20.000
-25.000
% FRPM, 9.166
% FRPM, -5.980
% FRPM, -13.110
Urban, 2.775
Urban, 0.954
Urban, 1.037
% Black, -3.577
% Black, -7.273
% Black, -13.151
SM Deletion
SM First School
MM

College Enrollment Models (N and Variance)

	SM Deletion	SM First School	MM
N Level 1 (student)	59,774	75,279	75,279
N Level 2 (school)	253	307	307
ICC	0.31	0.33	0.63


Model Estimates - Student Characteristics - College Enrollment
0.800
0.600
0.400
0.200
0.000
-0.200
-0.400
-0.600
-0.800
-1.000
-1.200
-1.400
Female
FRPM
ELL
Black
SPECED
MS Mobility
SM Deletion
SM First School
MM


Model Estimates - School Characteristics - College Enrollment
3.000
2.000
1.000
0.000
-1.000
-2.000
-3.000
% FRPM, 1.519
% FRPM, -0.008
% FRPM, -0.321
Urban, 0.460
Urban, 0.201
Urban, 0.100
% Black, -0.770
% Black, -0.863
% Black, -1.495
SM Deletion
SM First School
MM

Questions?

Summary

Summary

- The choice of modeling approach matters for substantive interpretation and subsequent policy decisions
- The loss of students and schools when ignoring student mobility results in threats to external validity
  - Deleting mobile students results in disproportionate losses of some types of students (EL, minority, FRPM)
- Assigning students to their first school attended may result in threats to internal validity
  - Especially when interested in school-level predictors
- Using multiple membership modeling represents a viable solution for handling student mobility

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For More Information

- MLDS Center website

https://mldscenter.maryland.gov/

- Working paper available upon request – Email:

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