

# 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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July 25, 2019

[mldscenter.maryland.gov](http://mldscenter.maryland.gov)

# Acknowledgement

The authors are grateful for the data, technical, and research support provided by the Maryland Longitudinal Data System (MLDS) Center and its agency partners. The views and opinions expressed are those of the authors and do not necessarily represent the views of the MLDS Center or its agency partners.

# Overview

- Many research and policy questions are essentially questions about variation and change
- We can understand variation and change using multilevel growth models
- Applied example using growth models to understand wage data from the Maryland Longitudinal Data System (MLDS)
- Discussion

Many research and policy questions are essentially questions about variation and change

# Examples from the MLDS Research

## Agenda

- What are the workforce outcomes for 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 college degrees?***

- Other examples: impact of new policy or intervention

We can understand variation  
and change using multilevel  
growth models

# Modeling variation and change

- Multilevel approach: Repeated measures nested within individuals
- Outcome = intercept + slope(time) (*Recall  $Y = mX + B$* )
  - Intercept: Average starting point
  - Slope: Average rate of change over time
- How does that trajectory change based on:
  - Events such as degree attainment
  - Demographic characteristics such as race and gender

# Applied example: Using growth models to understand wage data from the MLDS



# Research questions

1. What is the average quarterly wage in the first quarter after attainment of high school diploma? How much do wages change over time, on average?
2. How do wage trajectories vary by county and industry sector?
3. How do wage trajectories change upon enrollment in college and attainment of college degrees?
4. How do wage trajectories and college enrollment and degree effects vary by race, gender, and past poverty experiences?

# The MD Longitudinal Data System

- Links individuals' PK-12, postsecondary, and wage data
- All individuals with an education record (public PK-12 and/or postsecondary) in Maryland
- Starting in 2007-2008 school year
- Wage data come from data files submitted to the state by all employers subject to Unemployment Insurance (excludes federal government, military, independent contractors)
- College data come from MD colleges and National Student Clearinghouse

# Description of sample

- Students in 6th grade in 2007-2008 who did not transfer out of MD public schools
  - With at least one quarter of wage data
  - Never enrolled in college *or* only attended one type of college in MD (n=33,460)
- 12 quarters of wage data on average
- Total 384,806 observations
- 51% female, 49% male
- 35% Black, 65% not Black
- Poverty (FARMS eligibility grades 6-12)
  - 52% never FARMS, 48% ever FARMS

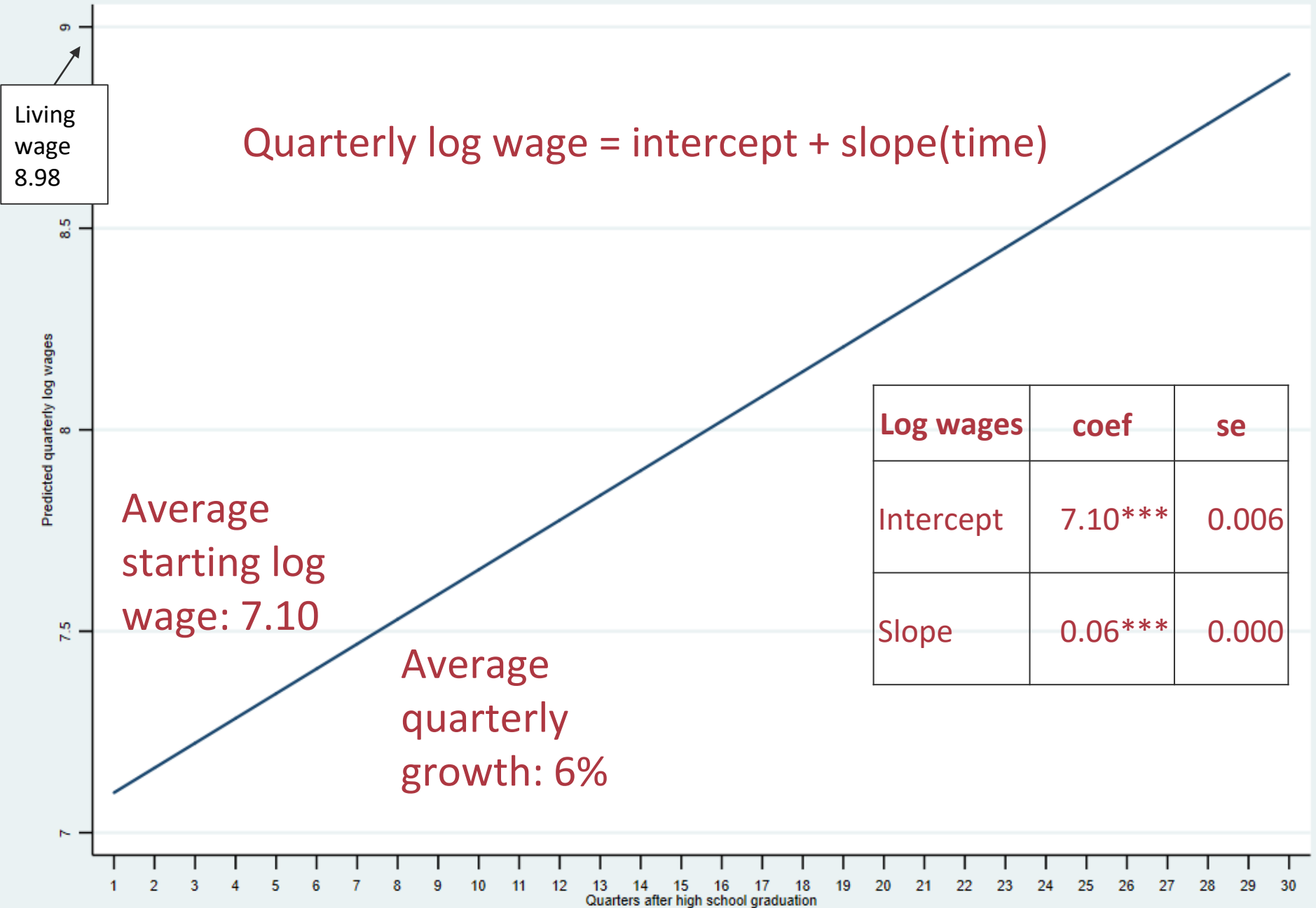
# Using growth models with MLDS

- Quarterly wage data post-HS graduation
  - Quarterly log wages = intercept + slope(time)
  - Formally:  $Y_{ti} = \pi_{0i} + \pi_{1i} \text{time}_{ti} + e_{ti}$   
 $\pi_{0i} = \beta_{00} + u_{0i} \quad \pi_{1i} = \beta_{10} + u_{1i}$
- Multilevel approach allows for partitioning of variance
  - Within individual (between occasions) vs. between individuals
  - 46% of variance in wages is due to variation within individuals over time (ICC = 0.46)
  - 54% of variance in wages is due to variation between individuals

# Research questions

1. What is the average quarterly wage in the first quarter after attainment of high school diploma? How much do wages change over time, on average?

# Unconditional predicted log wage trajectory for the poverty study cohort



# Unconditional predicted wage trajectory for the poverty study cohort



# Research questions

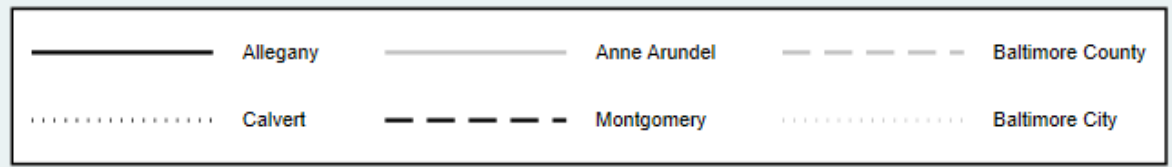
2. How do wage trajectories vary by county and industry sector?



Predicted log wage trajectories for the poverty study cohort by (selected) local school system

Living wage 8.98

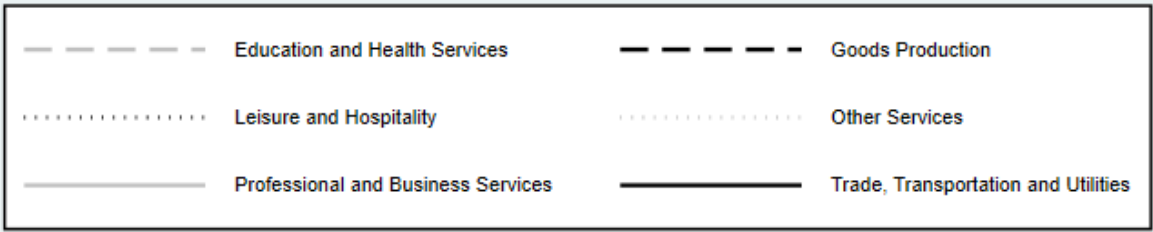
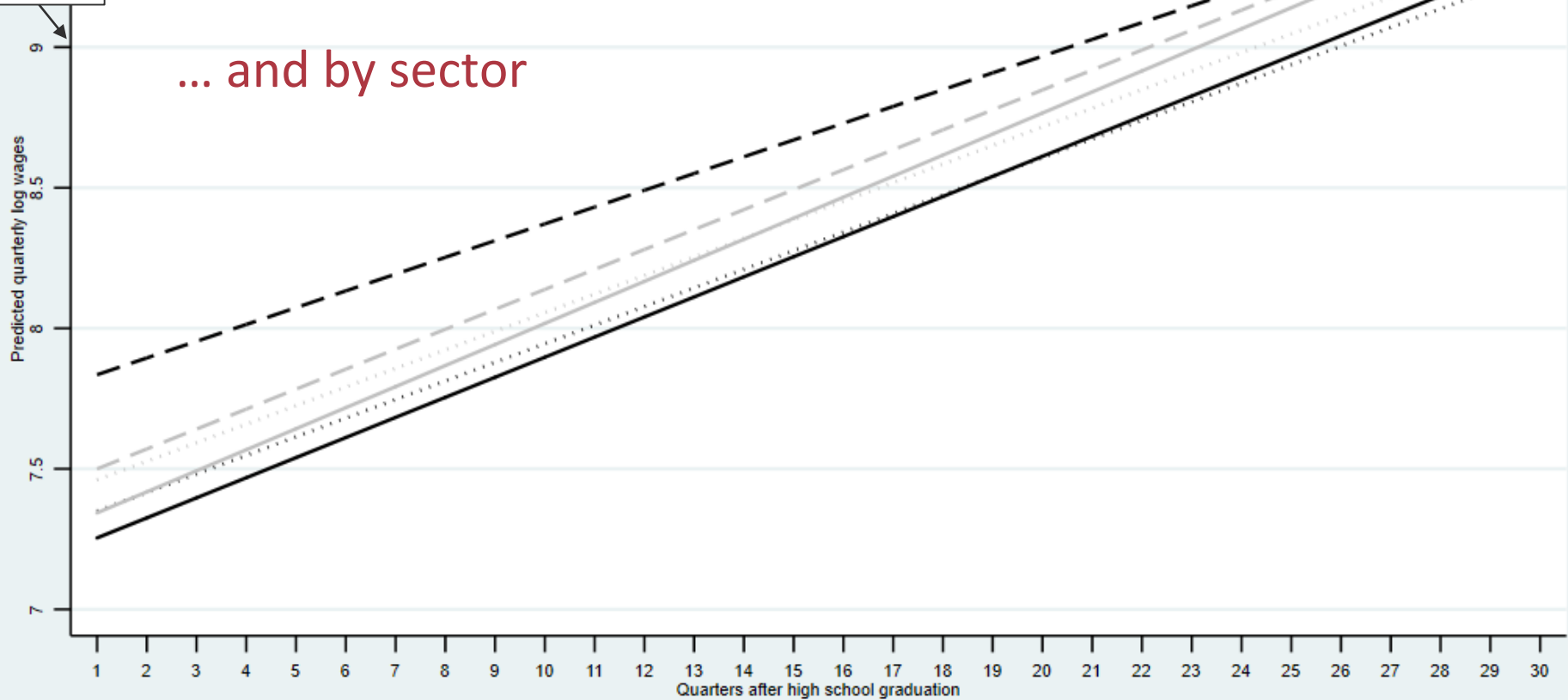
Starting wages and growth vary by county...



# Predicted log wage trajectories for the poverty study cohort by employment sector (6 most common)

Living wage 8.98

... and by sector



# Research questions

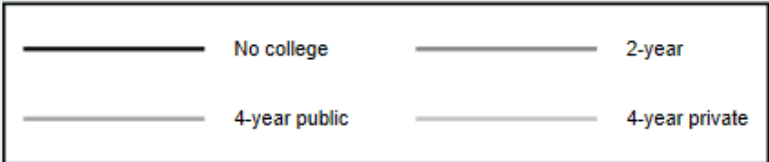
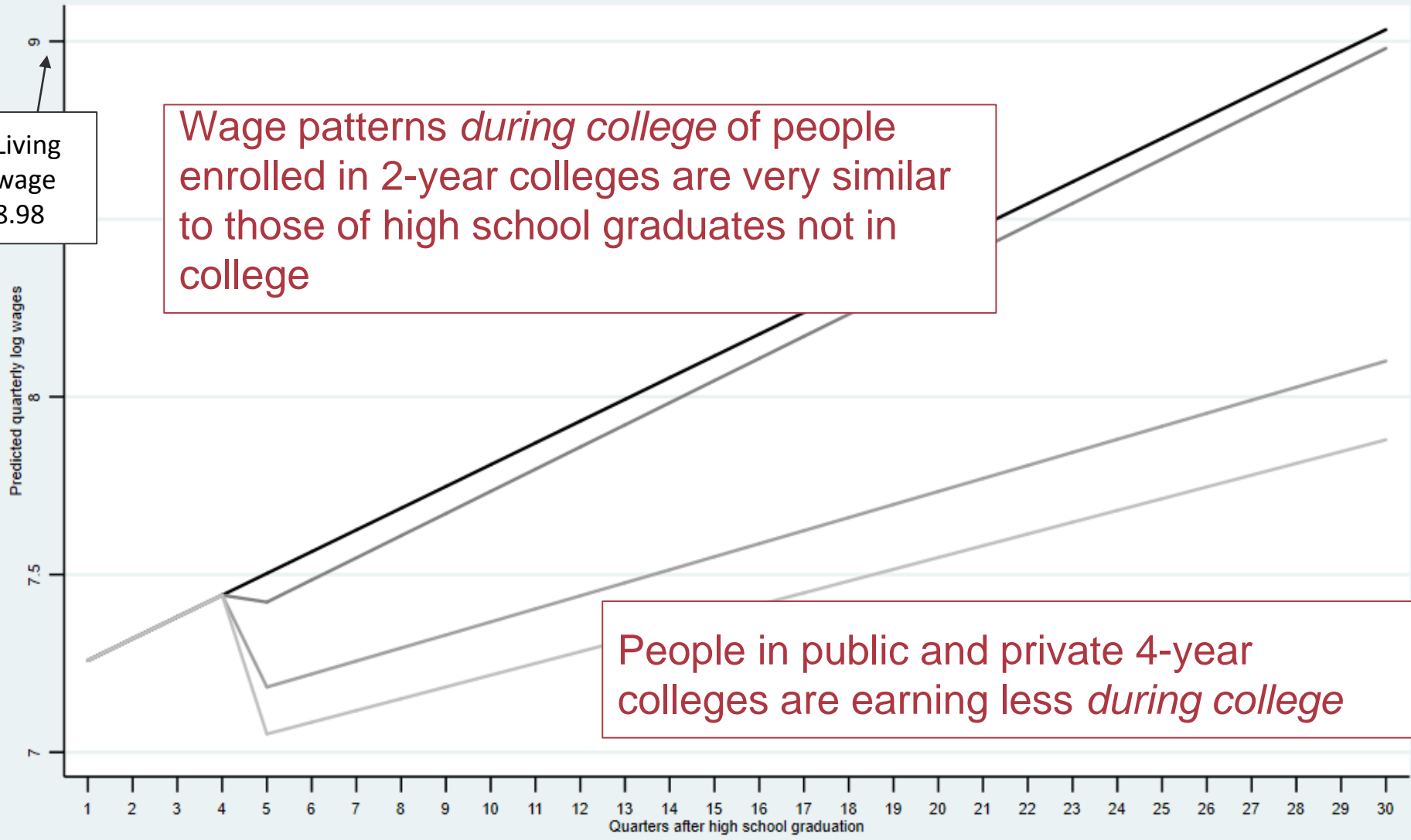
3. How do wage trajectories change upon enrollment in college and attainment of college degrees?

Predicted log wage trajectories for the poverty study cohort while enrolled in college, by college type

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Wage patterns *during college* of people enrolled in 2-year colleges are very similar to those of high school graduates not in college

People in public and private 4-year colleges are earning less *during college*



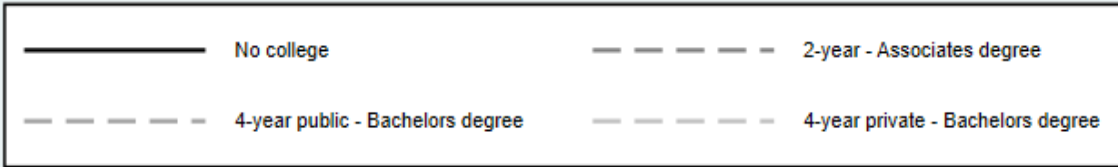
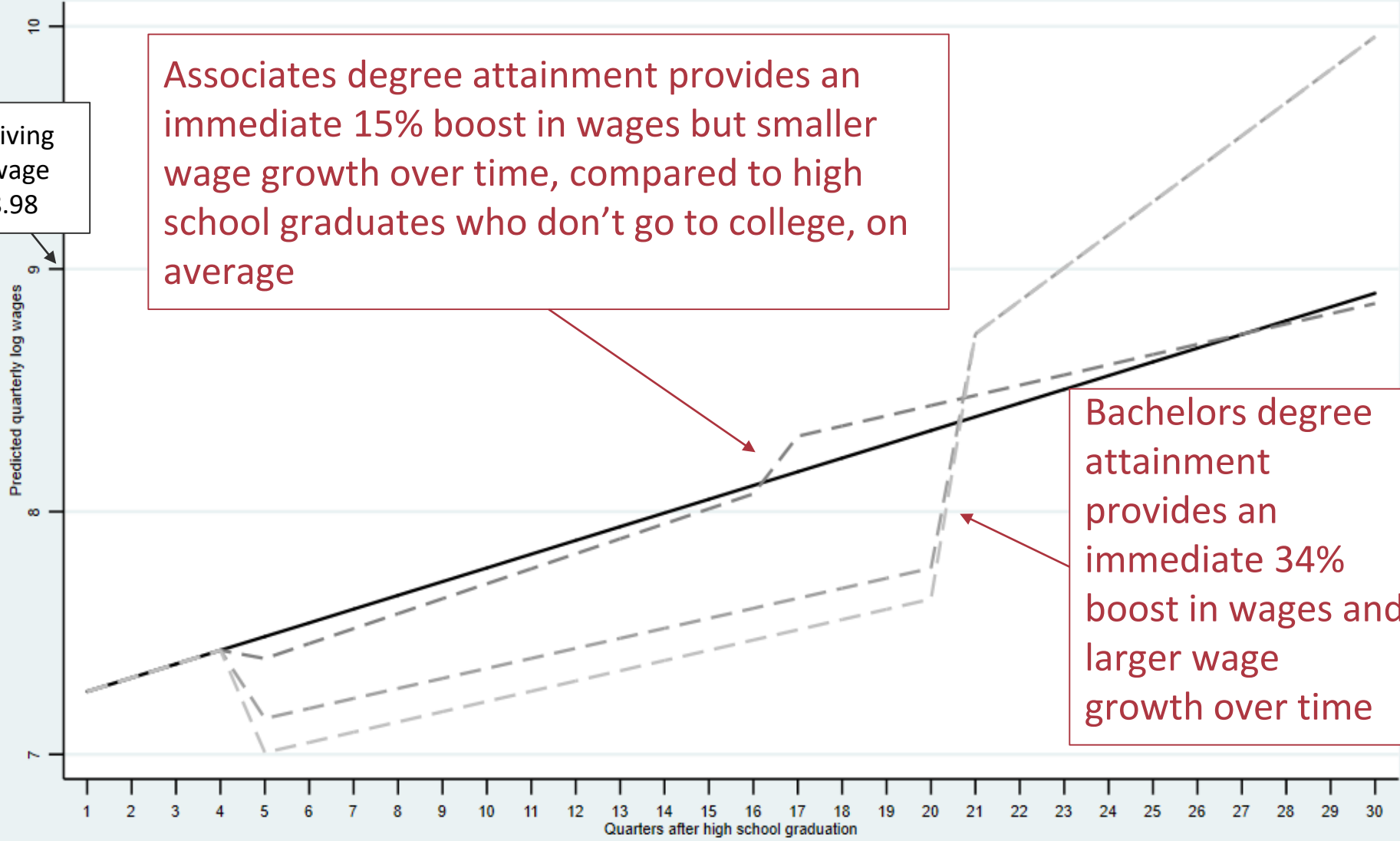
Predicted log wage trajectories for the poverty study cohort during and after college, by college type

Living wage 8.98

Predicted quarterly log wages

Associates degree attainment provides an immediate 15% boost in wages but smaller wage growth over time, compared to high school graduates who don't go to college, on average

Bachelors degree attainment provides an immediate 34% boost in wages and larger wage growth over time



# Research questions

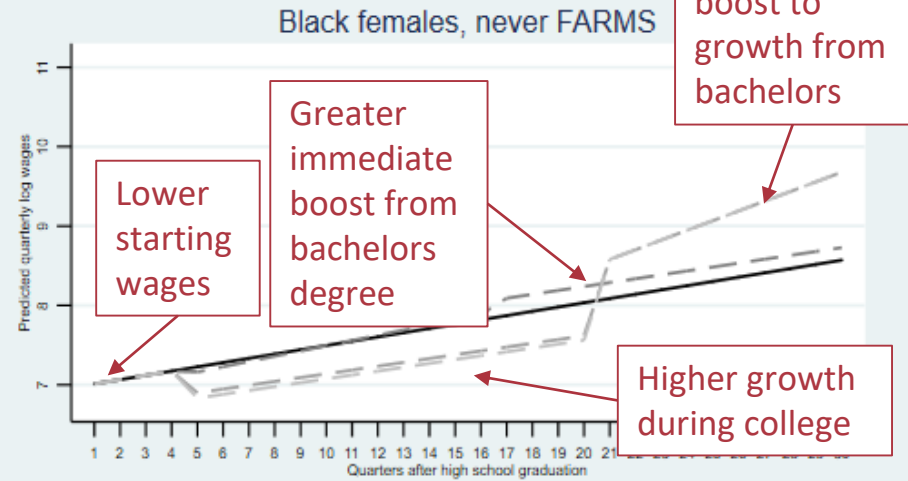
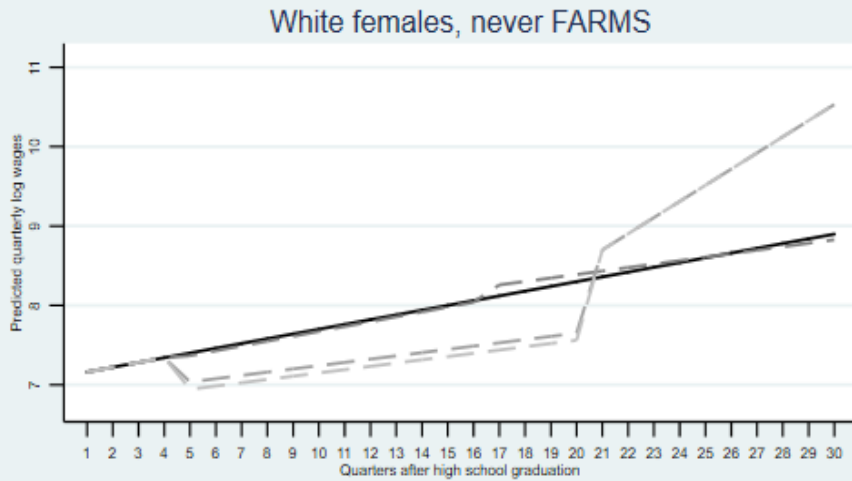
4. How do wage trajectories and college enrollment and degree effects vary by race, gender, and past poverty experiences?

# Race, gender, and poverty

	Enrollment in college				College degree	
	Post-HS	2-yr	4-yr priv	4-yr pub	Assoc	Bach
<b>Black</b>						
Intercepts	<b>-0.150***</b>	<b>-0.030*</b>	0.063	0.037	0.081	<b>0.152***</b>
Slopes	<b>-0.006***</b>	<b>0.011***</b>	<b>0.014*</b>	<b>0.013***</b>	0.011	<b>-0.075**</b>
<b>Female</b>						
Intercepts	<b>-0.131***</b>	<b>0.089***</b>	<b>0.122*</b>	<b>0.061***</b>	0.029	<b>0.125***</b>
Slopes	<b>-0.002*</b>	0.001	-0.003	0.003	-0.004	<b>0.060**</b>
<b>Ever FARMS</b>						
Intercepts	<b>0.139***</b>	-0.011	0.037	<b>0.109***</b>	-0.002	-0.076
Slopes	<b>-0.004**</b>	0.002	-0.003	0.001	-0.006	-0.045

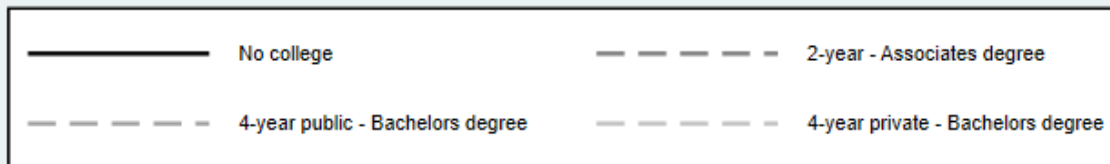
\*  $p < .05$  \*\*  $p < .01$  \*\*\*  $p < .001$  Model includes county and sector.

# Prototypical predicted log wage trajectories for the poverty study cohort females



For Blacks compared to whites of the same gender and poverty:

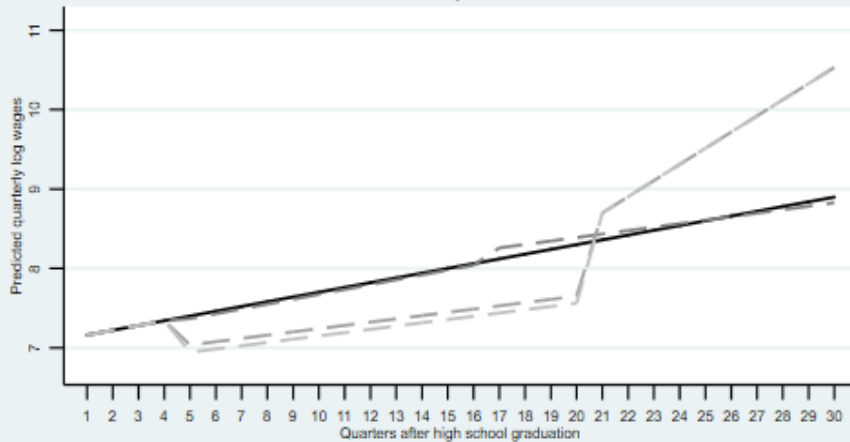
- Starting wages are 15% lower and overall quarterly growth is slightly smaller.
- Growth rates during college are slightly higher.
- A bachelors degree provides a 15% greater boost but an 8% flatter subsequent growth rate.



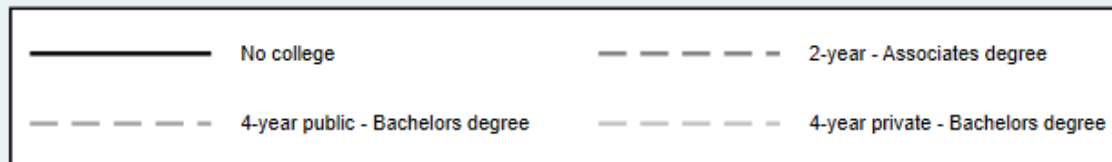
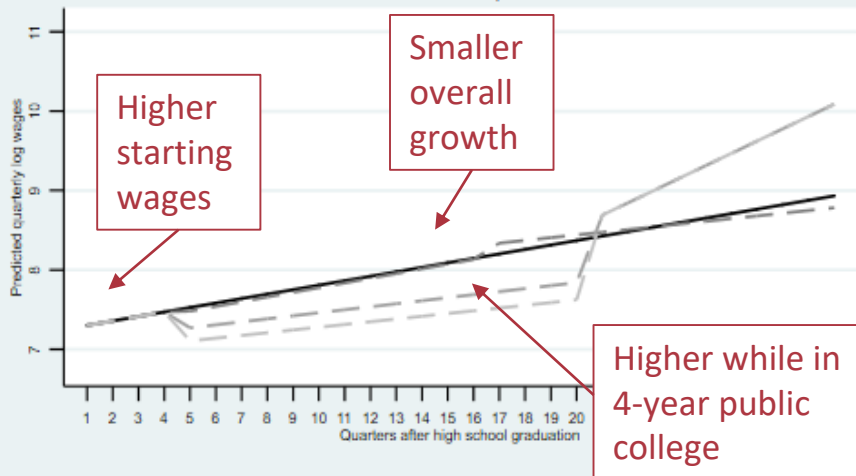


# Prototypical predicted log wage trajectories for the poverty study cohort females

White females, never FARMS



White females, FARMS



For people who experienced poverty:

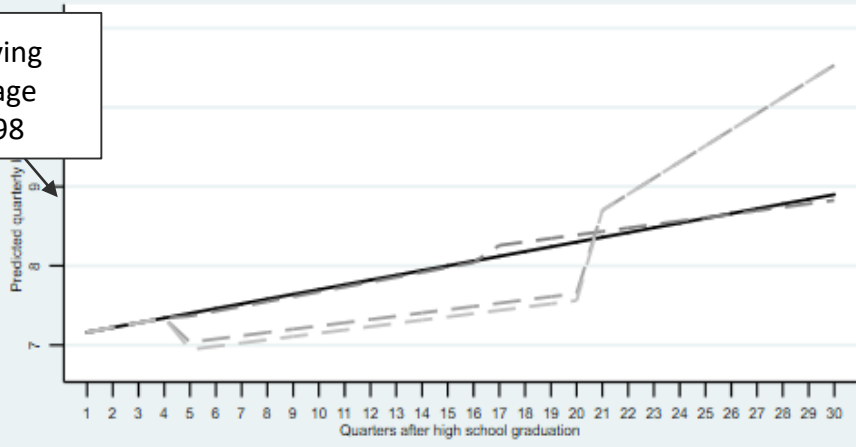
- Starting wages are 14% higher and overall quarterly growth is slightly smaller.
- Earnings while enrolled in 4-year public college are 11% higher.
- No difference in impact of associates or bachelors degrees.

# Prototypical predicted log wage trajectories for the poverty study cohort females

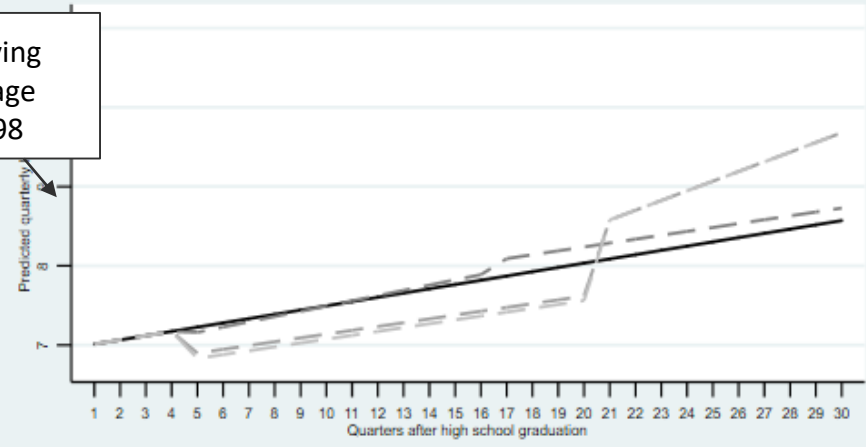
White females, never FARMS

Black females, never FARMS

Living wage 8.98



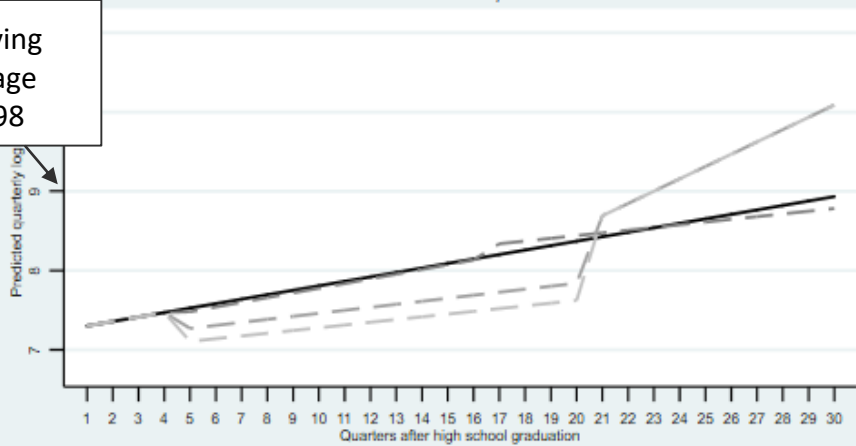
Living wage 8.98



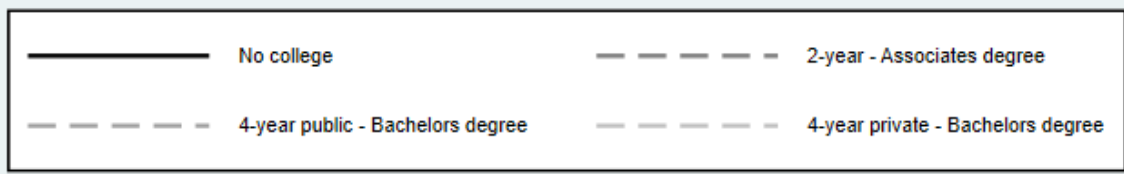
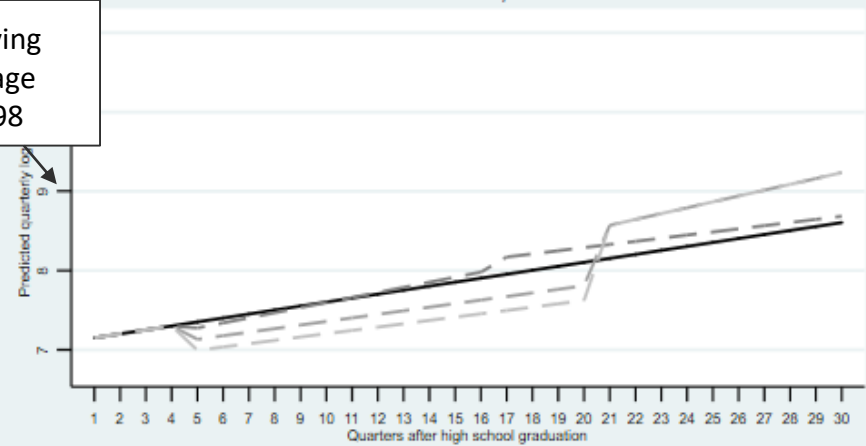
Living wage 8.98

White females, FARMS

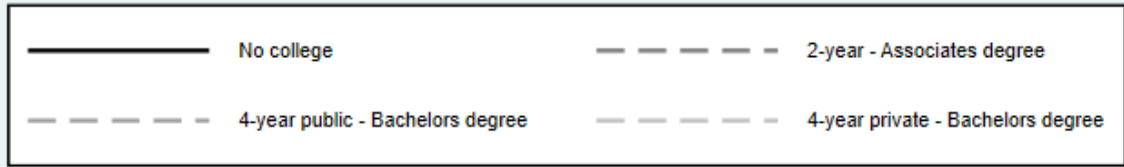
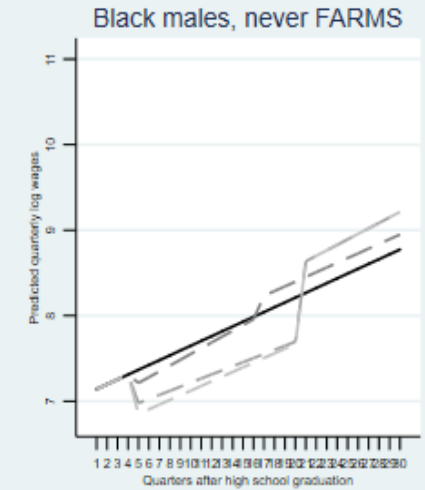
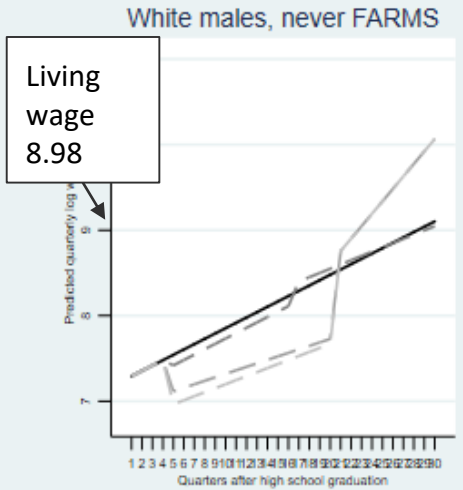
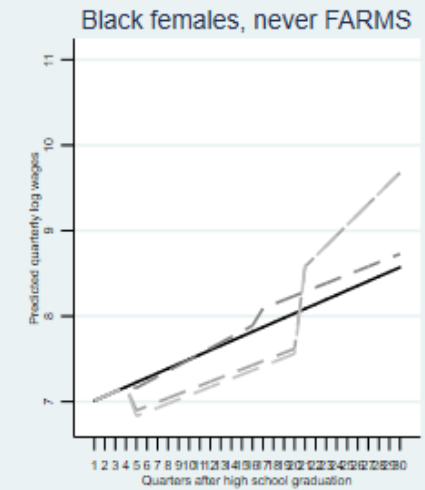
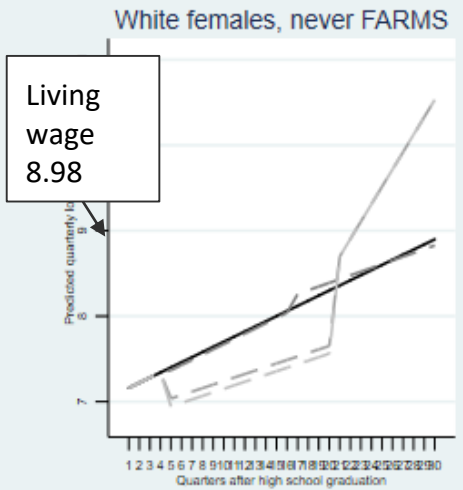
Black females, FARMS



Living wage 8.98



# Prototypical predicted log wage trajectories for the poverty study cohort



Overall, men have higher starting wages and slightly larger growth over time compared to similar women, but earn less while in college, and benefit less from a bachelors degree.

# Prototypical predicted log wage trajectories for the poverty study cohort

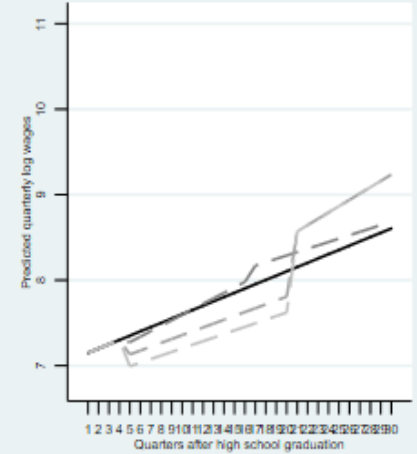
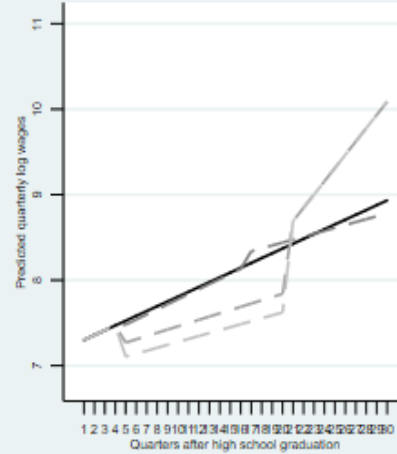
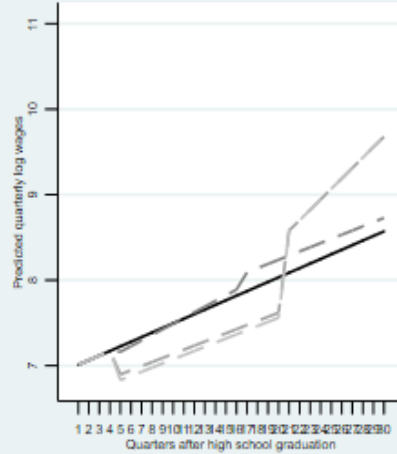
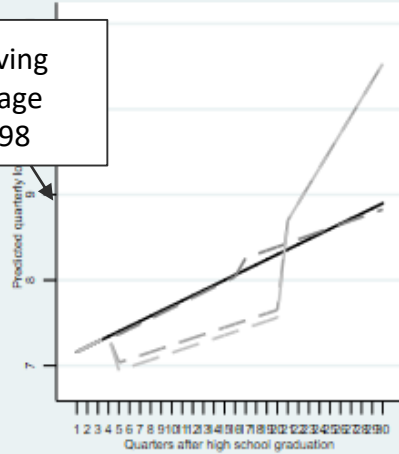
White females, never FARMS

Black females, never FARMS

White females, FARMS

Black females, FARMS

Living wage 8.98



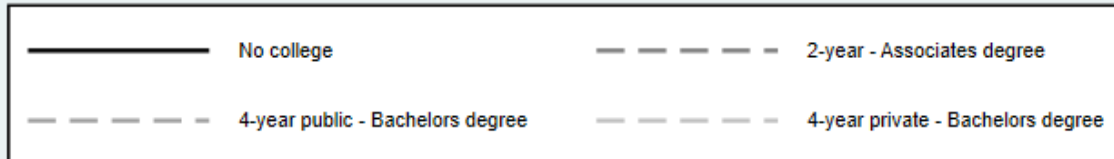
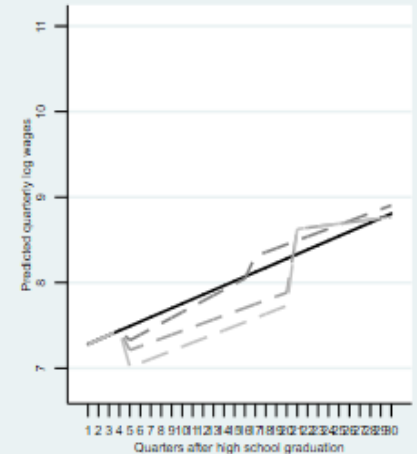
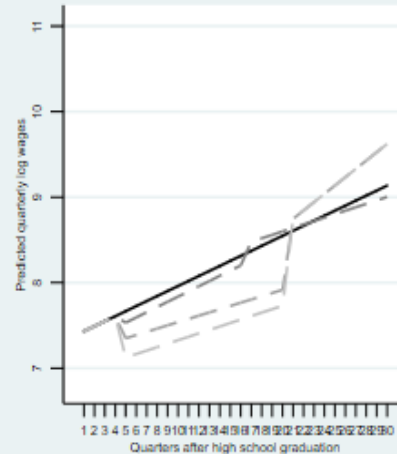
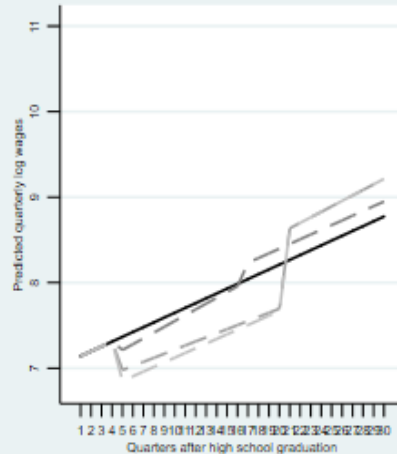
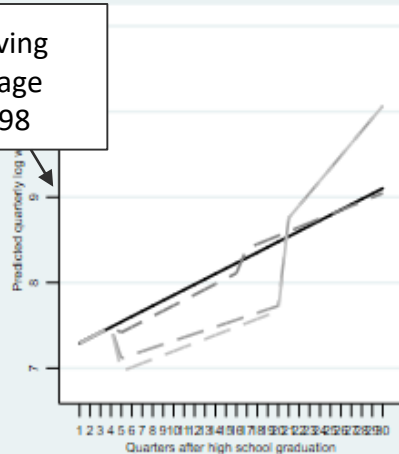
White males, never FARMS

Black males, never FARMS

White males, FARMS

Black males, FARMS

Living wage 8.98



# Prototypical predicted wage trajectories for the poverty study cohort

Living wage \$7,913

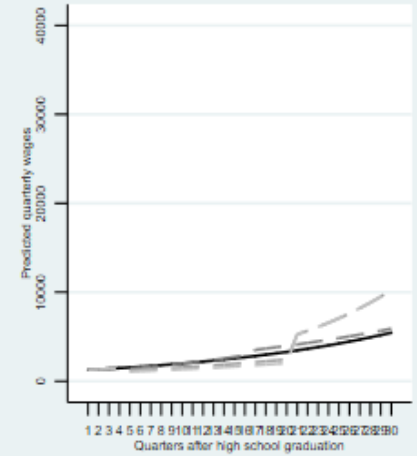
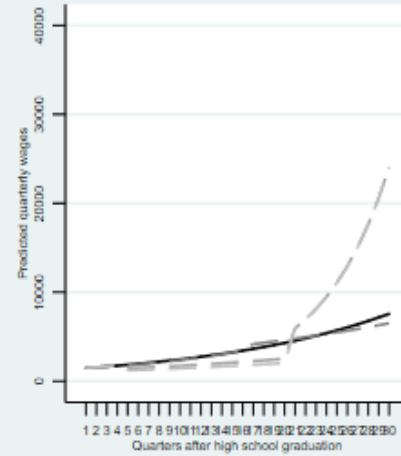
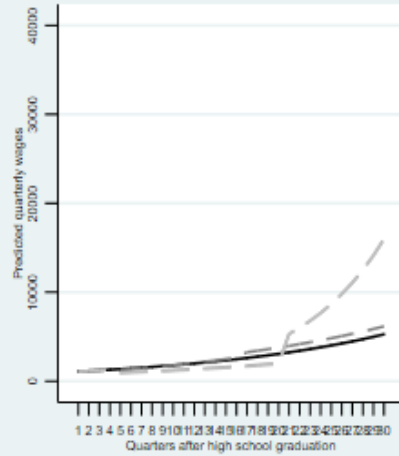
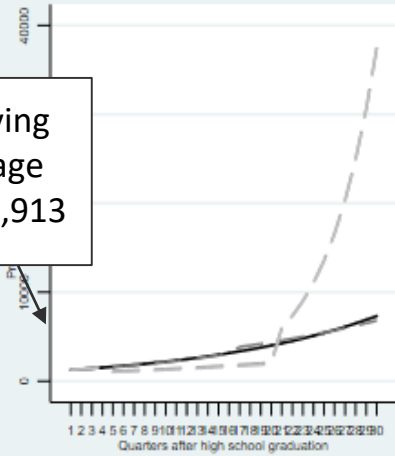
Living wage \$7,913

White females, never FARMS

Black females, never FARMS

White females, FARMS

Black females, FARMS

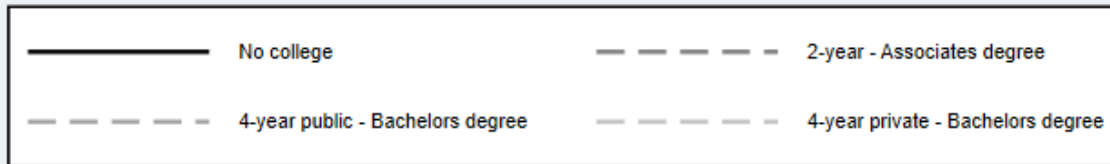
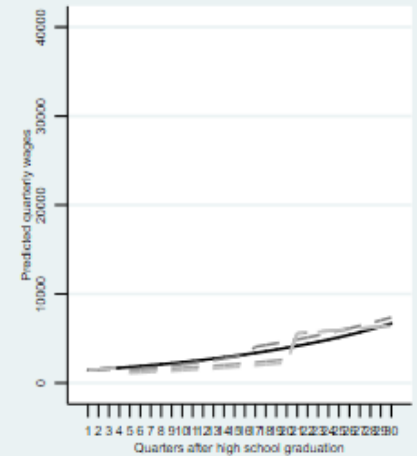
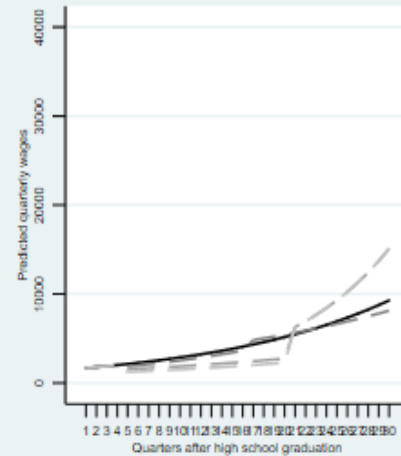
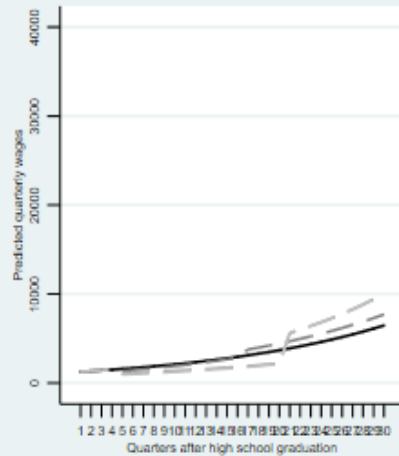
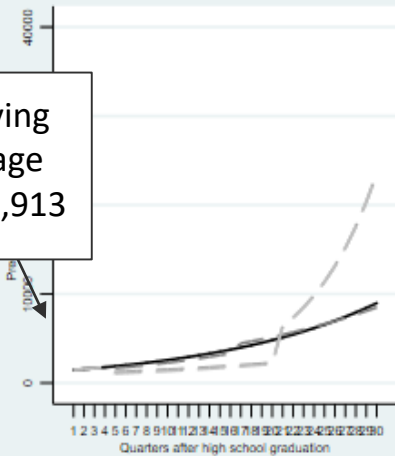


White males, never FARMS

Black males, never FARMS

White males, FARMS

Black males, FARMS



# Summary

- Bachelors degrees are associated with significant immediate boosts to wages and higher quarterly growth over time
- Associates degrees are associated with immediate boosts to wages but smaller subsequent growth compared to high school graduates who never enroll in college
- Race, gender, and poverty account for substantial variation in wage patterns and the impact of college degrees

## Discussion

- Multilevel growth modeling has several unique advantages:
  - Takes advantage of full information about everyone and their characteristics and wages
  - More accurately reflects reality
- However, it requires:
  - Theory on how to code time, what is important about time, how outcome might change over time
  - Initial time and effort for setting up data
  - Computing resources needed to run models

Poverty study reports:  
[mldscenter.maryland.gov/  
ResearchReports.html](https://mldscenter.maryland.gov/ResearchReports.html)

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April  
2019

## Student and School Concentrated Poverty in Maryland: What are the Long- term High School, College, and Career Outcomes?

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