MLDS CENTER
Maryland Longitudinal Data System

Better Data • Informed Choices • Improved Results

Applying Longitudinal Data Analysis Methods to Examine Poverty as a Predictor of Wage Trajectories

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MLDS Center Research Series
April 4, 2019
mldscenter.maryland.gov

Overview

- ○ Many MLDS research questions are essentially questions about change
- ○ We can understand change using multilevel growth models
- ○ Using growth models to understand wage data from the MLDS
- ○ Discussion

Many MLDS research questions are essentially questions about change

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- What are the workforce outcomes of Maryland high school non-completers?
- What are the workforce outcomes for Maryland students who earn a high school diploma but do not transition to postsecondary education or training?
- Are exiters of Maryland colleges successful in the workforce?

⇒ ***How do individuals' wages change upon attainment of high school and college degrees?***

# We can understand change using multilevel growth models

Modeling change using multilevel growth or repeated measures models

- ○ What is the basic shape of the trajectory?
  - ○ What is the average starting point (at time 0)?
    - ○ This is called the intercept
  - ○ What is the average rate of change over time (for each unit of time)?
    - ○ This is called the slope
  - ○ Recall Y = mX + B
    - ○ Outcome = slope(time) + intercept
- ○ How does that trajectory change based on
  - ○ Events such as degree attainment
  - ○ Demographic characteristics such as race and gender

At level-1 (within person):
Model the <u>individual change trajectory</u>, which describes how each person's status depends on time
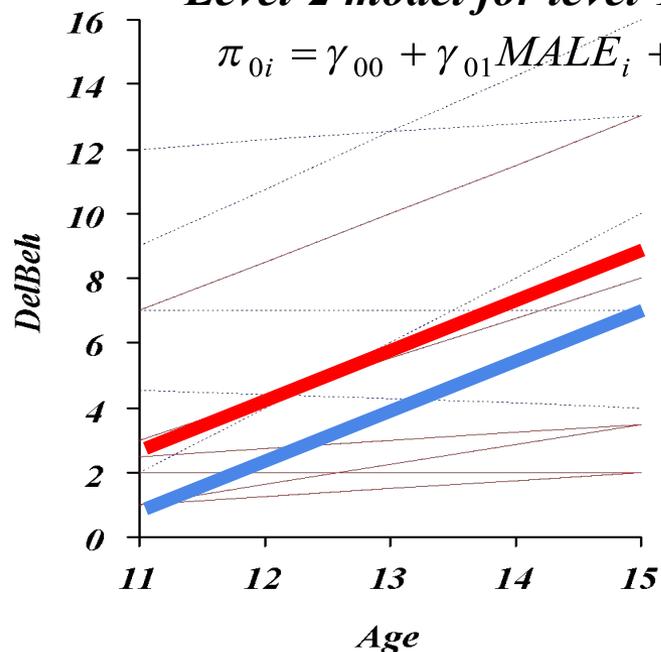
Anthony Bryk, SREE Summer 2016 HLM Short Course https://www.sree.org/video/
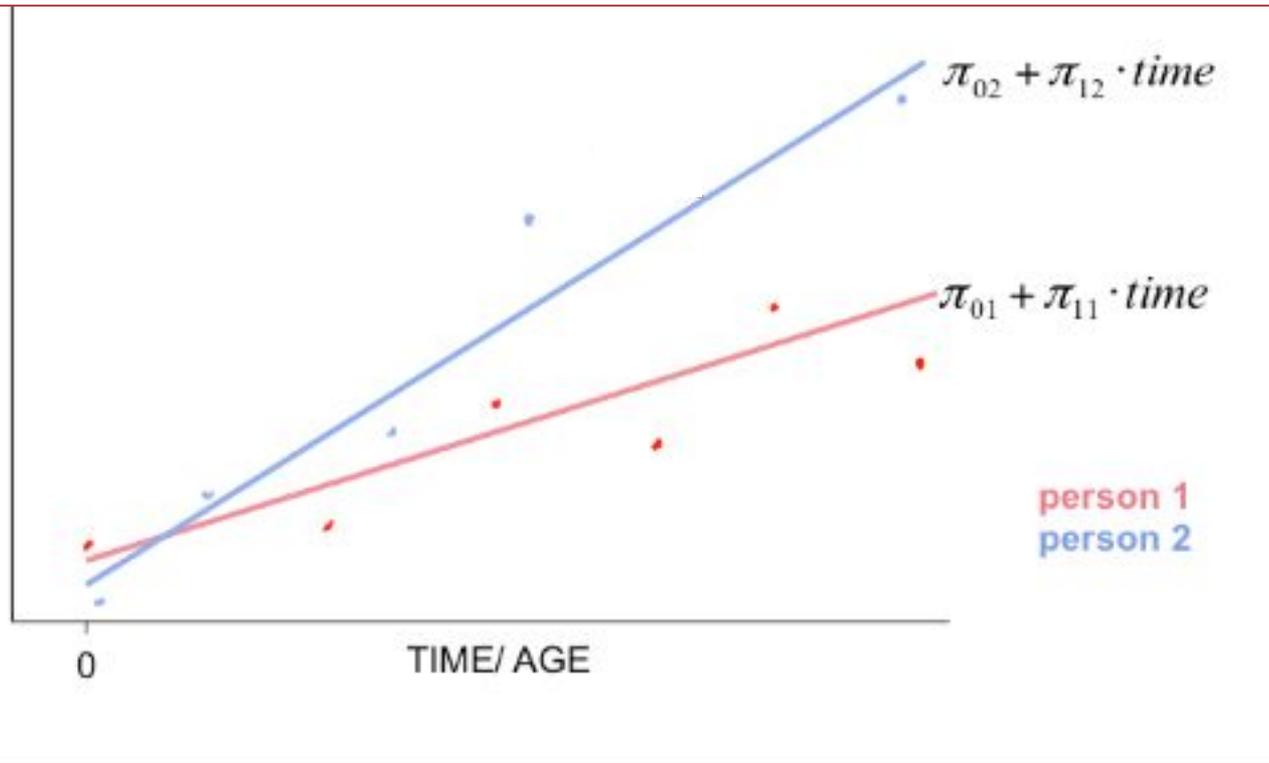
At level-2 (between persons):
Model <u>inter-individual differences in change</u>, which describe how the features of the change trajectories vary across people

Level-2 model for level-1 intercepts

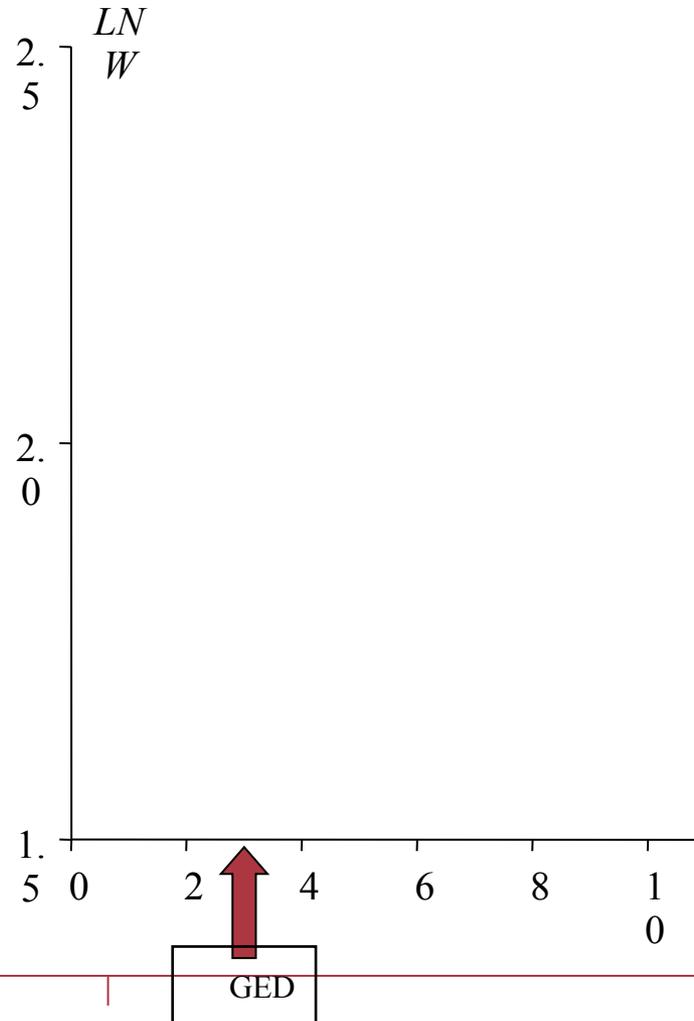$$\pi_{0i} = \gamma_{00} + \gamma_{01}MALE_i + \zeta_{0i}$$

Level-2 model for level-1 slopes

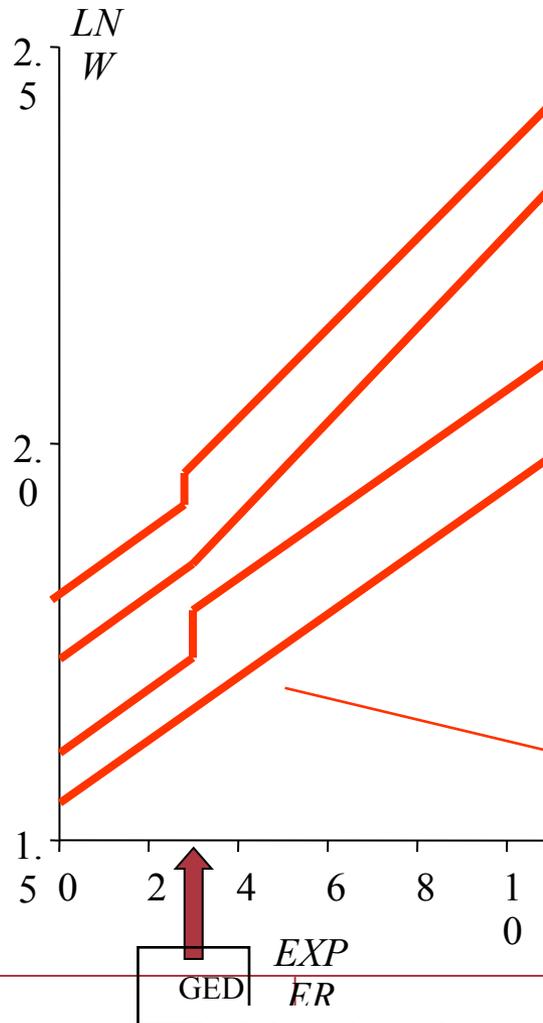$$\pi_{1i} = \gamma_{10} + \gamma_{11}MALE_i + \zeta_{1i}$$

Judith Singer, *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*

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What might the wage trajectory look like for someone who got a GED 3 years after labor force entry (post dropout)?

What might the wage trajectory look like for someone who got a GED 3 years after labor force entry (post dropout)?

Immediate shifts in both elevation & rate of change

An immediate shift in rate of change; no difference in elevation

An immediate shift in elevation; no difference in rate of change

No effect of GED whatsoever

Using growth models to understand wage data from the MLDS

Using growth models with MLDS

Wage data

- ○ Unit of time is quarters
- ○ For this example, set starting point at 4 quarters (Qs) prior to leaving high school (HS)

Research questions:

- ○ What is the average quarterly wage 4 Qs prior to leaving HS? How much do wages change over time, on average?
- ○ How do wage trajectories change upon attainment of high school and college degrees?
- ○ How do wage trajectories vary by race, gender, and poverty experiences?
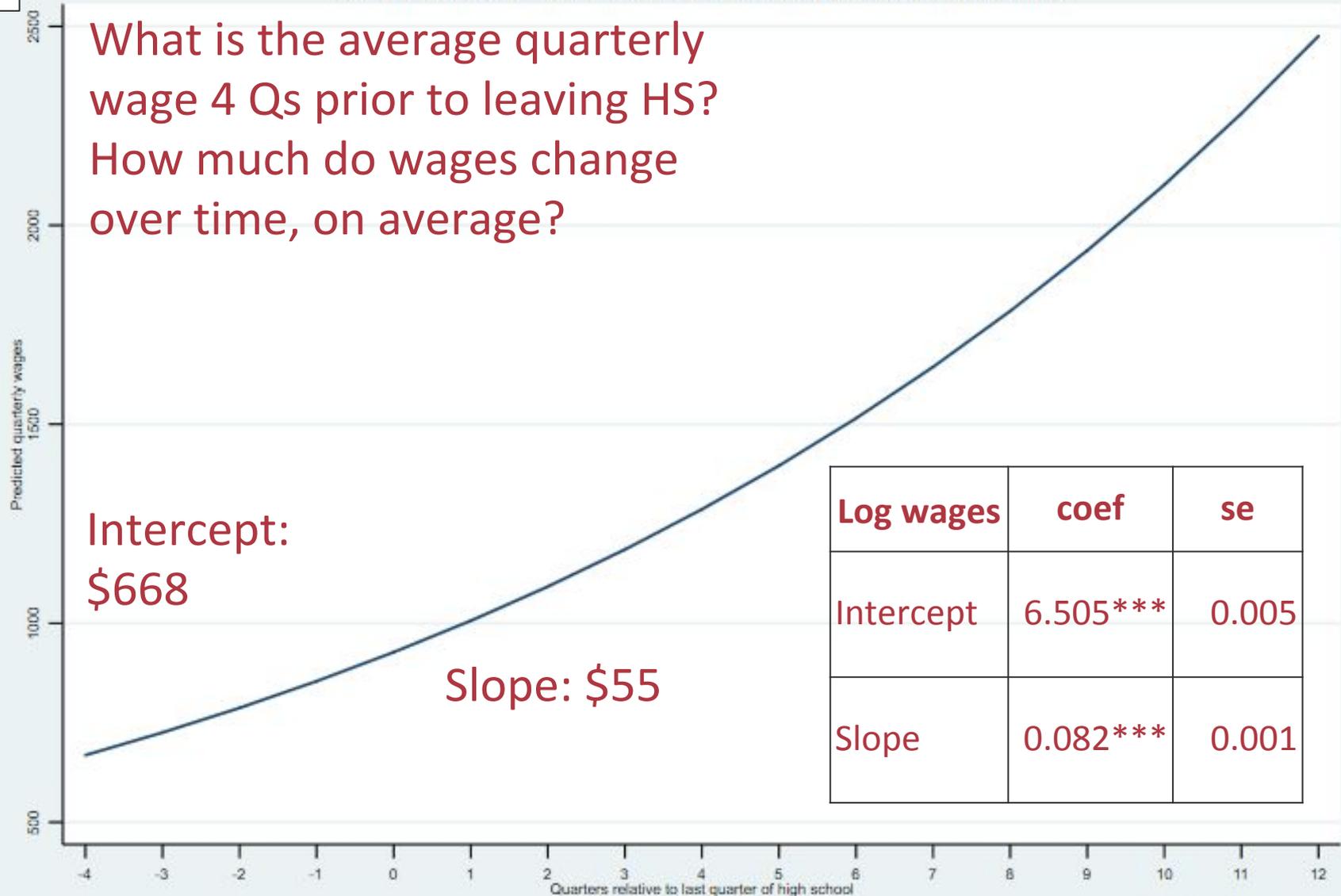
Description of sample

- Poverty study cohort: students in 6th grade in 2007-2008 who did not transfer out of MD public schools
- Repeated measures analysis: members of cohort with at least one quarter of wage data (n=43,607)
- 7 quarters of data on average
- 51% female, 49% male
- 35% Black, 65% not Black
- 52% never FARMS, 29% sometimes FARMS, 19% always FARMS

Living wage $7,913

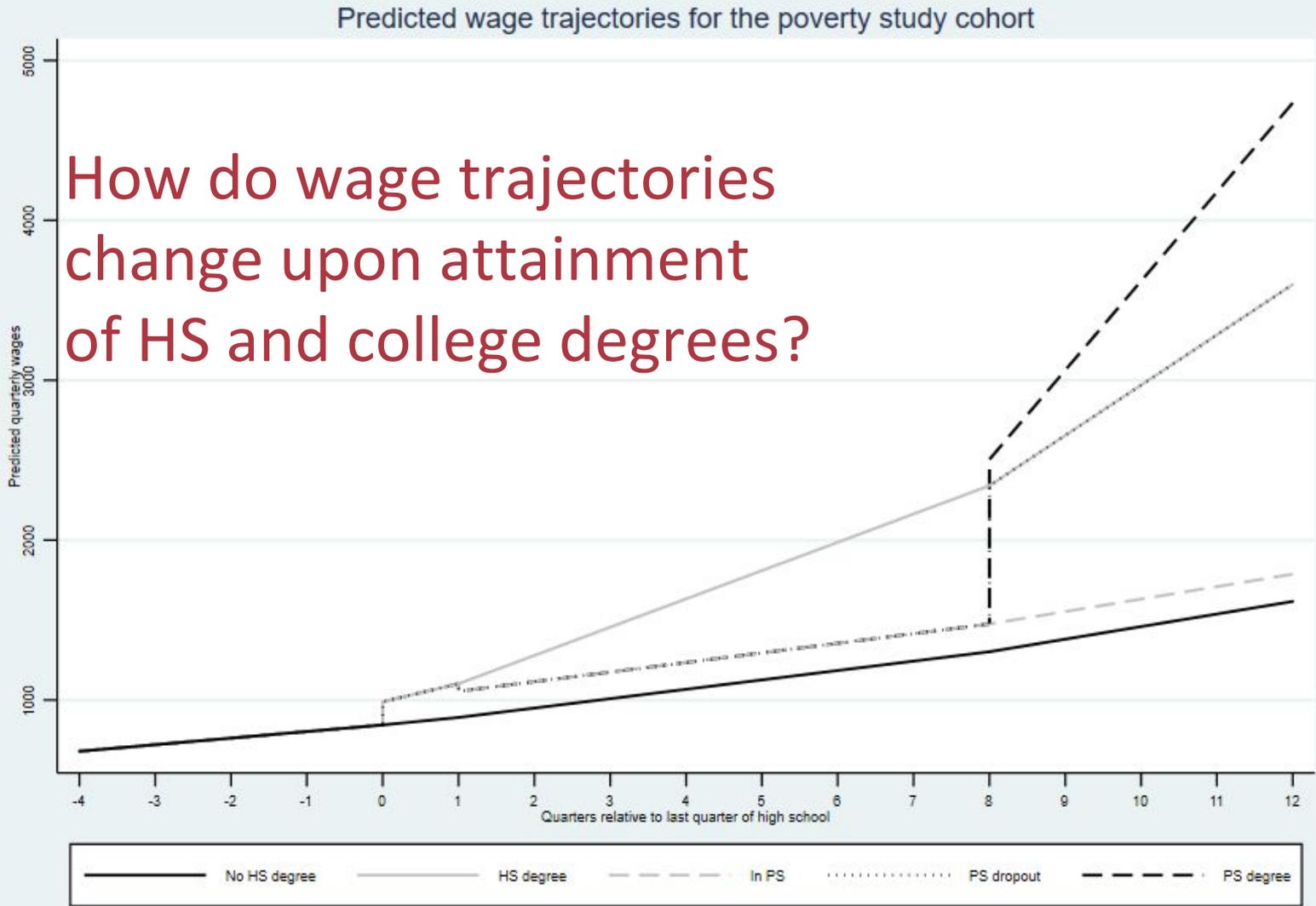Basic predicted wage trajectory for the poverty study cohort

What is the average quarterly wage 4 Qs prior to leaving HS? How much do wages change over time, on average?

Intercept: $668

Slope: $55

Log wages	coef	se
Intercept	6.505***	0.005
Slope	0.082***	0.001

Predicted quarterly wages

Quarters relative to last quarter of high school

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How do wage trajectories change upon attainment of high school and college degrees?

Log wages	coef	se
Intercept	6.522***	0.007
Slope	0.054***	0.002
Immediate change with HS degree	0.159***	0.007
Slope change with HS degree	0.053***	0.002
Immediate change with college enrollment	-0.044***	0.006
Slope change with college enrollment	-0.060***	0.002
Immediate change with college degree	0.068*	0.034
Slope change with college degree	0.052***	0.015

Predicted wage trajectories for the poverty study cohort

How do wage trajectories change upon attainment of HS and college degrees?

Predicted quarterly wages

Quarters relative to last quarter of high school

No HS degree   HS degree   In PS   PS dropout   PS degree

Summary of overall degree effects

- ○ Overall, attainment of a **high school degree** is associated with an **immediate 16% boost** in wages and a **5% increase in wage change over time**
- ○ Enrolling in college is associated with an immediate 4% loss in wages and a 6% decrease in wage change over time
- ○ Attainment of a **college degree** is associated with an additional **immediate 7% boost** in wages and an additional **5% increase in wage change over time**

How do wage trajectories vary by race, gender, and poverty experiences?

- ○ Blacks have **starting wages that are 8% lower** than whites, controlling for gender and poverty, and **3% smaller increases** in wages over time
- ○ Upon attaining a **HS degree**, Blacks have an immediate boost in wages that is **5% larger** than the boost for similar whites, and a **2% larger increase** over time
- ○ The benefit of a college degree is no different for Blacks compared to whites who are similar in terms of gender and poverty experiences

How do wage trajectories vary by race, gender, and poverty experiences?

- ○ Females have starting wages that are about the same as males, controlling for race and poverty, but **1% smaller increases in wages over time**
- ○ Upon attaining a **HS degree**, females have an immediate boost in wages that is **5% smaller** than similar males, and a **1% smaller increase** over time
- ○ The benefit of a college degree is no different for females compared to males who are similar in terms of race and poverty experiences

How do wage trajectories vary by race, gender, and poverty experiences?
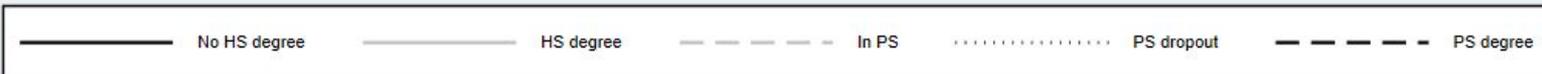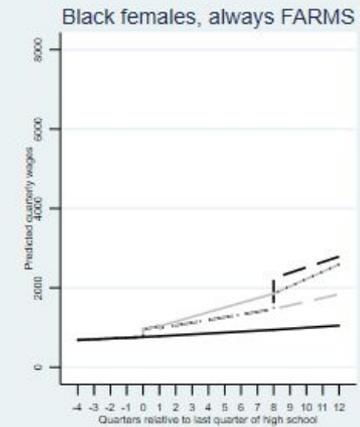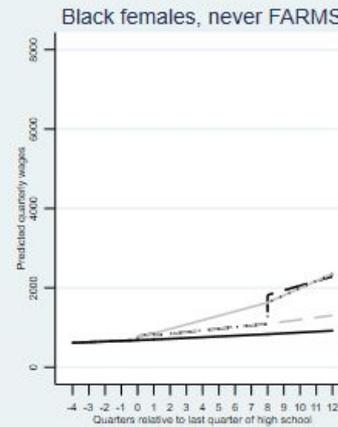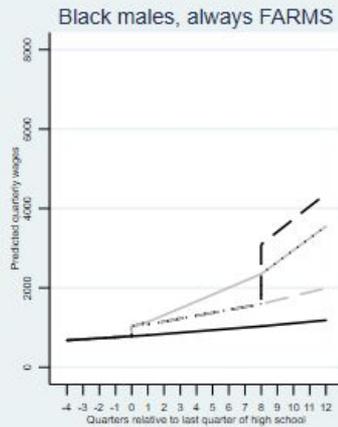
- ○ People who experienced poverty in MS-HS have **starting wages that are 10% higher** than similar students who never experienced poverty, but the same increases in wages over time
- ○ Upon attaining a **HS degree**, students who experienced poverty have an immediate boost in wages that is **about 8% larger** than similar students who were never poor
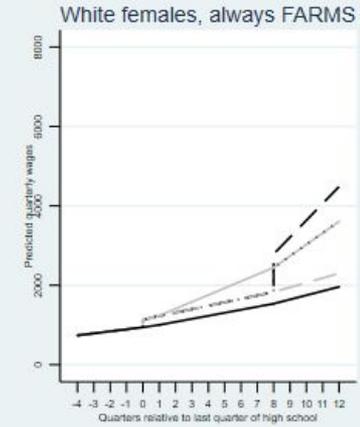- ○ Upon **college degree** attainment, students who were **intermittently** poor have **11% larger increases in wages over time** than similar students who were never poor

Prototypical predicted wage trajectories for the poverty study cohort

Living wage $7,913

Living wage $7,913

White males, never FARMS

White males, always FARMS

White females, never FARMS

White females, always FARMS

Black males, never FARMS

Black males, always FARMS

Black females, never FARMS

Black females, always FARMS

No HS degree   HS degree   In PS   PS dropout   PS degree
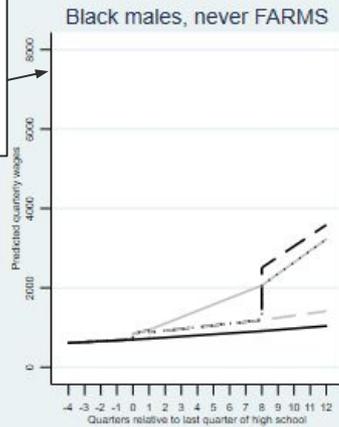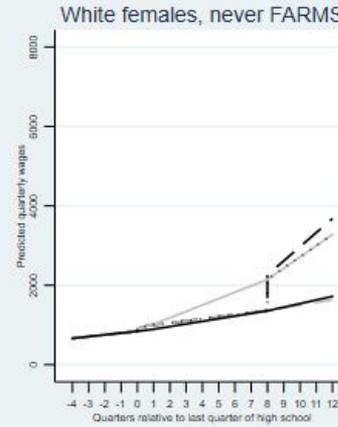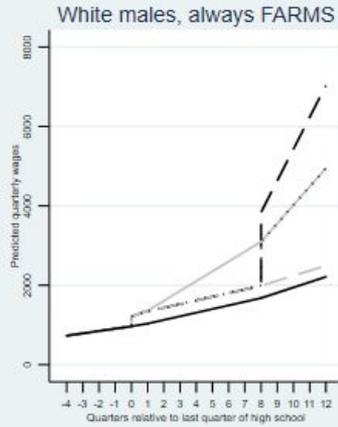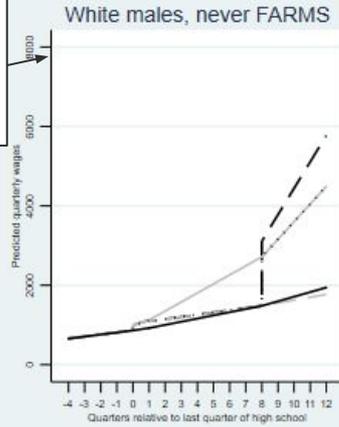
Summary

- ○ Both high school and college degrees are associated with significant immediate boosts to wages and subsequent quarterly increases in wages
- ○ Race, gender, and poverty account for substantial variation in the impact of high school and college degrees on wage patterns over time
- ○ The effects of educational and workforce policies and interventions should be evaluated within this context

Future Research

- ○ Consider additional time-varying and non-time-varying variables
    - ○ USM/CTE HS program completion
    - ○ College enrollment patterns and transfers (2 year/4 year)
    - ○ Industry employed
    - ○ County variation
- ○ What are the roles of schools/colleges?
    - ○ Students attending the same school may have more similar outcomes to one another than to students in other schools
    - ○ Could add school as level 3 (students nested in schools); multiple membership to account for all schools attended
    - ○ Could add school characteristics variables

Pros and Cons

Cons:

- Initial time and effort for setting up data
- Need a theory on how to code time and what is important about time
- Resources needed to run models

Pros:

- Takes advantage of full information about everyone and their characteristics and wages
- More accurately reflects reality

Discussion

What educational and workforce policies could be evaluated against this backdrop of wage patterns over time?

What MLDS data might be relevant to these analyses?

Additional resources

Judith Singer & John Willett, *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence* (2003)
http://gseacademic.harvard.edu/alda/

Stephen Raudenbush & Anthony Bryk, SREE Summer 2016 Hierarchical Linear Models Short Course (Day 3)
https://www.sree.org/video/index.php?item=2016HLMDay3Part1&new=Yes

Extra slides

Variation by gender

Change in parameters for females	coef	se
Change in intercept	0.009	0.013
Change in slope	-0.008*	0.004
Change in immediate change with HS degree	-0.052***	0.013
Change in slope change with HS degree	-0.012**	0.004
Change in imm. change with college enroll.	0.006	0.012
Change in slope change with college enroll.	0.021***	0.003
Change in imm. change with college degree	-0.085	0.070
Change in slope change with college degree	-0.012	0.043

Variation by race

Change in parameters for Blacks	coef	se
Change in intercept	-0.075***	0.015
Change in slope	-0.034***	0.004
Change in immediate change with HS degree	0.047**	0.015
Change in slope change with HS degree	0.021***	0.004
Change in imm. change with college enroll.	-0.040**	0.014
Change in slope change with college enroll.	0.013***	0.004
Change in imm. change with college degree	0.060	0.113
Change in slope change with college degree	-0.051	0.053

Variation by poverty duration

Change in parameters for sometimes FARMS	coef	se
Change in intercept	0.099***	0.016
Change in slope	0.006	0.004
Change in immediate change with HS degree	0.069***	0.016
Change in slope change with HS degree	-0.011*	0.005
Change in imm. change with college enroll.	-0.011	0.015
Change in slope change with college enroll.	0.023***	0.004
Change in imm. change with college degree	-0.120	0.096
Change in slope change with college degree	0.107*	0.053

Variation by poverty duration

Change in parameters for always FARMS	coef	se
Change in intercept	0.105***	0.019
Change in slope	0.002	0.005
Change in immediate change with HS degree	0.088***	0.019
Change in slope change with HS degree	-0.010	0.006
Change in imm. change with college enroll.	0.015	0.018
Change in slope change with college enroll.	0.021***	0.005
Change in imm. change with college degree	0.079	0.139
Change in slope change with college degree	0.006	0.061