How college credit in high school shifts college course-taking

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APPAM 2017

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College preparation matters

- Students spend a dozen years developing skills for college and labor force

- How can this time be used most efficiently?

- Efforts to expose high school students to advanced coursework can improve postsecondary and labor market outcomes
  - Early College High School increased college attendance and early degree completion (Berger, Turk-Bicakci, Garet, Knudson, Hoshen, 2014; Edmunds, Unlu, Glennie, Bernstein, Fesler, Fury, & Arshavsky, 2017)

  - Increasing math standards improves occupational outcomes for minority students (Goodman, 2017)

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Research Question

- Primary question: How does receiving college credit in high school shift the depth or breadth of their curricular choices?

- Context: Advanced Placement (AP) courses
  - 2.6M students and 4.7M exams taken in 2016
  - Previous research shows that AP causally decreases time-to-degree and shifts choice of college major (Smith, Hurwitz, & Avery, 2017; Avery, Gurantz, Hurwitz, & Smith, 2017)

- Our claim: Earning STEM credit increases depth of STEM study
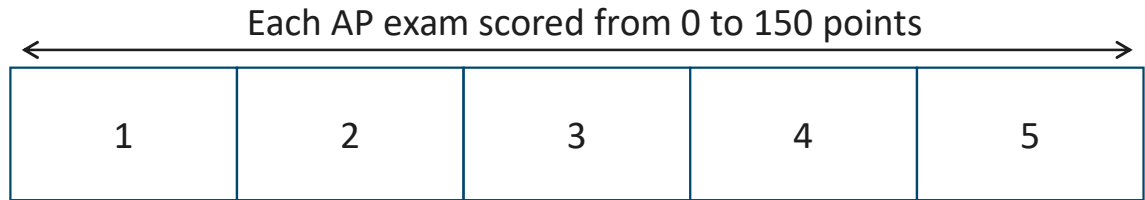 - Non-STEM unclear

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Context and Data

- Link AP exam takers in Florida to public postsecondary transcripts
  - Use 2004, 2005, and 2006 graduating high school cohorts
  - Transcripts end in 2010
    - Can follow each cohort four years

- Focus on ten most popular AP exams
  - STEM: Bio, Chem, Physics, Calc, Stat
  - Non-STEM: Eng Lang & Lit, US Govt & Hist, Psychology

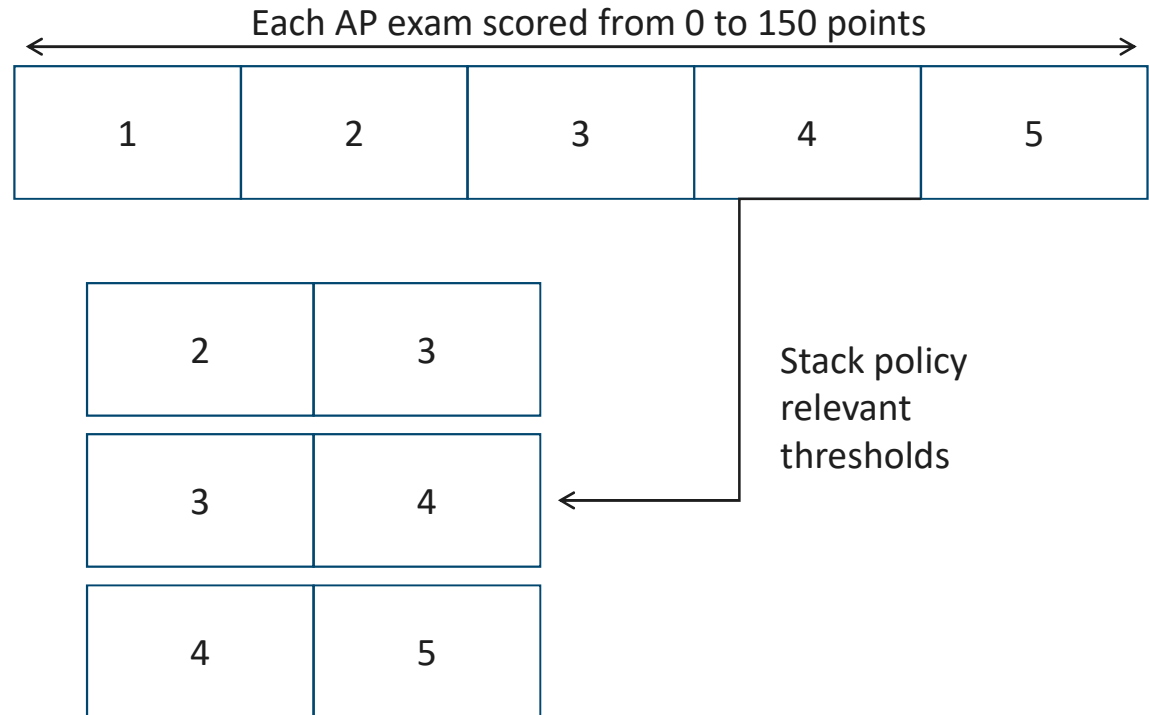- As expected, sample is more likely to be high-performing (SAT) and higher SES

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Methodology

Each AP exam scored from 0 to 150 points

1	2	3	4	5

- Regression discontinuity design
  - Continuous score that maps into 1 to 5 integer scores

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- Focus on college credit
  - Stack multiple thresholds
  - Use short bandwidths to avoid overlap

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1	2	3	4	5

Stack policy relevant thresholds

2	3

3	4

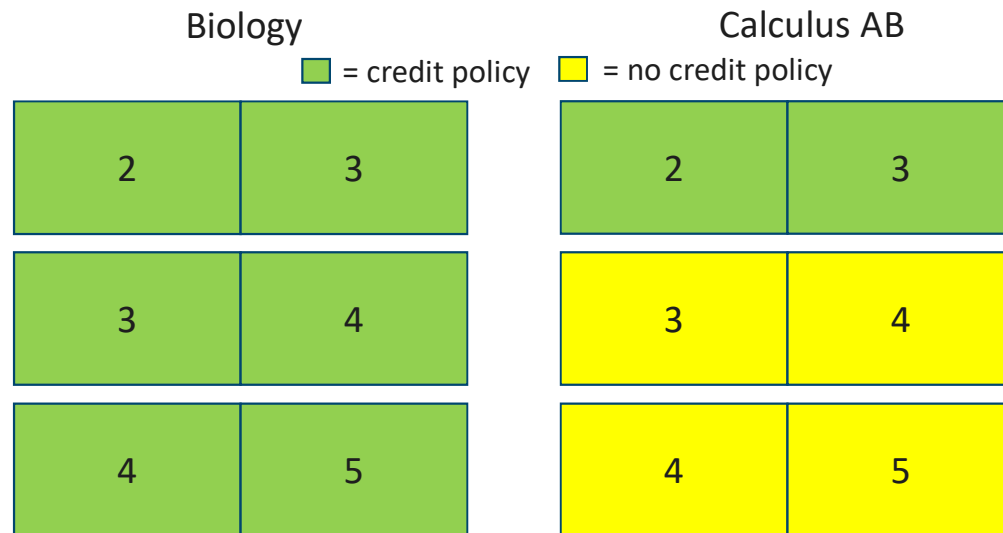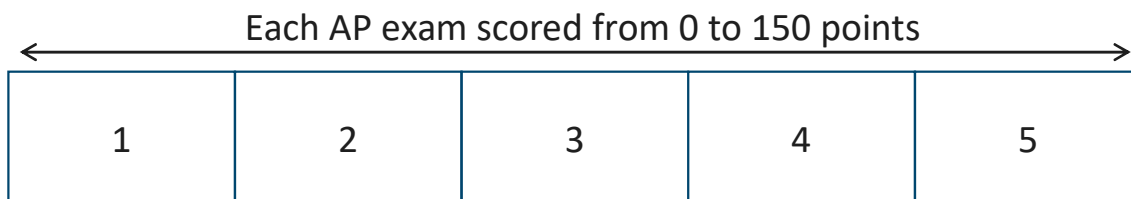| 4	5

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Methodology

- Regression discontinuity design
  - Continuous score that maps into 1 to 5 integer scores

- Focus on college credit
  - Stack multiple thresholds
  - Use short bandwidths to avoid overlap (6 points)
  - Identify credit policies from Florida campuses
  - Use thresholds with no credit offerings as "falsification" tests

Each AP exam scored from 0 to 150 points

| 1 | 2 | 3 | 4 | 5 |

Biology | Calculus AB

■ = credit policy   ☐ = no credit policy

Biology:
2	3
3	4
4	5

Calculus AB:
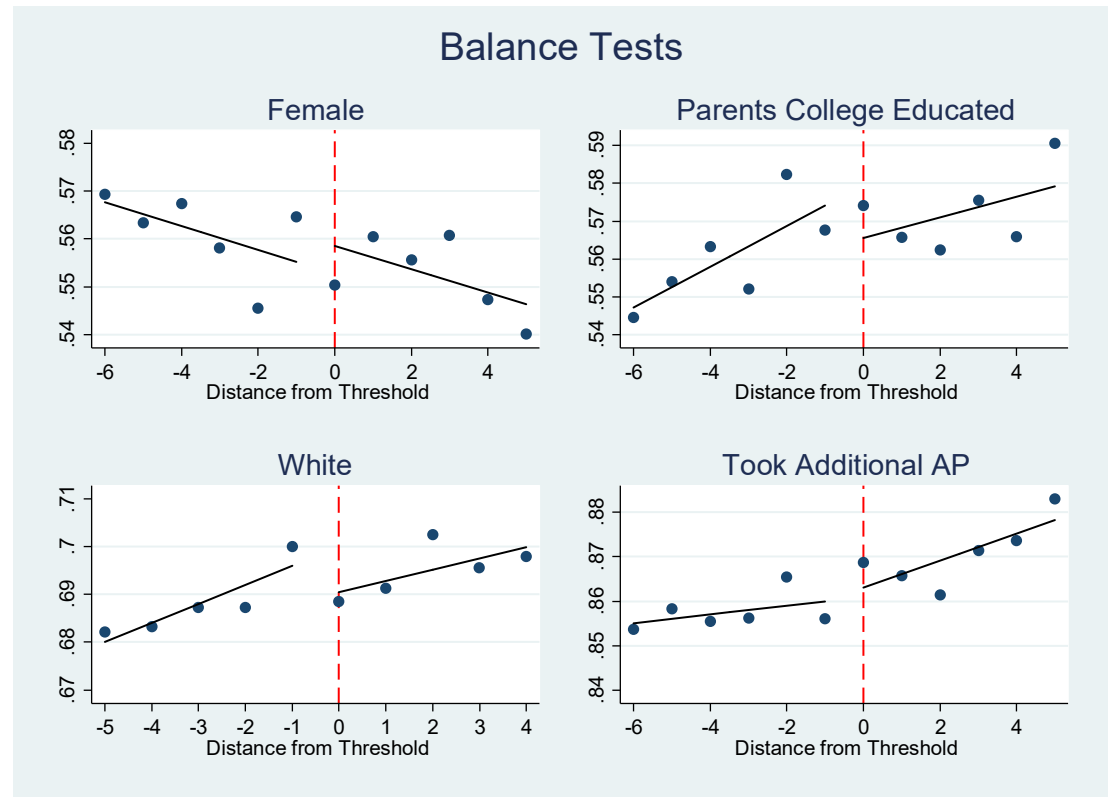| 2 | 3 |
| 3 | 4 |
| 4 | 5 |

$$Y_{iet} = \beta_0 + \beta_1 * Credit_{iet} + dist_{iet} + \theta_{et} + X_i + \varepsilon_{eit}$$

Includes exam-by-year FE and s.e. clustered by student
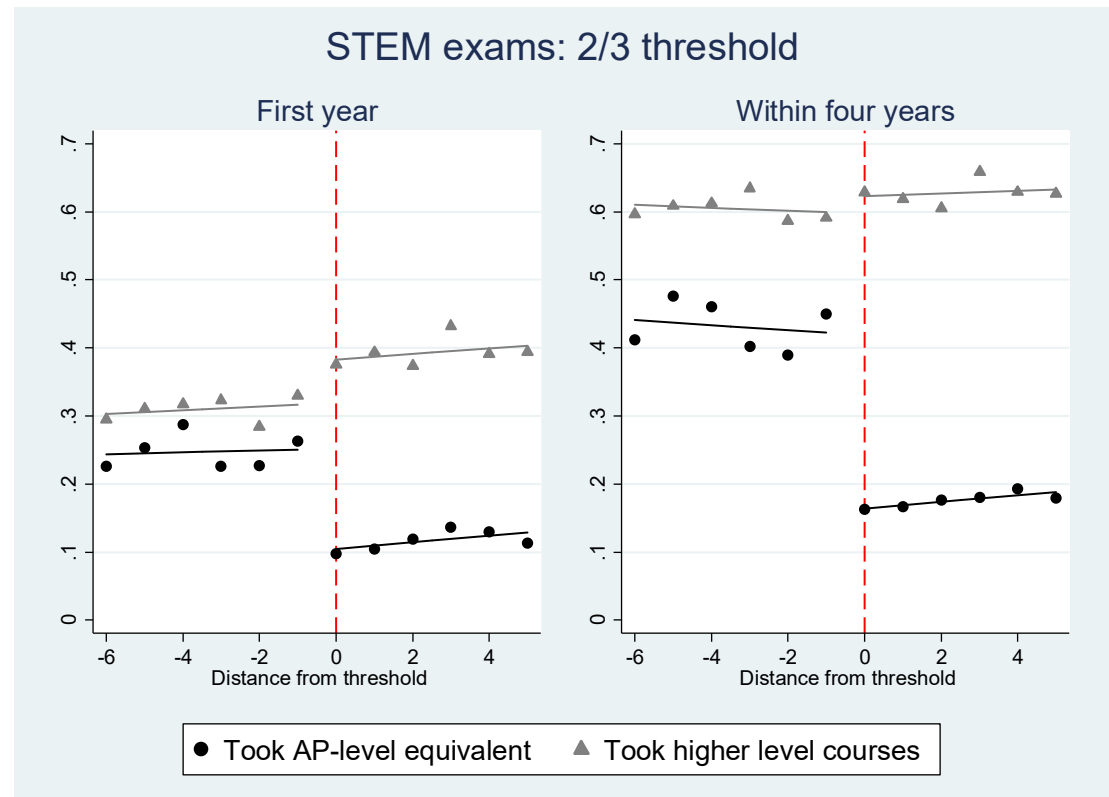
Validity checks

- Students unable to sort around thresholds and scores pre-determined

- Regressions test balance on:
  - Sector of attendance
  - Covariates

- No difference in four-year persistence

Balance Tests

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STEM Findings

- Being offered college-credit decreases likelihood of taking the requisite course by ~ 25pp
  - Additional beneficial impacts on math remediation or "combined, two-semester" introductory courses

  - Above the threshold, Math students more likely to repeat than Physical Sciences

STEM exams: 2/3 threshold

First year — Within four years

Distance from threshold

● Took AP-level equivalent ▲ Took higher level courses

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STEM Findings

- Large first-year impacts on:
  - Taking higher-level courses in AP exam subject
  - Additional STEM units outside of subject

- Results large but less precise after four years

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Impacts of crossing AP threshold on course-credit offering, STEM exams

	1 year	4 years
Total courses	0.077	-0.211
	(0.105)	(0.399)
Total courses in AP subject above AP exam	0.095**	0.141+
	(0.034)	(0.078)
Took zero courses (%)	-0.067**	-0.036+
	(0.019)	(0.019)
Took one course (%)	0.047**	0.017
	(0.016)	(0.015)
Took two or more courses (%)	0.020	0.019
	(0.013)	(0.020)
STEM courses	0.234**	0.244
	(0.084)	(0.289)
Non-STEM courses	0.015	-0.129
	(0.096)	(0.380)

Notes. + $p<0.1$, * $p<0.05$, ** $p<0.01$. STEM regressions include 9,801 observations.

STEM findings

- Results consistent across related outcomes:
  - Courses/units, attempted/passed

- Not driven by early dropouts or major choice

- Varying estimates across bandwidths, results generally robust or positive after four years

Total AP Field Units

Total STEM Units (Outside of AP exam)
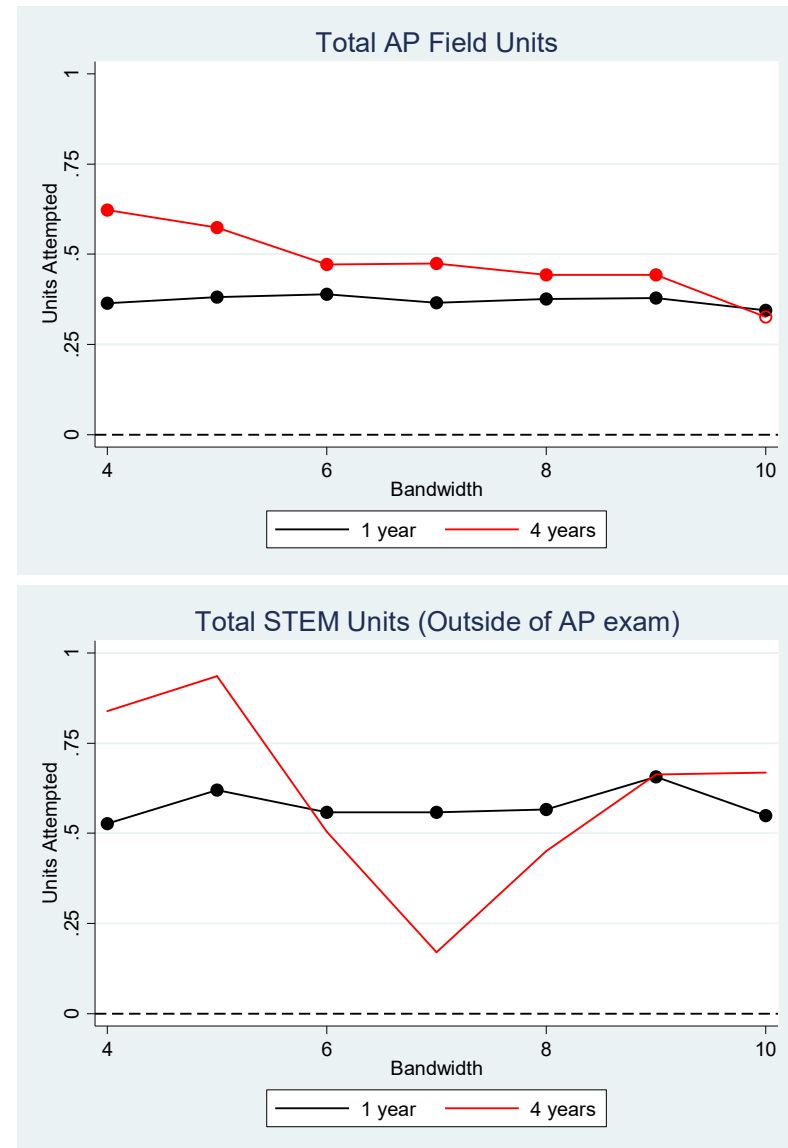
Non-STEM findings

- Students ~40pp less likely to take requisite course

- Credit policies:
  - Increase likelihood of taking zero courses in AP exam subject
  - Increase general non-STEM courses

Impacts of crossing AP threshold on course-credit offering, Non-STEM exams

	1 year	4 years
Total courses	0.016	-0.161
	(0.067)	(0.257)
Total courses in AP subject above AP exam	-0.003	-0.034
	(0.012)	(0.036)
Took zero courses (%)	0.013	0.032**
	(0.010)	(0.011)
Took one course (%)	-0.022*	-0.010
	(0.010)	(0.011)
Took two or more courses (%)	0.010*	-0.022*
	(0.004)	(0.009)
STEM courses	0.039	-0.258
	(0.056)	(0.181)
Non-STEM courses	0.249***	0.477*
	(0.059)	(0.237)

Notes. + $p<0.1$, * $p<0.05$, ** $p<0.01$. Non-STEM regressions include 28,159

Depth vs. breadth

Impacts of crossing AP threshold on concentration of course-offerings, four-year persisters

- <u>Depth</u>: Divide units into distinct categories
  - AP courses
  - Departments most commonly associated with (or outside) AP exam

- <u>Breadth</u>: Number of total departments

	STEM	Non-STEM
	4 years	4 years
Depth of course offerings		
Any AP designated courses	-0.942+	-1.661***
	(0.504)	(0.283)
Top 3 departments	0.609+	0.026
	(0.342)	(0.110)
Outside top 3 department	-1.322	1.328*
	(0.998)	(0.587)
Breadth of course offerings		
Number of departments	-0.430*	-0.088
	(0.189)	(0.120)

Notes. + p<0.1, * p<0.05, ** p<0.01.

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Next Steps and Discussion

- Students use college credit to significantly shift course-taking patterns

- Significant differences in the way students use STEM and non-STEM credit
  - STEM credit used to increase STEM focus whereas nonSTEM credits increase flexibility
  - May be largely due to selection in who takes exams

- Additional ways to think about curricular choice?
  - Power is relatively weak on four-year outcomes

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