Advanced Placement (AP) Policy: Impacts on Academic Outcomes at 4-Year Universities – An Update with New Data

Ohio Public Institutions of Higher Education

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Contents

Summary: Impact of the AP Policy on Academic Outcomes of Beneficiaries

1. Background:

In 2007, the Ohio State Legislature passed the Ohio Revised Code 3333.163, mandating the Ohio Board of Regents (OBR) – currently known as the Ohio Department of Higher Education – to recommend and the Chancellor of the OBR to adopt standards for Ohio public institutions of higher education in awarding credit to students with passing scores in Advanced Placement (AP) tests. A committee comprising representatives from the institutions and the OBR created a set of guiding principles. The resultant Advanced Placement (AP) policy was subsequently approved by the Ohio *Articulation and Transfer Advisory Council* and endorsed by the Chancellor. On the basis of the policy, OBR issued *Directive 2008-010* to institutions in the summer of 2009; the implementation of the AP policy was expected to coincide with the arrival of the FY2009-10 freshman classes.

Directive 2008-010 to institutions included the following AP policy components:

a. A score of 3 or higher will provide credit at any institution. The credit must count toward graduation and will meet a general education requirement if the course to which the AP credit is equivalent fulfills a requirement at the receiving institution.
b. When it clearly enhances the opportunity for student success, an institution should strongly advise that an AP score of at least 4 is needed for a student to be successful in a second course in a highly dependent sequence of courses in a STEM area.
c. A score of 3 or higher on an AP exam in a foreign language area will provide credit for at least the first year of foreign language at any institution.
d. Each institution will provide information on awarding AP credits, which should include the number of credits awarded and the course equivalents earned for scores of 3 or higher.
e. Credits earned via AP tests are transferable among Ohio public institutions of higher education according to transfer policy rules.

2. Desired outcomes of the policy:

a. Early college credit.
b. Shorter required time for graduation.
c. Motivation for academic success.

3. Key assumption:

The fundamental underpinning of the AP policy is the assumption that learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the same of corresponding college courses. The ability of the AP policy in achieving its desired outcomes depends crucially on whether the respective learning outcomes are indeed equivalent. If AP curricula are not adequate equals of college courses, academic success of the policy beneficiaries will be adversely affected.

4. Research Question:

How does the AP policy influence academic outcomes of policy beneficiaries? This report is an update of a previous study with new data on additional cohorts of freshman students.

It is important to note that the AP policy has a net positive effect if academic outcomes of policy beneficiaries improve as a result of the policy. More importantly, even if academic outcomes do not change, a likely scenario if AP test scores of 3, 4 and 5 and corresponding college courses confer equivalent learning outcomes, the AP policy is beneficial because students face reduced course loads and a shorter required graduation time, while academic outcomes remain unchanged. A rethinking of the AP policy should be in order only if the policy has adverse impacts on academic outcomes.

5. Investigation framework: The difference-in-difference (DID) estimator

First Step: Compare academic outcomes over time for the beneficiary group.

[X]: Difference in academic outcome of beneficiary group over time.

= Beneficiary Outcome (after policy) – Beneficiary Outcome (before policy).

X represents AP policy impacts + effects of temporal changes in non-policy determinants.

*Beneficiary group comprises students receiving credit for AP tests – with scores of 3, 4, and 5.

Second Step: Compare academic outcomes over time for the comparison group.

[Y]: Difference in academic outcome of the comparison group over time.

= Comparison Outcome (after policy) – Comparison Outcome (before policy).

Y represents effects of temporal changes in non-policy determinants of academic outcome.

*Comparison group comprises students who do not have AP tests, high-school and college dual enrollment credit, or any other form of transfer credit.

Third Step:

[X – Y]: Comparison of the comparisons, i.e., the DID estimator, nets out the effects of non-policy temporal changes, and quantifies AP policy impacts.

6. Indicators of academic outcome:

a. Grade Point Average (GPA) in the first-year of attendance.
b. Hours attempted in the first year of attendance.
c. Proportion of hours completed in the first year of attendance.
d. First-to-second year retention rates.

7. Sample components:

Before policy: 4-year main campus freshman cohorts - FY2005-06 through FY2008-09.
After policy: 4-year main campus freshman cohorts - FY2009-10 through FY2012-13.

8. Results:

The AP policy did not influence academic outcomes of AP policy beneficiaries at 4-year university main campuses; estimated policy impacts on GPA, attempted hours, proportion of completed hours were all numerically small and statistically insignificant. Importantly, the no-impact results apply also to separate sub-groups of policy beneficiaries, e.g., students with AP test scores of 3, 4, and 5, or students attending different USO campuses. These results imply that students receive equivalent learning outcomes with scores of 3, 4, or 5 in an AP test or by completing the corresponding course in a 4-year university main campus.

9. Conclusion:

The no-impact result shows that the AP policy did not influence academic outcomes of the beneficiaries of the AP policy, validating the fundamental underpinning of the AP policy that learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the learning outcomes associated with the corresponding college courses. The no-impact results also highlight the beneficial role of the AP policy: the guarantee of college credit under the AP policy provides students increased potentials for saving resources, time and money, while their academic standards remain unchanged.

1. Introduction: The report evaluates the impact of the Advanced Placement (AP) policy on selected short-term indicators of academic outcomes of the policy beneficiaries – freshman students with AP test scores of 3, 4, and 5 at Ohio's public 4-year university main campuses since the implementation of the policy in FY2009-10. The AP policy guarantees college credit for AP test scores of 3, 4, and 5 at Ohio's public institutions of higher education. A previous report, published in 2013, had estimated the impacts of the AP policy on short-term indicators of academic outcomes. The current study is an update of the previous study as it expands the sample by including two additional cohorts of students to enroll in Ohio's public institutions of higher education after the implementation of the AP policy.

The College Board administers AP tests and provides the following interpretation of test scores: scores of 5, 4, and 3 – *Extremely well qualified*, *Well qualified*, and *Qualified*, respectively, and scores of 2 and 1 – *Possibly qualified* and *No recommendation*, respectively. Scores of 3, 4 and 5 are considered as passing scores. Currently, more than 30 AP tests are offered by the College Board, and a large number of institutions of higher education in the nation awards college credit for scores of 3, 4 and 5.

Prior to the implementation of the AP policy in Ohio, the awarding of credit for AP tests was left to the discretion of individual institutions. The institutions decided whether to grant credit for a particular score in a particular AP test, and when granting credit, the number of hours to grant, the particular course to which credit was assigned, and if such credit would apply to meeting graduation requirements.

In its efforts to create a uniform standard in awarding college credit for AP tests, the Ohio State Legislature passed the Ohio Revised Code 3333.163 in 2007. The legislation mandated the Ohio Board of Regents (OBR) – currently known as the Ohio Department of Higher Education (ODHE) – to recommend and the Chancellor of the OBR to adopt standards for Ohio public institutions of higher education in awarding credit to students with passing scores in AP tests. A committee comprising representatives from the OBR and the institutions created a set of guiding principles, and the resultant AP policy was subsequently approved by the Ohio *Articulation and Transfer Advisory Council* and endorsed by the Chancellor. *Directive 2008-010* was issued to institutions in the summer of 2009, and the policy implementation coincided with the arrival of the FY2009-10 freshman classes.

Directive 2008-010 comprised the following.

a. A score of 3 or higher will provide credit at any institution. The credit must count toward graduation and will meet a general education requirement if the course to which the AP credit is equivalent fulfills a requirement at the receiving institution.
b. When it clearly enhances the opportunity for student success, an institution should strongly advise that an AP score of at least 4 is needed for a student to be successful in a second course in a highly dependent sequence of courses in a STEM area.
c. A score of 3 or higher on an AP exam in a foreign language area will provide credit for at least the first year of foreign language at any institution.
d. Each institution will provide information on awarding AP credits, which should include the number of credits awarded and the course equivalents earned for scores of 3 or higher.
e. Credits earned via AP tests are transferable among Ohio public institutions of higher education according to transfer policy rules.

As evident from the directive, the AP policy brought in three important immediate changes regarding the granting of AP credit. First, the policy established state-wide guarantees of college credit for AP test scores of 3, 4 and 5. Second, the policy eliminated uncertainties in the awarding of AP credit by requiring institutions to provide information on specific equivalent courses and the corresponding number of hours to be granted for scores of 3, 4 and 5 in each AP test. Finally, the policy guaranteed that AP credits applied to meeting graduation requirements and transferred among institutions. In a nutshell, the AP

policy allowed students to accumulate early credit in college, helping them save resources, both time and money.

The basic premise of the AP policy is that learning outcomes associated with AP test scores of 3, 4, and 5, and those associated with the successful on-campus completion of corresponding college courses are equivalent. Statewide guarantees of college credit for AP test scores of 3, 4 and 5, therefore, allow students to substitute college courses with AP credit but with the expectation that learning outcomes do not change as a result of it. If the equivalency of learning outcomes is indeed a valid proposition, the AP policy helps students save time and money but without comprising academic standards.

However, if the equivalency of learning outcomes is not a valid proposition and AP curricula are not adequate equals of college courses, students with passing scores in AP tests will not have the required mastery of course content they need to succeed in college. They will have an inadequate preparation for college, especially for higher level courses. The inadequate preparation would be reflected in lower values of course completion rates, grade point average (GPA), retention rates in the short term, and lower graduation rates in the long run.

Against this backdrop, it is extremely important to empirically validate the premise that learning outcomes are indeed equivalent. Estimates of the impact of the AP policy on different indicators of academic outcome for the policy beneficiaries would provide sufficient validation of the hypothesis of equivalent learning outcomes.

The 2013 report had estimated the impact of the AP policy on short-term indicators of academic outcomes including GPA, the number attempted hours, and course completion rates, all from the first year of attendance, using data on four cohorts of first-time freshman students, FY2007-08, FY2008-09 from before the policy, and FY2009-10, and FY2010-11 after its implementation. The investigation involved the comparison of academic outcomes between groups with and without AP tests (with scores of 3, 4, and 5) before and after policy implementation. A second study (2016) used the same sample and the same methodology in investigating the impact of the AP policy on long-term academic outcome indicators including graduation rates.

The two studies found that the AP policy did not influence academic outcomes either in the short or in the long term, validating the basic premise of the AP policy that learning outcomes associated with AP test scores of 3, 4, and 5, and those associated with the successful on-campus completion of college courses are equivalent.

In the earlier reports, data considerations had necessitated the use of only two post-policy freshman cohorts – from FY2009-10 and FY2010-11 – to identify any change in academic outcomes following the implementation of the AP policy. Since then, enrollment and course records have become available for additional cohorts of freshman students. The current study accordingly updates the investigation of the impact of the AP policy on short-term academic outcome indicators with observations on two additional cohorts of freshman students – FY2011-12 and FY2012-13. The expansion of the sample allows us to examine if the no-impact results and its implied validation of equivalent learning outcomes obtained from the original sample are applicable to the newer cohorts of AP policy beneficiaries.

In order to strike a balance between pre and post-policy observations, the current sample includes two additional cohorts of freshman students from the pre-policy period – from FY2005-06 and FY2006-07. Overall, the sample comprises four cohorts from before the implementation of the AP policy and four after its implementation. The current study also considers an important additional short-term indicator of academic outcome – first-to second year retention rates.

The recipients of AP credit are usually from more affluent family backgrounds. They are also academically more able, as reflected in their concentration at more selective institutions. Since academic ability and family-financial backgrounds go hand-in-hand with college success, the estimation of AP policy impacts takes into account the influence of a large number of demographic and economic characteristics of students, as well as of the overall influence of the institutions they attended.

The results show that for the sample of all 4-year university main campus students, the AP policy did not have an impact on academic outcomes. Estimated impacts of the AP policy on GPA, the number of attempted hours, and the proportion of completed hours are numerically small and statistically insignificant. However, the policy is found to have a small positive effect on first-to-second year retention rates.

The results for the aggregate sample validate the basic assumption of the AP policy regarding the equivalency of learning outcomes. However, do such results apply uniformly to different segments of the beneficiary group? In particular, does the AP policy have similar impacts on students with AP test scores of 3 and those with test scores of 4 or 5? In a similar vein, does the AP policy have similar results for policy beneficiaries attending different 4-year university main campuses?

Our investigations show that the 'no-impact' results for GPA, the number of attempted hours, and course completion rates hold for separate groups of policy beneficiaries with AP test scores of 3, 4 and 5, allaying concerns that students with scores of 3 cannot master the necessary learning outcomes. The policy is also found to lower the number of on-campus hours by a small margin for students with AP test scores of 3 and 4. The result is consistent with the idea that AP credits substitute for on-campus credit. Interestingly, the policy does not reduce the number on-campus hours for students with AP test scores of 5; those students received college credit for AP tests even prior to the AP policy implementation.

The no-impact results are observed to hold in nine out of 12 individual 4-year university main campuses, including those with more demanding academic requirements. However, in three campuses, the policy appears to have lowered the first-year GPA; careful considerations of the data and the methodology reveal that those results are due either to data anomalies or to the specifics of the methodology used on particular samples of individual 4-year university main campuses, and not related to the policy itself.

The results highlight the beneficial role of the AP policy; the accumulation of early credit accorded by the policy provides students increased potentials for saving resources, both time and money, but without any adverse impact on their academic standards.

The rest of the report is organized as below. Section 2 provides brief descriptions of the methodology, the data, and the sample selection criteria, and section 3 portrays demographic, academic and economic characteristics of program beneficiaries and the comparison group. Section 4 presents descriptive results, and section 5 presents analytical results. Concluding remarks are in section 6.

2. Methodology and Sample

2.a Methodology

AP policy impacts are estimated with the methodology known as the difference-in-difference (DID) estimator. The DID estimator compares changes (differences) in average academic outcomes before and after policy implementation separately for policy beneficiaries and the comparison group. A comparison of the before-and-after differences between the two groups quantifies AP policy impacts.

The beneficiary group comprises students with AP test scores of 3, 4, and 5; these students are guaranteed of receiving college credit after AP policy implementation. However, students with similar AP test scores before the AP policy implementation did not have such guarantees. Consequently, a

comparison of academic outcomes before and after AP policy implementation for this group reveals AP policy impacts plus the influence of other (non-policy) factors related to academic outcomes.

The comparison group comprises students without AP tests; these students were not eligible for AP credit either before or after the policy. As such, any change in their academic outcomes between the pre and post-policy periods represents only the influence of non-policy determinants of academic outcomes that changed over time. When differences in academic outcomes before and after the policy for the beneficiaries are compared to the same of the comparison group, the influence of non-policy determinants drops off, and the impact of the AP policy is quantified.

2.b Data Sources

The data used in this report are obtained from two separate sources. The main data source is the Higher Education Information (HEI) system of the OBR; HEI provides information on enrollment, grades, the number of attempted and completed hours, and a variety of individual, family, and school characteristics. The other source of information is a proprietary data set from the College Board that provides AP test scores.

2.c Criteria for selection of freshman students

The sample used in the study is drawn on freshman students at 4-year university main campuses; freshman FY2005-06, FY2006-07, FY2007-08 and FY2008-09 cohorts represent the pre-policy period whereas freshman FY2009-10, FY2010-11, FY2011-12, and FY2012-13 cohorts represent the after-policy period.

Three separate conditions are used in the selection of students in each freshman cohort.

a. Students from a particular cohort were enrolled at an Ohio public 4-year university main campus in at least one term in the specific academic year.
   For example, students in the FY2007-08 freshman cohort were enrolled in a 4-year university main campus in at least one of the following terms: Summer 2007, Autumn 2007, Winter 2008, or Spring 2008. Similarly, students from the freshman FY2010-11 cohort were enrolled in any of Summer 2010, Autumn 2010, Winter 2011, or Spring 2011 terms.
b. Students were first-time, freshman enrollees, as indicated by the institution.
   As a measure of an additional verification, individual enrollment records were checked to ensure that a student had not been enrolled at Ohio public institutions as an undergraduate in the previous 6-year period.
c. Students were 21 years old or younger during the first year of attendance.

2.d Criteria for selection of policy beneficiaries

Two key pieces of information – maximum AP test scores of 3, 4 or 5 for individual students from the College Board data, and whether the student was granted credit for AP tests by institutions– from the HEI data – are used in classifying students as policy beneficiaries. The following describes the steps used in the assignation.

a. Students with maximum AP test scores of 3, 4 or 5, from the College Board data, are matched with samples of freshman students from the HEI data, using an identification number that is common to both data sets.
b. The identification number is missing for a subset of students with AP tests in the College Board data, preventing a match of those students with their records from the HEI data. For a majority of those cases, student names – the combination of the last, the middle, and the first names – are used to combine the College Board data with the HEI data. Additional elements of

corroboration present in both data sets, namely high school codes, gender, and ethnicity, are used to ensure that the matches are correct.

c. For a number of students, HEI data indicate that institutions had granted them credit for AP tests, although the HEI records of those students cannot be matched with the College Board data on AP test scores using either an identification number or the combined name variables. These students are also included in the beneficiary group.

2.e Criteria for selection of the comparison group

Comparison group students are required to receive college credit only through the completion of college courses; the following steps are used to classify students as members of the comparison group.

1. Students had not taken an AP test prior to enrolling in college as undergraduates.
2. Students had not received college credit through dual high-school and college enrollment prior to enrolling in college as undergraduates.
3. Students had not received college credit from any source other than course completion in the first year of attendance.

2.f Sample

The sample used in the report is based on the selection criteria described in sections 2.d, 2.e, and 2.f. However, data considerations prevented the inclusion of students from one 4-year university main campus in the sample. The sample has 249,613 observations; table 1 provides a breakdown of the sample over time and between the groups.

Table 1. Breakdown of 4-Year University Main Campus Sample: By Policy Beneficiary Status and the Timing of Policy Implementation.

	Overall Sample N=249,613							
	Before Policy Sample N=122,871				**After Policy Sample** N=126,742			
	Eligible but no benefits: Before Policy N=30,509				**Beneficiaries: After Policy** N=38,822			
Beneficiary Group: Students with AP test scores of 3, 4, and 5.	2005-6	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
	7,055	7,542	7,898	8,014	8,586	9,124	10,265	10,847
Comparison Group: Students without AP credit or any alternative credit.	**Comparison Group: Before Policy** N=92,362				**Comparison Group: After Policy** N=87,920			
	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
	23,118	23,839	22,764	22,641	22,013	22,423	22,781	20,703

The sample is evenly divided between the pre and post-policy periods – 122,871 (49.2%) before the policy and 126,742 (50.8%) after the policy. Students with scores of 3, 4 and 5 in AP tests accounted for 24.8% of the pre-policy segment. Both the number and the share of student with AP test scores of 3, 4

and 5 increased substantially after the policy, rising to 38,822 or 30.6% of the post-policy part of the sample. In contrast, the number and the share of students in the control group both declined after the policy; from 92,594 or 75.2% to 87,920 or 69.4% of the sample.

3. Sample Description

Table 2 presents summary statistics on students' demographic, academic and economic characteristics; the accompanying description focuses on how the characteristics of policy beneficiaries and the comparison group changed after the AP policy implementation.

Table 2. Demographic and Economic Characteristics of 4-year University Main Campus Students: By Policy Beneficiary Status and the Timing of Policy Implementation.

	Beneficiary		**Comparison**	
	[1]	[2]	[3]	[4]
	Before Policy N=30,509	After Policy N=38,822	Before Policy N=92,362	After Policy N=87,920
Male	50.1%	49.5%	49.0%	49.5%
Age (years)	19.4	19.4	19.4	19.5
Ethnicity				
White	85.8%	83.8%	75.9%	68.7%
Black	3.3%	3.1%	13.5%	15.3%
Hispanic	2.4%	3.0%	2.2%	3.0%
Asian	5.0%	4.6%	1.7%	1.4%
Other ethnicities	3.5%	5.6%	6.7%	11.7%
Economic Characteristics				
Family income – 2010-11 constant prices	$115,354	$119,085	$82,677	$77,232

Note: Average family income is based on non-missing values of the variables.

Columns [1] and [3] of table 2 report pre-policy summary statistics for AP policy beneficiaries and the comparison group, respectively, while columns [2] and [4] report post-policy summary statistics for the two groups.

From columns [1] and [3] of table 2, students from the beneficiary and the comparison groups were almost identical with respect to gender and age before policy implementation; each group was evenly divided between male and female students, and the average age of students in the beneficiary and the comparison group was also very similar: 19.4 and 19.5 years, respectively.

The two groups, however, differed substantially with respect to ethnicity and family income. Columns [1] and [3] of table 2 show that before AP policy implementation, 85.8% of the students from the beneficiary group were White while only 75.9% of the comparison group students were White. On the other hand, only 3.3% of the students from the beneficiary group were Black while four times the proportion – 13.5% – of the comparison group was Black. AP policy beneficiaries were substantially wealthier than students from the comparison group; before policy implementation, students from the beneficiary and the comparison groups had average family income of $115,354 and $82,677, respectively.

Columns [2] and [4] of table 2 inform how AP policy beneficiaries and the comparison group differed with respect to individual and family characteristics after AP policy implementation. Similar to the before-policy observation, policy beneficiaries and students from the comparison group were identical with respect to age and gender characteristics in the post-policy period.

However, the observed large differences in family income and ethnicity between the policy beneficiaries and the comparison group become larger after the AP policy implementation. For example, the average family income increased after the policy from $115,354 to $119,058 for the beneficiaries but declined from $82,677 to $77,232 for the comparison group.

The ethnicity composition of the two groups also changed in the post-policy period; the proportion of White students declined among in both groups. However, policy beneficiaries experienced a decline from 85.8% to 83.8% while the extent of the decline for the comparison group was much larger – from 75.9% to 68.7%. Over the same period of time, the proportion of Black students remained similar in the beneficiary group but increased from 13.5% to 15.3% in the comparison group.

Table 3. Characteristics of High School Districts of 4-year University Main Campus Students: By Policy Beneficiary Status and the Timing of Policy Implementation.

	Beneficiary		**Comparison**	
	[1]	[2]	[3]	[4]
	Before Policy N=30,509	After Policy N=38,822	Before Policy N=92,362	After Policy N=87,920
(1). Major urban – very high poverty	3.7%	2.8%	7.1%	7.8%
(2). Rural/Small Town – moderate to high income	4.3%	4.3%	4.6%	4.4%
(3). Rural/Agricultural – high poverty, low income	2.2%	1.8%	4.4%	4.2%
(4). Rural/Agricultural – small student population	4.1%	3.0%	6.4%	5.4%
(5). Urban – low income, high poverty	6.1%	4.8%	9.9%	10.0%
(6). Urban/Suburban – high income	21.7%	20.6%	20.2%	19.3%
(7). Urban/Suburban – very high income	26.5%	30.1%	13.8%	13.3%
(8). School information unavailable	31.5%	32.5%	33.5%	35.6%

Another aspect of the difference in the socio-economic characteristics between AP policy beneficiaries and the comparison group is evidenced in the characteristics of their respective high school communities. Table 3 presents summary statistics on the characteristics of high school communities. High school characteristics are not available for a large number of students because of the absence of the relevant information for students who had graduated from high schools located outside of Ohio.

Before policy implementation, 48.2% of the students from the beneficiary group were from 'high or very high income' urban communities – combined categories (6) and (7) from column [1] of table 3. In contrast, only 34.0% of the comparison group students were from those two affluent, urban communities, as observed from categories (6) and (7) of column [3] of table 3. Moreover, the proportion of beneficiaries from 'low income and high poverty' communities – combined categories (1), (3) and (5) from column [1] – added up to only 12.0% before policy implementation, but the same three categories accounted for 21.4% of students in the comparison group.

The extent of the differences in the high school communities between the two groups became more pronounced after AP policy implementation. For example, the proportion of 'high or very high-income' urban communities increased in the beneficiary group from 48.2% to 50.7% after the policy but declined from 34.0% to 32.6% among the students in the comparison group over the same period of time. Moreover, the proportion of 'low income and high poverty' communities declined from 12.0% to 9.4% in the beneficiary group but remained unchanged among students in the comparison group.

Tables 2 and 3 reveal that relative to students from the comparison group, the beneficiaries of the AP policy were from more affluent family and high school communities; beneficiaries also had lower degrees of ethnic diversity, reflected in the high proportion of White students in the group. The extent of those differences between the two groups increased in the post-policy period. Family income and ethnicity characteristics, however, are generally positively correlated with measures of student success. As such, it is expected that beneficiaries of the AP policy experienced higher levels of academic success in college both before and after AP policy implementation. It is, therefore, necessary to control for the influence of individual, family and high-school characteristics of students in the quantification of AP policy impacts on academic outcomes of policy beneficiaries.

4. Descriptive Results

This section reports summary statistics on academic outcome indicators for AP policy beneficiaries and students from the comparison group separately for the pre and post-policy periods. The comparison of the average values of academic outcome indicators by beneficiary-comparison status, and by the timing of AP policy implementation, is intended to provide an illustration of how the AP policy influenced academic outcomes of the policy beneficiaries.

Table 4 reports summary statistics on GPA, the number of attempted hours, and the proportion of completed hours, all from students' first year of attendance, and the first-to-second year retention rates.

Table 4. Summary Statistics on Selected Indicators of Academic Outcomes for 4-year University Main Campus Students: By Policy Beneficiary Status and the Timing of Policy Implementation.

	Beneficiary		Comparison	
	[1]	[2]	[3]	[4]
	Before Policy N=30,509	After Policy N=38,822	Before Policy N=92,362	After Policy N=87,920
GPA (on a scale of 0-4)	3.238	3.221	2.466	2.421
Hours attempted	32.2	31.7	28.2	27.7
Proportion of hours completed	94.1%	94.5%	80.4%	79.5%
First-to-second year retention rate	95.8%	95.1%	83.9%	80.9%

From table 4, it is evident that there were large differences in the average values of GPA, the number of attempted hours, and the proportion of completed hours between beneficiaries – from column [1] – and the comparison group – from column [3]. Before AP policy implementation, the average GPA for students with AP test scores of 3, 4 and 5, and those from the comparison group were 3.238 and 2.466, respectively. Similarly, the two groups had attempted 32.2 and 28.2 hours, respectively in the first year of attendance, and had completed 94.1% and 80.3%, respectively, of the attempted hours. There were also large differences in retention rates between the two groups before the implementation of the AP policy. The average retention rate of the beneficiary group was 95.8% before the AP policy whereas average retention rates were 84.0% for the comparison group.

Columns [2] and [4] of table 4 inform on the post-policy comparison of average academic outcomes for beneficiaries and the comparison group, respectively. The average values of three of the four indicators, namely, GPA, attempted hours, and completion rates, changed marginally over time for both groups. For example, average GPA declined from 3.238 to 3.221 for the beneficiaries and from 2.464 to 2.421 for the comparison group. Similarly, the average number of attempted hours declined from 32.2 to 31.7 for the beneficiaries and from 28.2 to 27.7 for the comparison group. The proportion of completed hours increased slightly for beneficiaries, from 94.1% to 94.5%, and declined by a small margin, from 80.4% to 79.5%, for the comparison group. Average retention rates, however, changed in a contrasting manner for the two groups. For AP policy beneficiaries, average retention rates declined from 95.8% to 95.1% – a change of 0.007 points – while the comparison group experienced a larger decline of 0.030 points – from 83.9% to 80.9%.

In light of the observation from table 4 – very small changes in GPA, the number of attempted hours and course completion rates after AP policy implementation for either beneficiaries or the comparison group – it appears that that the AP policy is likely to have exerted little influence on those outcomes for the policy beneficiaries. However, the observations on retention rates, especially the large decline over time for the students from the comparison group and smaller changes in it for the policy beneficiaries suggest that the AP policy is likely to be associated with a positive influence on retention rates.

5. Analytical Results

5.a Aggregate Sample

This section presents analytical results – the estimated impacts of the Advanced Placement policy on selected short-term indicators of academic outcome including first-year GPA, course completion rates, the number of attempted hours, and first-to-second year retention rates.

Because AP policy beneficiaries and students from the comparison group differ substantially in socio-economic characteristics, important determinants of college success, the difference-in-difference estimates of AP policy impacts are obtained controlling for the influence of a large number of characteristics of the students as well as of the overall influence of individual campuses they attended. The estimation also takes explicit account of the possibility that error terms in the regression equations for individuals attending the same 4-year main campus are correlated.

AP policy impacts are estimated using the difference-in-difference (DID) estimator on the aggregate sample of first-time freshman students attending Ohio public 4-year university main campuses. These results apply to the entire system of public 4-year university main campuses in the state. However, because of existing concerns regarding the potential non-uniformity of AP policy impacts among AP policy beneficiaries with different AP test scores – 3, 4, or 5, for example – or those attending different 4-year main campuses, AP policy impacts are also estimated separately for students with different AP test-scores and for those attending different 4-year university main campuses.

Table 5 presents DID estimates of AP policy impacts obtained from the aggregate sample. Row (1) represents the effect of time – changes in academic outcomes between the pre and the post-policy periods independent of the policy; time effects are common to policy beneficiaries and the comparison group. Row (2) represents the effect of the group, i.e., the average difference in academic outcome between beneficiaries and the comparison group independently of the policy. Finally, row (3) presents the estimated impacts of the AP policy.

Table 5. Estimated Effects of the AP Policy on First-Year GPA, the Number of Attempted Hours, the Proportion of Completed Hours, and the First-to-Second Year Retention Rates.

	[1]	[2]	[3]	[4]
	GPA Scale: (0-4)	**Completion Ratio**	**Attempted hours**	**Retention Rate**
	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)
(1). Effect of Time: (Difference between after & before policy, common to beneficiaries & comparisons).	0.003 (0.033)	0.005 (0.008)	-0.211 (0.205)	-0.024*** (0.006)
(2). Effect of Group: (Average difference between beneficiaries & comparisons).	0.524*** (0.091)	0.071*** (0.017)	2.352*** (0.571)	0.052*** (0.013)
(3). Effect of Policy: (Change in outcome for beneficiaries after policy).	-0.021 (0.031)	-0.0003 (0.007)	-0.276 (0.206)	0.011** (0.005)
Is the estimated policy effect statistically significant?	No.	No.	No.	Yes.
Policy Effect?	**No impact.**	**No impact.**	**No impact.**	**Positive Impact**
R-squared	0.239	0.187	0.183	0.082
Number of observations	249,613			

Note: *** denote statistical significance at 1.0% error level.

Entries in row (1) of table 5 reveal that the effect of time was negligible, meaning that changes in non-policy determinants of academic outcome common to both beneficiaries and the comparison group had little influence on GPA, the number of attempted hours, and the proportion of completed hours, all from the first year of attendance; the estimates are small in magnitude and also statistically insignificant. However, for retention rates from the first to the second year, the effect of time is negative and statistically significant. The coefficient implies that over time, average retention rates declined for both the beneficiary and the control groups by 2.4 points.

Entries in row (2) show large and statistically significant differences in average academic outcomes between AP policy beneficiaries and students from the comparison group. The large values of the group-effects reflect that regardless of the AP policy, students from the beneficiary group performed better than students from the comparison group. The beneficiary group on average had 0.524 points higher GPA, 7.1 points higher completion rates, 2.352 more attempted hours and 5.2 points higher retention rates.

Finally, row (3) of table 5 reports estimated impacts of the AP policy on GPA, the number of attempted hours, the proportion of completed hours, and the first-to-second year retention rates. The coefficients

show that the AP policy had small, negative and statistically insignificant associations with GPA, the number of attempted hours, and course completion rates, meaning that the AP policy did not influence any of those important indicators of academic outcome. Numerical values of the coefficients were small: -0.021, -0.276, -0.0003, respectively for GPA, course completion rates, and the number of attempted hours. In contrast to the above, the AP policy is found to have a positive although small impact on the first-to-second year retention rates. Row (3) of table 5 shows that first-to-second year retention rates increased by 0.011 points as a result of the AP policy.

The AP policy guarantees college credit for students with AP test scores of 3, 4 and 5. Prior to the implementation of the policy, the granting of college credit for AP tests was to the discretion of the institutions. The foremost initial effect of the AP policy, therefore, is an increase the number of students who received college credit for their AP tests. While the policy is expected to help such students reduce college costs and shorten the length of their required graduation time, there is also a legitimate concern regarding academic outcomes: how well do students do once they are guaranteed to receive college credit for passing scores in AP tests? The results in table 5 provide direct answers to the question, and clearly show that the AP policy did not influence important short-term indicators of academic outcomes including GPA and course completion rates. These results validate the fundamental underpinning of the AP policy: learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to learning outcomes associated with corresponding college courses.

5.b Are the results uniform?

While the no-impact results from the aggregate sample validate the hypothesis of equivalent learning outcomes, it remains to be seen if such results apply uniformly to different segments of the policy beneficiaries such as students with different AP test scores or those attending different 4-year university main campuses.

5.b.i Testing the uniformity of results: Policy impacts do not vary by AP test scores

A major concern regarding the equivalency of learning outcomes is that although the hypothesis is likely to be valid for AP test scores of 4 and 5, it may not be true for scores of 3. The hypothesis maintains that students receiving a score of 3 in an AP test do not obtain the required mastery of the content of the corresponding college course. 0Consequently, the AP policy is likely to have an adverse impact on GPA or course completion rates for the students with AP test scores of 3. The concern with potentially non-uniform policy impacts for different AP test scores is addressed by the estimating separate sets of policy impacts for students with different AP test scores. The results are presented in table 6.

Column [1] of table 6 presents AP policy impacts on the first-year GPA, while columns [2], [3], and [4] present estimated impacts on course completion rates, the number of attempted hours, and first-to-second year retention rates, respectively. Reading from top to bottom, the rows of table 6 presents estimated impacts of the AP policy on beneficiaries with AP test scores of 3, 4 and 5. The entries in column [1] show, similar to the results observed for the aggregate sample, that the AP policy does not influence first-year GPA for students with different AP test scores; the estimated coefficients for students with separate test scores of 3, 4 and 5 are all small, negative, and statistically insignificant, meaning that the AP policy has the same no-impact result on GPA for separate groups of students with scores of 3, 4 or 5. Very similar results – the AP policy having small, negative, and statistically insignificant impacts on course completion rates are observed from column [2] of table 6. Taken together, the statistically insignificant and small magnitude coefficients regarding AP policy impacts on GPA and course completion rates for separate groups of students with AP test scores of 3, 4 and 5 reinforce the validity of the equivalency of learning outcomes between passing scores in AP tests and the successful on-campus completion of college courses.

Table 6. Estimated Effects of the AP Policy on First-Year Grade Point Average (GPA), the Number of Attempted Hours, and the Proportion of Completed Hours: By AP Test scores.

	[1]	[2]	[3]	[4]
	GPA Scale: (0-4)	**Completion Ratio**	**Attempted hours**	**Retention Rate**
	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)
Estimated AP policy effect: **Maximum AP test scores of 3**	-0.029 (0.032)	-0.004 (0.006)	-0.420* (0.195)	0.007 (0.005)
Is AP policy effect statistically significant?	No	No	Yes	No.
Estimated AP policy effect: **Maximum AP test scores of 4**	-0.020 (0.041)	-0.003 (0.007)	-0.564* (0.268)	0.013* (0.006)
Is AP policy effect statistically significant?	No	No	No	Yes. Positive Effect.
Estimated AP policy effect: **Maximum AP test scores of 5**	-0.007 (0.045)	-0.009 (0.007)	-0.323 (0.119)	0.006 (0.006)
Is AP policy effect statistically significant?	No	No	No	Yes. Positive Effect.
Estimated AP policy effect: **AP test scores not known.**[1]	0.065 (0.056)	0.005 (0.010)	-0.434 (0.283)	0.002 (0.007)
Is AP policy effect statistically significant?	No	No	No	Yes. Positive Effect.

Note: *** and ** denote statistical significance at 1.0% and 5.0% error level, respectively.

Interestingly, the AP policy has statistically significant negative effects on the number of attempted hours for students with AP test scores of 3 and 4, but not for students with scores of 5. The estimated impacts, although small, are consistent with expectations: as students receive credit for AP tests, they are expected to take fewer hours on campus. Importantly, a major contribution of the AP policy is the guarantee of college credit for students with test scores of 3 (and 4 to some extent) because institutions had provided credit for AP test scores of 5 even prior to the implementation of the AP policy. Finally, the AP policy appears to increase first-to-second year retention rates for students with scores of 4; the numerical value of the coefficient, however, is small.

[1] Some Ohio public institution students with AP tests cannot be identified in the College Board data. Although their AP test scores cannot be known, the institutions report them as AP credit recipients.

5.b.ii Testing the uniformity of results: Do policy impacts vary by campus?

Public 4-year universities main campuses in Ohio differ with respect to the size of their student populations, the characteristics of the students, and most importantly, with respect to the demands they place on their students. It is, therefore, natural that questions arise regarding the uniformity of the no-impact result among different 4-year main campuses. A particular hypothesis in this regard proposes that the AP policy has adverse effects on academic outcomes at academically demanding campuses. The hypothesis maintains that positive results in less demanding campuses offset the adverse effects for the more demanding campuses and generate the observed no-impact result for the aggregate sample.

An investigation of the hypothesis is presented in table 7a and 7b. Table 7a presents estimated impacts of the AP policy on first-year GPA, the number of attempted hours, the proportion of completed hours, and first-to-second year retention rates for nine of the 12 campuses included in the sample. The estimates for the other three campuses in the study are presented in table 7b.

Table 7a. Estimated Impacts of the AP Policy on Selected Indicators of Academic Outcomes for Policy Beneficiaries: By Individual 4-Year University Main Campuses.

University of Akron				
Indicators	GPA (0-4 scale)	Completion rate	Attempted hours	Retention rate
Numerical value	+ 0.025 pts.	0.021 pts.	– 0.9 hrs.	+ 0.002 pts.
Statistically significant?	No	Yes	Yes	No
Policy Impact	No impact	Positive impact	Negative impact	No impact
Cleveland State University				
Numerical value	– 0.085 pts.	– 0.007 pts.	-0.7 hrs.	+ 0.0001 pts.
Statistically significant?	No	No	No	No
Policy Impact	No impact	No impact	No impact	No impact
Miami University				
Numerical value	– 0.004 pts.	+ .005 pts	+ 0.2 hrs.	+ 0.008 pts.
Statistically significant?	No	No	Yes	No
Policy Impact	No impact	No impact	Positive impact	No impact
Ohio State University				
Numerical value	– 0.004 pts.	– 0.002 pts.	– 0.4 hrs.	+ 0.030 pts.
Statistically significant?	No	No	Yes	Yes
Policy Impact	No impact	No impact	Negative impact	Positive impact
Ohio University				
Numerical value	– 0.018 pts.	+ 0.001 pts.	– 0.3 hrs.	+ 0.015 pts.
Statistically significant?	No	No	Yes	Yes
Policy Impact	No impact	No impact	Negative impact	Positive impact
Shawnee State University				
Numerical value	– 0.013 pts.	+ 0.028 pts.	– 2.6 hrs.	+ 0.056 pts.
Statistically significant?	No	No	Yes	No
Policy Impact	No impact	No impact	Negative impact	No impact
University of Toledo				
Numerical value	+ 0.003 pts.	– 0.007 pts.	+ 0.2 hrs.	+ 0.017 pts.
Statistically significant?	No	No	No	No
Policy Impact	No impact	No impact	No impact	No impact

Table 7a (continued). Estimated Impacts of the AP Policy on Selected Indicators of Academic Outcomes for Policy Beneficiaries: By Individual 4-Year University Main Campuses.

Wright State University				
Numerical value	+ 0.088 pts.	+ 0.013 pts.	+ 0.4 hrs.	+ 0.015 pts.
Statistically significant?	Yes	No	No	No
Policy Impact	Positive impact	No impact	No impact	No impact
Youngstown State University				
Numerical value	+ 0.027 pts.	– 0.037 pts	+ 0.2 hrs.	+ 0.032 pts.
Statistically significant?	No	Yes	No	Yes
Policy Impact	No impact	Negative impact	No impact	Positive impact

Table 7a shows that the AP policy does not have an adverse impact on GPA in any of the nine campuses reported in the table; the results show that GPA remains unchanged in eight of the nine campuses, and increases in one. Completion rates also do not change in eight of the nine campuses reported in table 7a. Table 7a also shows that the number of attempted hours decreases in four campuses, consistent with expectations, and increases marginally in one.[2] Table 7a also shows that retention rates increase in two campuses, and remain unchanged in the remaining ones. Overall, the results in table 7a show that excepting one institution, the AP policy has either small, positive effects or no effects on GPA, course completion rates, and retention rates.

Table 7b presents estimated impacts of the AP policy on GPA, course completion rates, the number of attempted hours, and the first-to-second year retention rates for the Bowling Green State University, the University of Cincinnati, and Kent State University. The estimated policy impacts at these three institutions are presented separately because the policy appears to have negative impacts on GPA in each of the three institutions. The results, after additional investigations, are found tied to two important factors – data anomaly, and the characteristics of data and the estimation methodology.

Bowling Green State University, the University of Cincinnati, and Kent State University: Apparently adverse policy effects

Table 7b shows that the AP policy leads to a decline of 0.263 in GPA at the Bowling Green State University but does not have any impact on course completion rates, the number of attempted hours, and the first-to-second retention rates at the institution. The AP policy appears to have a wider set of effects at the University of Cincinnati and Kent State University. At each institution, first-year GPA appears to decline as a result of the AP policy, by 0.174 at the University of Cincinnati, and by 0.096 points at Kent State University. Course completion rates also appear to decline as a result of the policy at both institutions, by 0.050 points at the University of Cincinnati, and by 0.012 points at Kent State University.

[2] The negative impact on the number of attempted hours in the first year of attendance implies that AP credit substitutes college courses to a small extent.

Table 7b. Estimated Impacts of the AP Policy on Selected Indicators of Academic Outcomes for Policy Beneficiaries: By Individual 4-Year University Main Campuses.

Bowling Green State University				
Indicators	GPA (0-4 scale)	Completion rate	Attempted hours	Retention rate
Numerical value	– 0.263 pts.	– 0.002 pts.	– 0.03 hrs.	– 0.001 pts.
Statistically significant?	Yes	No	No	No
Policy Impact	Negative impact	No impact	No impact	No impact
University of Cincinnati				
Numerical value	– 0.174 pts.	– 0.050 pts.	– 1.2 hrs.	– 0.025 pts.
Statistically significant?	Yes	Yes	Yes	Yes
Policy Impact	Negative impact	Negative impact	Negative impact	Negative impact
Kent State University				
Numerical value	– 0.096 pts.	– 0.012 pts.	– 0.6 hrs.	+ 0.003 pts.
Statistically significant?	Yes	Yes	Yes	No
Policy Impact	Negative impact	Negative impact	Negative impact	No impact

Bowling Green State University: Data Anomaly behind Apparent Negative Impacts

Additional investigations reveal data anomaly to be the cause behind the negative estimated impact of the AP policy on GPA at the Bowling Green State University. The sample includes freshman cohort data from FY2005-06 through FY2008-09 from the pre-policy period, and FY2009-10 through FY2012-13 from the post-policy period. Average GPA for the AP policy beneficiaries are found to have declined by 0.363 points after the AP policy. The large decline in average GPA is due to an error in the data submitted by the institution affecting the FY2012-13 cohort; average GPA declined from 3.234 in FY2011-12 to 2.434 in FY2012-13 at the institution.

University of Cincinnati and Kent State University: Estimator property and improving freshman quality behind the apparently negative results

The estimated negative impacts of the AP policy at the University of Cincinnati and Kent State University are due to a combination of estimator and data characteristics. The difference-in-difference estimator identifies AP policy impacts by comparing two differences. The first difference shows changes in outcome indicators such as GPA before and after policy implementation for program beneficiaries, i.e., students with AP test scores of 3, 4 or 5. The AP policy guarantees college credit for these students. As such, the before-and-after (policy) difference in GPA for this group represents the impact of the policy as well as the influence of other factors not related to the policy. The difference-in-difference estimator identifies policy impacts by removing the influence of the other factors, known also as the trend, by using the second difference. The second difference calculates changes in GPA, before-and-after policy, for students without AP tests. Because these students did not receive AP policy benefits, any change in GPA for them is due entirely to the influence of other factors not related to the policy. A difference of the two differences, therefore, removes the common trend, and quantifies the impact of the AP policy.

An important requirement for the estimator, however, is to have the trends for beneficiary and comparison groups cancel each other. If the two trends do not cancel each other, the estimation of policy impacts becomes complicated. Consider the following example: if non-policy factors do not influence the average GPA of the beneficiaries but cause the average GPA of the comparison group to

increase over time, the difference-in-difference estimator would ascribe negative impacts to the policy although there are no impacts on the beneficiaries.

The above is the scenario that has given rise to the apparently negative impact of the AP policy at the University of Cincinnati and Kent State University. The data show that changing non-policy factors causing large increases in especially GPA for the comparison groups at both institutions.

University of Cincinnati

Tables 8a and 8b present insights into the causes of the estimated negative impacts of the policy at the University of Cincinnati. Table 8a reports average GPA before and after AP policy implementation for policy beneficiaries and the comparison group. Table 8a shows that GPA increased by 0.178 for the comparison group while it declined by a small amount (0.036) for the program beneficiary group, giving rise to a large, negative estimated impact of the AP policy. Similarly, table 8b reports the before-after breakdown of completion rates between policy beneficiary and comparison groups, and shows completion rates increasing by 0.068 for the comparison group and by 0.007 for the beneficiary group, giving rise to a large, negative estimated impact of the AP policy on course completion rates.

Table 8a. Changes in GPA before and after the AP Policy at the University of Cincinnati: AP Program Group and the Comparison Group.

GPA					
	N	**Before**	**N**	**After**	**GPA(after) – GPA(before)**
Program	3,268	3.248	4,574	3.214	3.214 – 3.248 = **–** 0.034
Comparison	8,526	2.602	7,543	2.784	2.784 – 2.602 = **+** 0.182
Estimated Policy Impact (on GPA)					**–** 0.034 – 0.182 = **–** 0.216[3]

Table 8b. Changes in Completion Rates before and after the AP Policy at the University of Cincinnati: AP Program Group and the Comparison Group.

Completion Ratio					
	N	**Before**	**N**	**After**	**Completion Ratio(after) – Completion Ratio (before)**
Program	3,268	0.931	4,574	0.938	0.938 – 0.931 = +0.007
Comparison	8,526	0.803	7,543	0.870	0.871 – 0.803 = **+** 0.068
Estimated Policy Impact (on Completion Ratio)					0.007 – 0.068 = – 0.075

Although tables 8a and 8b show that the relatively large increases in GPA and completion rates for the comparison group caused the estimated impacts of the AP policy to appear as negative at the University of Cincinnati, it is still important to know why GPA declined for the policy beneficiaries at the institution. In particular, is the decline in GPA at the institution related to the AP policy? If the AP policy were responsible for the declining average GPA of policy beneficiaries at the institution, a comparison of average GPA by AP test scores (at the institution) would reveal the association. Because students with AP test scores of 3 are the foremost and direct beneficiaries of the AP policy, any decline in average GPA of the policy beneficiary group at the institution would be concentrated among students with AP test scores of 3.

[2] Estimated policy impact on GPA and completion rates in table 8a, 8b, 9a, and 9b are slightly different from corresponding estimates presented in table 7b because the latter control for influence of individual and institutional characteristics.

Table 9 accordingly presents a before-after comparison of average GPA for students with AP test scores of 3, 4 and 5. Table 9 shows that for students with scores of 3, 4 and 5, the average GPA declined by 0.031, 0.049 and 0.039 points, respectively. It is evident that post-policy decline in average GPA for policy beneficiaries at the University of Cincinnati was not concentrated among students with AP test scores of 3. Moreover, since the AP policy is not likely to have influenced credit granting practices at the institution for students with AP test scores of 5, the decline in average GPA of 0.039 points for this group is not related to the AP policy. An extension of the same logic implies that non-policy factors caused the decline in average GPA for all policy beneficiaries at the University of Cincinnati. Unfortunately, the influence of the non-policy factors on first-year GPA for the policy beneficiaries cannot be removed using the difference in first-year GPA for the comparison group which increased by a large margin after the AP policy. The observed negative impact of the AP policy at the University of Cincinnati is tied to the opposite directions of time trends between the beneficiaries and the comparison group.

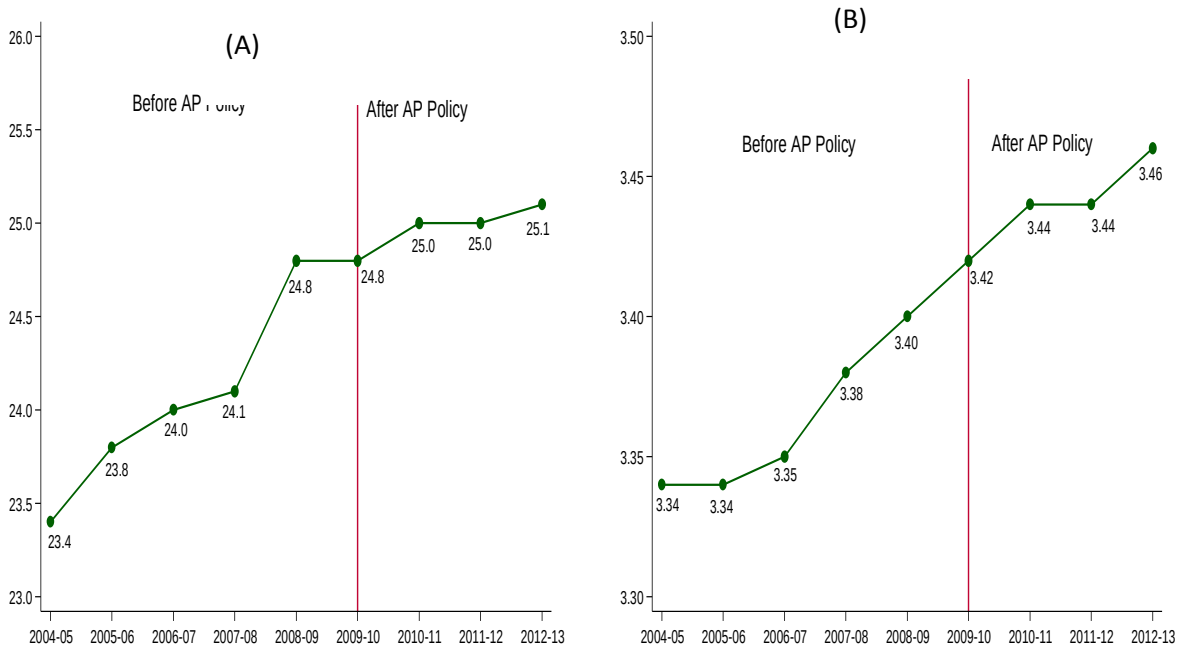
Table 9. Changes in GPA before and after the AP Policy at the University of Cincinnati: By AP Test Scores for the Program Group.

	Before		**After**		**GPA(after) – GPA(before)**
AP scores	**N**	**GPA**	**N**	**GPA**	
3	965	3.022	1,169	2.991	2.991 – 3.022 = - 0.031
4	905	3.240	1,181	3.191	3.191 – 3.240 = - 0.049
5	740	3.483	965	3.444	3.444 – 3.483 = - 0.039
NA	658	3.325	1,259	3.267	3.267 – 3.325 = - 0.058
Comparison Group	8,526	2.602	7,543	2.784	2.784 – 2.602 = **+0.182**

It is evident that the apparently negative impacts of the AP policy at the University of Cincinnati are due to increases in the average values of the indicators of academic outcome only for students in the comparison group. The important task, therefore, is to know why academic outcomes improved after AP policy implementation but only among students from the comparison group.

Although the scope of the current study does not allow a full-scale investigation of the specific factors responsible for improving academic outcomes for students in the comparison group, an increase in the overall quality of the student body at the at the University of Cincinnati is likely to be a major factor. Since FY2004-05, the University of Cincinnati has experienced considerable improvements in the quality of its freshman classes. For example, the average ACT score of the freshman class increased from 23.4 in 2004-05 to 25.1 in 2012-13. Panel (A) of graph 1 plots the average ACT scores of freshman classes; the graph shows that average ACT scores increased the most before the implementation of the AP policy but improvements continued after the policy. A similar picture is observed in panel (B) of graph 1 where average high school grade point averages of the incoming classes are plotted for the period between FY2004-05 and FY2012-13; panel (B) of graph 1 shows that the average GPA of the incoming classes increased from 3.34 in FY2004-05 to 3.46 in FY2012-13.

Graph 1. Average ACT Scores (panel A) and Average High School GPA (panel B) of Freshman Cohorts at the University of Cincinnati: FY2004-05 to FY2012-13.



Source: Data on ACT scores and High-school GPA received from the Office of Institutional Research at the University of Cincinnati.

However, can a sustained increase in the overall quality of incoming freshman classes at the institution be concentrated among students in the comparison group? The following considerations show that such a situation is indeed possible. First, students in the comparison group accounts for almost 70% of the freshman class in a given year at the University of Cincinnati. Second, AP test-takers are typically the highest achieving components of any freshman class in the institution before or after the policy. Taken together, the two facts make it clear that an improvement in the overall quality of freshman classes must be due to a disproportionately larger increase in quality in the comparison group.

Kent State University

The combined characteristics of data and estimation methodology seem to be behind the observed estimated negative impacts of the AP policy on GPA and course completion rates at Kent State University as well. Tables 10a and 10b present the before-and-after breakdown of GPA and course completion rates, respectively, between program beneficiaries and the control group. Table 10a shows that first-year GPA increased by 0.082 points after the AP policy implementation for the policy beneficiary group. First-year GPA, however, increased by 0.202 points for students from the comparison group over the same period. Table 10b shows that completion rates increased by 0.014 and 0.029 points for the policy beneficiary and the comparison groups, respectively, after the implementation of the AP policy. Tables 10a and 10b show that both GPA and course completion rates increased for the policy beneficiary group after the AP policy implementation at the Kent State University, but even larger increases for students from the comparison group over the same period gave rise to the estimated negative impacts of the policy.

Table 10a. Changes in GPA before and after the AP Policy at Kent State University: AP Program Group and the Comparison Group.

GPA					
	N	**Before**	**N**	**After**	**GPA(after) – GPA(before)**
Program	1,503	3.250	1,692	3.332	3.332 – 3.250 = **+** 0.082
Comparison	10,463	2.477	11,134	2.679	2.679 – 2.477 = **+** 0.202
Estimated Policy Impact (on GPA)					0.082 – 0.202 = **–** 0.120

Table 10b. Changes in Completion Rates before and after the AP Policy at Kent State University: AP Program Group and the Comparison Group.

Completion Ratio					
	N	**Before**	**N**	**After**	**Completion Ratio(after) – Completion Ratio (before)**
Program	1,503	0.924	1,692	0.938	0.938 – 0.924 = +0.014
Comparison	10,463	0.822	11,134	0.851	0.851 – 0.822 = +0.029
Estimated Policy Impact (on Completion Ratio)					0.014 – 0.029 = – 0.015

While tables 10a and 10b show that the estimated negative impacts of the AP policy on GPA and course completion rates at Kent State University are due the comparison group experiencing larger increases in both variables after the AP policy implementation, it is important to ask why the program beneficiary groups experienced lower growth in GPA and course completion rates after the implementation of the AP policy. In particular, it is important to know if the lower growth of the two important academic outcome indicators for the program beneficiary group is related to the AP policy itself.

Because students with AP test scores of 4 and 5 had received college credit for their AP tests even prior to the implementation of the AP policy, the foremost initial contribution of the policy is to guarantee college credit for scores of 3 in AP tests. Consequently, any impact of the AP policy on outcome indicators should be concentrated around students with AP test scores of 3. An investigation of the hypothesis that the changes in GPA and course completion rates for the program beneficiaries are due to factors not related to the AP policy, table 10c presents a comparison of GPA for program beneficiaries before and after AP policy implementation by AP test scores.

Table 10c. Changes in GPA before and after the AP Policy at the Kent State University: By AP Test Scores for the Program Group.

	Before		**After**		**GPA(after) – GPA(before)**
AP scores	**N**	**GPA**	**N**	**GPA**	
3	507	3.117	559	3.173	3.173 – 3.117 = + 0.056
4	273	3.294	351	3.349	3.349 – 3.294 = + 0.055
5	140	3.451	204	3.516	3.516 – 3.451 = + 0.065
NA	583	3.290	578	3.411	3.411 – 3.290 = + 0.121
Comparison Group	10,463	2.477	11,134	2.679	2.679 – 2.477 = **+ 0.202**

Although it is evident from table 10c that GPA changed by almost the same margin for students with AP test scores of 3, 4 and 5, the policy is likely to have affected credit granting practices only for students with scores of 3. Based on the evidence, it is safe to conclude that the extent of the increases in GPA for the program beneficiaries is related not to the policy but to factors not related to the policy. By the same token, the increase of 0.202 in GPA for the comparison group is also due to factors not related to the AP policy because students in the comparison group did not take AP tests. The larger increase in GPA for students in the comparison group at Kent State University is most likely related to an increasing quality of the incoming freshman class at the institution.

6. Conclusion:

This report examines the impact of the Advanced Placement (AP) policy on academic outcomes of policy beneficiaries attending Ohio's public 4-year university main campuses. In 2007, the Ohio Legislature mandated Ohio public institutions of higher education to adopt standards in awarding college credit for AP tests. Subsequently, the AP policy was formed with inputs from the public institutions and the Ohio Board of Regents (currently known as the Ohio Department of Higher Education). The policy was approved by the *Ohio Articulation and Transfer Advisory Council* and endorsed by the OBR Chancellor. The implementation of the policy was expected to coincide with the arrival of the FY2009-10 freshman class at the institutions.

The AP policy guarantees college credit for students with AP test scores of 3, 4 and 5, and is expected to increase savings by students because the accumulation of early credit helps them face reduced course loads and a potentially shortened required time for graduation. The head-start accorded by the policy could also improve students' college performance. The cornerstone of the AP policy is the hypothesis of equivalent learning outcomes: learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the same of corresponding college courses.

A previous report, from 2013, had estimated the impact of the AP policy on selected short-term indicators of academic outcome using a sample of freshman cohorts from FY2007-08 and FY2008-09 from before the AP policy and from FY2009-10 and FY2010-11 after the policy. Another recent study had used the same sample of students to estimate the impacts of the AP policy on long-term academic outcomes including graduation rates. The studies have found that the AP policy did not influence important academic outcome indicators including GPA and course completion rates in the short run, and graduation rates in the long run. The results validate the basic premise of the AP policy – learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the learning outcomes associated with the corresponding college courses.

In the earlier reports, data considerations had necessitated the use of only two post-policy freshman cohorts, from FY2009-10 and FY2010-11, to identify any change in academic outcomes following the implementation of the AP policy. Since then, data on additional cohorts of freshman students have become available. The current study updates the investigation of the impact of the AP policy on short-term indicators of academic outcome with observations on two additional cohorts of freshman students, from FY2011-12 and FY2012-13. The idea behind the expansion of the sample is to examine if the observed no-impact results and its implied validation of equivalent learning outcomes from the original sample are applicable once information on additional post-policy cohorts are taken into consideration.

Our investigations show that the AP policy continues to have no impact on first-year GPA, course completion rates, and the number of attempted hours when the additional cohorts are included in the sample. The policy, however, is found to have a small, positive influence on first-to-second year retention rates. Similar to the findings from the earlier studies, the no-impact results observed for the

aggregate sample validate the important premise of the AP policy: learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the learning outcomes associated with the corresponding college courses.

The 'no-impact' results are found to hold for separate groups of policy beneficiaries as well; academic outcomes of separate groups of policy beneficiaries – those with different AP test scores or attending different 4-year university main campuses are not influenced by the AP policy. These results ally concerns that students with lower AP test scores, 3 for example, do not master the content of the corresponding college course. Similarly, the results also confirm that academic outcomes of students attending academically more demanding campuses are not adversely affected by the policy. Although estimated AP policy impacts appear to be negative in three campuses, additional investigations show such results to be due to a combination of data anomalies and estimator properties, and not due to the policy itself.

The current study highlights the beneficial role of the AP policy; the policy provides students increased potentials for saving resources, but without any adverse impact on academic standards.