

# The Advanced Placement (AP) Policy: Impacts on Academic Outcomes

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# Research question, methodology, results, and their interpretation

## Question

What is the impact of the Advanced Placement (AP) policy on academic outcomes of policy beneficiaries?

## Methodology

Difference-in-difference estimator quantifies AP policy impacts.

## Results

Estimates show that AP policy did not influence GPA, number of attempted hours, proportion of completed hours, or completion rates in higher level courses.

## Interpretation

*No-impact* result implies that AP test scores of 3, 4 and 5 & corresponding college courses confer equivalent learning outcomes.

The AP policy allows early credit accumulation and increases savings potentials while academic standards remain unchanged.

# AP policy: History of formation and the timing of implementation

- History
  - Revised Code 3333.163 (passed in 2007) of the Ohio State Legislature mandated the adoption of standards in awarding college credit for Advanced Placement (AP) tests. The AP policy, formed with inputs from institutions in the University System of Ohio (USO) and the Ohio Board of Regents (OBR), was subsequently approved by the *Articulation and Transfer Advisory Council*, and endorsed by the OBR Chancellor. OBR issued the relevant directive to USO institutions in summer 2009 and the implementation of the policy was expected to coincide with the arrival of the FY2009-10 freshman classes.
- Note:
  - Some institutions had made their FY2009-10 AP credit decisions prior to receiving the OBR directive; for them, the AP policy is fully implemented starting with the freshman FY2010-11 class.

# AP policy: Components and immediate consequence

- AP policy components:
  - College credit for AP test scores of 3, 4, 5 & satisfaction of first-year foreign language requirement for a score of 3 in an AP foreign language test.
  - Complete lists from institutions on equivalent courses and hours of credit granted for scores of 3, 4 and 5 in each AP test.
  - Equivalency of AP and college credit; AP credits meet graduation requirements & transfer among institutions subject to existing transfer policy rules.
- How many tests are we talking about?
  - Among Ohio public high school seniors in 2010, 23,045 had appeared at a total of 59,123 AP tests; the following was the distribution of scores:
  - Scores of 3: 15,254 (25.8% of the tests).
  - Scores of 4: 12,653 (21.4% of the tests).
  - Scores of 5: 9,697 (16.4% of the tests).

# AP policy: Expected benefits, key assumption, and validation

- Expected benefits of the AP policy: Early credit accumulation
  - Leads to smaller course-loads and shorter required graduation time.
  - Creates increased potentials for savings resources – time and money.
  - The head-start could also motivate students for future academic success.
- Fundamental underpinning of the AP policy:
  - Learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the same from successful completion of corresponding college courses.
- But what if learning outcomes are not equivalent?
  - If students with AP test scores of 3, 4 or 5 cannot master learning outcomes of college courses, AP policy will have adverse impacts on academic outcomes.
- **It is, therefore, crucial to validate the assumption:**
  - We validate the key assumption by estimating the impact of the AP policy on academic outcomes of policy beneficiaries.

# AP policy impacts: What to expect and how to interpret

- The AP policy can have any of the following three types of impacts on academic outcomes of the beneficiaries:
  1. No change in academic outcomes.
  2. Improvements in academic outcomes.
  3. Deterioration of academic outcomes.
- In cases 1 and 2, students enjoy the benefits of the AP policy, while academic standards remain unchanged or improve.
  - Verdict: AP policy is beneficial.
- In case 3, academic standards are compromised.
  - Verdict: A rethinking of the AP policy is warranted.

# How do we estimate policy impacts?

## Methodological concerns

- The simplest is the difference estimator:
  - Difference in average GPA between students with and without AP tests, respectively, computed after policy implementation.  
$$= \text{GPA}_{(\text{AP group})} - \text{GPA}_{(\text{non-AP group})}^*$$
- However, difference in GPA does not quantify policy impacts. Average GPA may differ between the groups because of the policy as well as for other reasons.
  - Generally, AP test-takers have larger family income and higher ACT scores, both correlates of academic success.
- So how do we estimate the impacts of the AP policy?
  - We use the **Difference-in-Difference (DID) estimator** to eliminate influences of other determinants of academic success.

\*Florida Department of Education used the difference estimator in evaluating AP policy impacts.

# Difference-in-difference (DID) estimator: An illustration with GPA

	Before Policy	After Policy	Difference in GPA: (After – Before) Policy
Students with AP test scores of 3, 4, and 5.	$GPA_{\text{before}}$ ..... AP credit not guaranteed.	$GPA_{\text{after}}$ ..... AP credit guaranteed.	<b>X: <math>GPA_{\text{after}} - GPA_{\text{before}}</math></b> Impact of policy + Impact of non-policy changes
Students without AP tests.	$GPA_{\text{before}}$ ..... No AP credit.	$GPA_{\text{after}}$ ..... No AP credit.	<b>Y: <math>GPA_{\text{after}} - GPA_{\text{before}}</math></b> Impact of non-policy changes
<b>Difference-in-difference (DID)</b>			$X - Y:$ ↓ Impact of AP policy



# Difference-in-difference (DID) estimator: A worked-out example with GPA

	Before Policy: GPA	After Policy: GPA	Difference in GPA: (After – Before) Policy
Students with AP test scores of 3, 4, and 5.	3.252 ..... AP credit not guaranteed.	3.242 ..... AP credit guaranteed.	<b>X: 3.242 – 3.252</b>  <b>= - 0.010</b>
Students without AP tests.	2.434 ..... No AP credit.	2.382 ..... No AP credit.	<b>Y: 2.382 – 2.434</b>  <b>= - 0.052</b>
<b>Impact of AP policy Difference-in-difference (DID)</b>			<b>X – Y:</b> <b>= - 0.010 – (- 0.052)</b> <b>= 0.042*</b>

\*Estimated impact is not statistically significant.

# Estimating policy impacts with DID Estimator: We need data from before and after AP policy

	Sample N=125,310	
	<u>Before AP Policy</u> FY2007-08 & FY2008-09 freshman cohorts N=62,466	<u>After AP Policy</u> FY2009-10 & FY2010-11 freshman cohorts N=62,844
<b>Policy beneficiary group:</b> AP credit or AP test scores of 3, 4 and 5.	N=15,860	N=17,797
<b>Comparison group:</b> No AP credit.	N=46,606	N=45,047

# What do we get from the DID estimator?

- First and foremost, estimates of AP policy impacts.
- We also get group effect: The difference in average outcome between beneficiaries and the comparison group, regardless of the AP policy.
- And the time effect: The influence of non-policy factors that changed after the AP policy.
- We obtain the results controlling for influences of the characteristics of students and their institutions.

# DID estimate summaries: First-year outcomes

	GPA	Number of attempted hours	Proportion of completed hours
Group effect	0.420***	2.058***	0.064***
Time effect	-0.018 Statistically insignificant	0.012 Statistically insignificant	0.004 Statistically insignificant
Policy impact	0.037 points, Statistically insignificant	0.058 hours, Statistically insignificant	0.003 points, Statistically insignificant

Note: \*\*\* denotes statistical significance at 1.0% error level.

- **Group effect (difference between AP and non-AP groups):**
  - AP test-takers have higher GPA (0.420 points), more attempted hours (2.058 hours) and higher completion ratio (of 0.064 points) in the first year.
- **Time effect (influence of non-policy factors that changed over time)**
  - Negligible and statistically insignificant.
  - Non-policy changes did not influence academic outcomes.
- **Policy impact :** No-Impact; small and statistically insignificant coefficients.  
AP policy did not influence academic outcomes of policy beneficiaries.

# DID estimate summaries: Completion rates in higher level courses

	Calculus II	Physics I	English Composition II
Group effect	0.072***	0.050***	0.024***
Time effect	0.008 Statistically insignificant	0.013 Statistically insignificant	-0.003 Statistically insignificant
Policy impact	0.012 points, Statistically insignificant	-0.008 hours, Statistically insignificant	0.003 points, Statistically insignificant

Note: \*\*\* denotes statistical significance at 1.0% error level.

- **Group effect (difference between AP and non-AP groups):**
  - AP test-takers have higher average completion rates in Calculus II (0.072 points), Physics I (0.050 points), and English Composition II (0.024 points).
- **Time effect (influence of non-policy factors that changed over time):**
  - Negligible and statistically insignificant.  
Non-policy temporal changes did not influence academic outcomes.
- **Policy impact:** No-impact; small and statistically insignificant coefficients.  
AP policy did not influence completion rates in higher level courses.

# No-impact results: Implications and alternative explanation

- **Implications of no-impact result:**
  - AP test scores of 3, 4 and 5, and corresponding college courses confer equivalent learning outcomes.
  - Specific interpretation: Receiving scores of 3, 4 or 5 in Calculus AB, or completing Calculus I in college, for example, prepares students in a similar manner for Calculus II.
- **An alternative explanation of the no-impact result: Policy impacts differ by test score**
  - Students with scores of 3 do not master learning outcomes of corresponding college courses; AP policy affects them adversely.
  - Students with scores of 4 and 5 master the learning outcomes; AP policy does not affect them adversely.
  - If there are fewer students with 3s, and more students with 4s and 5s after the policy, declining outcomes of the 3s are offset by the success of 4s and 5s.
  - Overall consequence? Average results will show no impact.

# No-impact results: Verification of alternative explanation

		Before Policy		After Policy	
	AP test score	Number	GPA	Number	GPA
AP policy beneficiary group	<b>3</b>	<b>3,711</b>	<b>3.118</b>	<b>3,450</b>	<b>3.038</b>
	<b>4</b>	<b>3,296</b>	<b>3.241</b>	<b>3,125</b>	<b>3.220</b>
	<b>5</b>	<b>2,435</b>	<b>3.469</b>	<b>2,884</b>	<b>3.458</b>
Comparison Group:	<b>No AP test</b>	<b>46,606</b>	<b>2.434</b>	<b>45,047</b>	<b>2.382</b>

# Verification of alternative hypothesis: Policy impacts on GPA do not differ by test scores

	<b>GPA (After Policy) – GPA (Before Policy)</b>	<b>Impact of AP policy</b>
AP test score: 3	<b>3.038 – 3.118 = - 0.080</b>	<b>- 0.080 – (- 0.052) = - 0.028 (Statistically insignificant)</b>
AP test score: 4	<b>3.220 – 3.241 = - 0.021</b>	<b>- 0.021 – (- 0.052) = 0.031 (Statistically insignificant)</b>
AP test score: 5	<b>3.458 – 3.469 = - 0.011</b>	<b>- 0.011 – (- 0.052) = 0.041 (Statistically insignificant)</b>
<b>Comparison group: No AP test</b>	<b>2.382 – 2.434 = - 0.052</b>	



# Another verification: Completion rates in higher level courses do not differ by test scores

<b>Completion rates: Calculus II</b>	<b>Comp. Rate (After Policy) – Comp. Rate (Before Policy)</b>	<b>Impact of AP policy</b>
AP test score: 3 (Calculus AB)	<b><math>0.922 - 0.936 = 0.014</math></b>	<b><math>0.014 - 0.016 = -0.002</math> (Statistically insignificant)</b>
AP test score: 4 (Calculus AB)	<b><math>0.956 - 0.941 = 0.015</math></b>	<b><math>0.015 - 0.016 = -0.001</math> (Statistically insignificant)</b>
AP test score: 5 (Calculus AB)	<b><math>0.982 - 0.971 = 0.011</math></b>	<b><math>0.011 - 0.016 = -0.005</math> (Statistically insignificant)</b>
Comparison group: No AP test	<b><math>0.862 - 0.846 = 0.016</math></b>	

# Data refute also a second alternative explanation of no-impact results

- **Alternative explanation of the no impact result: Policy impacts differ by campus**
  - AP policy has a negative impact in more demanding institutions but the success of policy beneficiaries in less demanding institutions hide it.
- **We verify the claim by estimating policy impacts at individual campuses:**
  - GPA remained unchanged in eight of the 12 campuses. GPA increased in two campuses, one of them a premier institution. GPA declined marginally in two campuses, both due to data anomalies (please consult the full report for a detailed description).
  - Proportion of completed hours remained unchanged in 11 out of 12 campuses. Proportion of completed hours declined in one campus, again due to data anomalies (please consult the full report).
  - Attempted hours remained unchanged in six campuses, increased in four and declined marginally in two.

# Conclusion

- The AP policy guarantees college credit for students with test scores of 3, 4 and 5.
- Early credit accumulation under the policy is expected to reduce course-loads, shorten the required graduation time, and help increase savings by students.
- The policy is based on the assumption that learning outcomes of AP test scores of 3, 4 and 5 are equivalent to the same of corresponding college courses.
- If learning outcomes are not equivalent, AP test takers will be adversely affected.
- We estimate AP policy impacts on a variety of academic outcome indicators using the difference-in-difference estimator on a sample of 4-year university main campus freshman students from before and after the policy.
- Our results show that the AP policy did not influence academic outcomes of policy beneficiaries. The no-impact result validates equivalency of learning outcomes between AP tests (scores of 3, 4, 5) and corresponding college courses.
- Additional investigations confirm that the no-impact result applies uniformly to AP test-takers; in particular, policy impacts do not differ by test score or by campus.