

# Advanced Placement (AP) Policy: Long-Term Impacts on Academic Outcomes at 4-Year Universities

*Ohio Public Institutions of Higher Education*

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

### 1. Background:

The Ohio Board of Regents (OBR), currently known as the Ohio Department of Higher Education (ODHE), implemented its Advanced Placement (AP) policy in FY2009-10. The policy was implemented in response to legislation passed in 2007 by the Ohio Congress. Ohio Revised Code 3333.163 had mandated OBR to create uniform standards in awarding college credit for AP tests. A committee comprising representatives from Ohio public institutions of higher education and the OBR created a set of guidelines, and the resultant policy was approved by the *Ohio Articulation and Transfer Advisory Council* and endorsed by the Chancellor. *Directive 2008-010*, issued to the institutions in summer 2009, 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. Key assumption: Equivalency of learning outcomes

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 learning outcomes associated with the successful completion of corresponding college courses.

### 3. Expected long-term impacts of the AP policy:

If the equivalency of learning outcomes is a valid assumption:

- a. Academic outcomes including college graduation will not be adversely affected by the AP policy.
- b. Students will graduate with fewer hours of credit completed on-campus.
- c. If the number of hours completed on campus declines substantially as a result of the AP policy, policy beneficiaries will experience an increase in early graduation rates.

### 4. Research question: Is the assumption of equivalent learning outcomes valid?

If the assumption of equivalent learning outcomes is not valid and AP curricula are not adequate equals of college courses, academic success of the policy beneficiaries will be adversely affected.

A 2013 report had investigated the question, focusing on AP policy impacts on short-term indicators of academic outcome including first-year grade point average (GPA) and course completion rates. The results showed no impact of the AP policy, validating the assumption of equivalent learning outcome.

The current study extends the evaluation of the AP policy by looking at its impacts on long-term indicators including graduation rates and the number of on-campus hours completed at graduation.

**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. Graduation Rates
- b. Hours of credit completed on-campus at graduation.

**7. Sample components:**

<b>Before policy:</b>	4-year university main campus freshman students: FY2007-08 and FY2008-09 cohorts.
<b>After policy:</b>	4-year university main campus freshman students: FY2009-10, FY2010-11 cohorts.

**8. Results:**

The AP policy does not influence 4-year graduation rates. The study also finds that students with scores of 3, 4 and 5 received 2.5 hours of additional AP credit as a result of the policy, and those who graduated in four years completed 1.7 fewer hours of credit on campus.

**9. Conclusion:**

The no-impact (on graduation) result validates the hypothesis that learning outcomes associated with AP test scores of 3, 4, and 5 are equivalent to the learning outcomes associated with the successful completion of corresponding college courses. However, the same result also implies that the AP policy did not increase early graduation rates of the policy beneficiaries. The AP policy resulted in a 2.5 hour increase of credit granted for AP tests and a decline of 1.7 on-campus completed hours at graduation. Taken together, the results show that students substituted on-campus hours with AP credit without any detrimental effects on their graduation outcomes. While students saved resources as a result of the policy, the number of additional hours of AP credit granted to them due to the policy was not large enough (for the period under consideration) to generate an increase in early graduation rates.

## I. Introduction:

The report estimates the impact of the Advanced Placement (AP) policy on graduation rates and other long-term indicators of academic outcomes for students enrolled in public 4-year university main campuses in Ohio.

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 implementation of the AP policy in FY2009-10, the awarding of credit for AP tests was left to the discretion of individual public institutions of higher education in Ohio. Institutions used to decide whether to grant credit for a particular score in a particular AP test, and when granting credit, they also decided the number of hours to grant, the particular course to which credit was assigned, and if such credit applied to meeting graduation requirements.

In its efforts to create a uniform set of standards in awarding college credit for AP tests, the Ohio State Legislature passed legislation, 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.

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 the number of hours to be granted and the equivalent courses for scores of 3, 4 and 5 in each AP test. Finally, the policy guaranteed that AP credits applied to meeting graduation requirements and also transferred among institutions.

The AP policy guarantees college credit for passing scores in AP tests. The recipients of AP credit, therefore, can potentially graduate with a smaller load of courses completed on campus, and by the

same token, can reduce the time needed for graduation. However, whether students actually take advantage of the AP policy depends crucially on the validity of the assumption that learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to learning outcomes associated with the successful completion of corresponding college courses. If the assumption of equivalent learning outcomes is valid, the expected long-term benefits of the AP policy can indeed be realized.<sup>1</sup>

However, if the assumption of equivalent learning outcomes is not valid, and the AP curricula were not adequate equals of college courses, students receiving credit for AP tests may not be adequately prepared for the rigors of college education. Consequently, although they could start college with a larger accumulation of early credit, the beneficiaries of the AP policy may not be primed for success in subsequent higher level courses. As a result, the subsequent academic outcomes of the policy beneficiaries including degree completion could be adversely affected. Given the benefits expected of the AP policy on the one hand, and the potential for compromised academic standards on the other, it is important to know how the policy influences academic outcomes. If learning outcomes associated with AP test scores of 3, 4 and 5 and the corresponding college courses are indeed equivalent, the AP policy will involve a like-for-like substitution, and will not have an adverse impact on academic outcomes.

In light of the importance of the hypothesis of equivalent learning outcomes, the *Ohio Articulation and Transfer Network* (OATN) had estimated the impact of the AP policy on a number of short-term indicators of academic outcome including first-year grade point average (GPA), the number of attempted hours, and course completion rates. The investigation had used data on cohorts of first-time freshman students attending Ohio public 4-year university main campuses from before and after the implementation of the AP policy.<sup>2</sup> The results of the investigation, published in a 2013 report, show that the AP policy did not influence any of the selected indicators of academic outcomes, providing strong support to the hypothesis that learning outcomes are indeed equivalent.<sup>3</sup>

The short-term focus of the previous investigation was necessitated by data availability considerations; freshman cohorts that enrolled following the implementation of the AP policy had not been in college for a sufficiently long period of time to allow an investigation of long-term effects. The current report extends the investigation by considering long-term academic outcomes such as graduation rates and the number of completed on-campus hours at graduation.

The current study follows the estimation methodology, known as the 'difference-in-difference' (DID) estimator, used in the 2013 report. The methodology requires identifying policy beneficiaries, i.e., students with scores of 3, 4 and 5 in AP tests, and the comparison group, i.e., students without AP tests. Academic outcome indicators such as graduation rates are compared before and after policy implementation for each group. For policy beneficiaries, any change in graduation rates after AP policy implementation represents the impact of the policy plus effects of changes in non-policy factors. For students from the comparison group, any change in outcomes after AP policy implementation represents only the effects of changes in non-policy factors. A comparison of the two differences nets out non-policy effects, and quantifies the impacts of the AP policy. The evaluation uses a sample of first-time freshman 4-year university main campus students from FY2007-08, FY2008-09, FY2009-10, and FY2010-11, the same sample used for the 2013 report.

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<sup>1</sup> Whether students take advantage of the opportunities accorded by the AP policy, and graduate early or with a smaller load of on-campus courses are also tied to factors determining their overall education choices including educational aspirations, resource constraints, and expected post-college earnings.

<sup>2</sup> Because very small proportions of students at 2-year colleges and 4-year university regional campuses have AP test scores of 3, 4 and 5, a separate report presented descriptive results on those institutions.

<sup>3</sup> The report, titled *Advanced Placement (AP) Policy: Impacts on Academic Outcomes at 4-Year Universities* is available at <https://www.ohiohighered.org/transfer/research>.

The recipients of AP credit are usually from more affluent family backgrounds. They are also academically more able, as reflected in their ACT scores and the characteristics of their high-schools and 4-year universities. Since family-financial background, academic ability, and school characteristics go hand-in-hand with college success, the estimation of AP policy impacts takes into account of key demographic, academic, and economic characteristics of the individuals, along with the overall influences of their high-schools and post-secondary institutions.

Graduation outcomes for a freshman cohort are usually expressed with respect to the length of time from initial enrollment to the time of graduation, and the 6-year graduation rate is a popular measure. The current study, however, uses the 4-year graduation rate because information on 6-year graduation outcomes was not available for all of the post-policy cohorts at the time of study. Although more students from the freshman cohorts would go on to graduate beyond the 4th year of attendance, the 4-year rate is a good measure of long-term outcomes for the current study on account of the following. First, a lack of change in the 4-year graduation rate as a result of the AP policy would validate the assumption of equivalent learning outcomes. Second, if 4-year graduation rate declines as a result of the AP policy, it can be interpreted as the policy having adverse long-term impacts academic outcomes thus invalidating the equivalency of learning outcomes. Finally, if the 4-year graduation rate increases as a result of the AP policy, it would indicate the policy promoting early graduation.

The estimates show that the AP policy did not have an impact on 4-year graduation rates. The result is a validation of the hypothesis that learning outcomes associated with scores of 3, 4 and 5 in AP tests are equivalent to the learning outcomes of the corresponding college courses.

The same results, however, also show that the AP policy did not increase early graduation rates. A separate set of estimates show that AP credits granted to individuals increased by 2.5 hours on average as a result of the AP policy. Moreover, among the eventual 4-year graduates, on-campus completed hours declined by 1.7 hours as a result of the AP policy. In other words, the beneficiaries of the AP policy received more credit for their AP tests as a result of the policy which in turn allowed them to reduce the number of on-campus completed hours at graduation. However, although the result clearly shows some substitution between AP credit and on-campus hours, the extent of the increase in AP credit for the particular sample is not large enough to warrant an increase in early graduation rates.

There are questions on whether the results of the AP policy not influencing graduation outcomes apply uniformly to different segments of the beneficiary group. In particular, there are concerns if the no-impact result applies to students with an AP test score of 3, and also to students with AP test scores of 4 and 5. In a similar vein, there are questions on whether the no-impact result holds for students attending different public 4-year university main campuses in Ohio.

Both concerns, however, are found to be misplaced. Results show that the AP policy does not influence 4-year graduation rates when groups of students with AP test scores of 3, 4 or 5 are considered separately. The no-impact result is also found in all but two campuses; the estimated impacts are positive in the two campuses.

The rest of the report is organized as below. Section II provides brief descriptions of the methodology, the data, and the sample selection criteria. Section III portrays demographic, academic and economic characteristics of program beneficiaries and the comparison group. Section IV presents descriptive results, and section V presents analytical results. Concluding remarks are in section VI.

## **II. Methodology and Sample**

### **II.A. Methodology:**

AP policy impacts are estimated with a 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 who enrolled with similar AP test scores but before the implementation of the AP policy did not enjoy such guarantees. A comparison of academic outcomes before and after AP policy implementation for this group reveals policy impacts plus the influence of 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 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.

### **II.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 Ohio Board of Regents (OBR), currently known as the Ohio Department of Higher Education (ODHE); 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 proprietary individual level data on AP tests from the College Board.

### **II.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 FY2007-08 and FY2008-09 cohorts represent the pre-policy period whereas freshman FY2009-10 and FY2010-11 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 a USO 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 an Ohio public 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 institution of higher education as an undergraduate in the previous 6-year period.
- c. Students were 21 years old or younger during the first year of attendance.

### **II.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 assignment.

- 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 USO 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.

**II.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.

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

**II.F. Sample:**

The sample used in the report is based on the selection criteria described in sections II.C, II.D, and II.E. However, data considerations prevented the inclusion of students from one public 4-year university main campus. The sample has 125,310 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 Size N=125,310			
	Before Policy Sample Size N=62,466		After Policy Sample Size N=62,844	
<b>Beneficiary Group:</b> <u>Comprises students with:</u> AP test scores of 3, 4 or 5, College credit for AP tests	<b>Beneficiaries: Before Policy</b> N=15,860		<b>Beneficiaries: After Policy</b> N=17,797	
	FY2007-08 N=7,850	FY2008-09 N=8,010	FY2009-10 N=8,601	FY2010-11 N=9,196
<b>Comparison Group:</b> <u>Comprises students with:</u> No AP test No dual credit No alternative credit	<b>Comparison Group: Before Policy</b> N=46,606		<b>Comparison Group: After Policy</b> N=45,047	
	FY2007-08 N=23,383	FY2008-09 N=23,223	FY2009-10 N=22,541	FY2010-11 N=22,506

### III. Sample Description:

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

Table 2. Demographic, Academic 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=15,860	After Policy N=17,979	Before Policy N=46,606	After Policy N=45,047
Male	50.3%	49.5%	49.5%	49.6%
Age (years)	19.4	19.4	19.5	19.5
<b>Ethnicity</b>				
White	86.5%	84.9%	74.6%	69.7%
Black	3.3%	3.2%	13.8%	15.6%
Hispanic	7.0%	8.1%	6.7%	8.3%
Asian	5.1%	4.6%	1.7%	1.4%
Other ethnicities	2.7%	4.6%	7.7%	10.5%
<b>Academic and Economic Characteristics</b>				
ACT scores (max. 36)	27.3	27.4	20.9	20.8
Family income – 2010-11 constant prices	\$117,459	\$121,623	\$82,954	\$77,445

Note: Average ACT scores and family income are based on non-missing values of the variables.

Columns [1] and [2] of table 2 report demographic, academic and economic characteristics of the AP policy beneficiaries from before and after the implementation of the policy, respectively, while columns [3] and [4] report the same statistics for students from the comparison group.

From a comparison of column [1] and column [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 groups was 19.4 and 19.5 years, respectively.

The two groups, however, differed substantially with respect to ethnicity, ACT scores, and family income. Column [1] table 2 shows that before AP policy implementation, 86.5% of the students from the beneficiary group were White while column [3] shows that only 74.6% 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 – 13.8% – of the comparison group was Black. Similarly, 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 \$117,459 and \$82,954, respectively. Beneficiaries were also academically more able; they had average ACT score was 27.3 while average ACT scores for the comparison group was only 20.8.

Columns [2] and [4] of table 2 inform on 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 period, the beneficiary and the comparison groups were identical with respect to age and gender characteristics in the post-policy period.

However, the observed differences in family income and ethnicity between the beneficiary and the comparison groups become larger after the implementation of the AP policy. For example, the average family income of beneficiaries increased from \$117,459 in the pre-policy period to \$121,623 in the post-policy period, whereas the average family income of the comparison group declined from \$82,954 to \$77,445 over the same period of time. Ethnicity compositions of the two groups also changed in the post-policy period; the proportion of White students among policy beneficiaries declined from 86.5% to 84.9%, but the share of White students declined in a more pronounced way among students in the comparison group – from 74.6% to 69.7%. At the same time, the proportion of Black students remained similar in the beneficiary group but increased from 13.8% to 15.6% in the comparison group.

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, due mostly to the absence of the relevant information for students who had graduated from high schools located outside of Ohio.

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=15,860	After Policy N=17,979	Before Policy N=46,606	After Policy N=45,047
<b>(1).</b> Major urban – very high poverty	3.5%	2.8%	7.1%	8.2%
<b>(2).</b> Rural/Small Town – moderate to high income	4.2%	4.4%	4.4%	4.4%
<b>(3).</b> Rural/Agricultural – high poverty, low income	2.0%	1.8%	4.3%	4.2%
<b>(4).</b> Rural/Agricultural – small student population	3.9%	3.2%	6.1%	5.7%
<b>(5).</b> Urban – low income, high poverty	5.9%	5.0%	9.7%	10.2%
<b>(6).</b> Urban/Suburban – high income	21.7%	21.2%	19.7%	19.6%
<b>(7).</b> Urban/Suburban – very high income	26.9%	30.4%	13.0%	13.2%
<b>(8).</b> School information unavailable	31.7%	31.3%	35.9%	34.4%

Table 3 shows that before the implementation of the AP policy, 48.6% of the students from the beneficiary group were from ‘high or very high income’ urban communities – the combined categories of (6) and (7) from column [1]. In contrast, only 32.7% of the comparison group students were from those two affluent and urban communities, as observed from the same combined categories column [3]. Moreover, the proportion of beneficiaries from ‘low income and high poverty’ communities – combined categories of (1), (3) and (5) in column [1] – added up to only 11.4% before policy implementation, but the same three categories accounted for 21.1% of students in the comparison group in the same period.

The differences between the beneficiary and the comparison groups with respect to the characteristics of their high school communities become wider after the implementation of the AP policy. For example, the proportion of 'high or very high-income' urban communities increased in the beneficiary group from the pre-policy value of 48.6% to 51.6% in the post-policy period. In contrast, the proportion of 'high or very high income' urban communities among students in the comparison group remained similar in the pre and the post-policy periods. On the other hand, the combined proportion of 'low income and high poverty' communities declined from 11.4% to 9.6% in the beneficiary group but increased from 21.1% to 22.6% 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 were also academically more able, as expressed in their higher Act scores, and 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, academic ability and ethnicity characteristics, however, are usually correlated with measures of student success. 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 academic, economic, and ethnic characteristics of students in the quantification of AP policy impacts on academic outcomes of policy beneficiaries.

#### **IV. Descriptive Results:**

This section reports summary statistics on academic outcome indicators for AP policy beneficiaries and for students from the comparison group from before and after the implementation of the AP policy. The descriptive results highlight changes in academic outcomes after the implementation of the AP policy.

The AP policy guarantees college credit for students with scores of 3, 4 and 5 in AP tests. If learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the learning outcomes of the corresponding courses, the policy should not have an adverse impact on the overall rates of graduation. Moreover, since students with scores of 3, 4 and 5 in AP tests are expected to receive a higher number of AP credit hours as a result of the policy, they should have the opportunity of graduating from college with a smaller number of credit hours completed on campus.

Graduation rates for freshman cohorts are usually defined with respect to the length of time from initial enrollment to graduation. The 6-year graduation rate is a common measure of academic assessment because students are considered to have been in college for a sufficiently long period of time to complete the 4-year college degree.<sup>4</sup> The impact of the AP policy, therefore, should ideally be estimated on 6-year graduation rates. However, at the time of the report preparation, graduation information necessary to calculate the 6-year graduation rate was not available for all of the freshman cohorts that enrolled after the implementation of the AP policy, and the current study estimates the impact of the AP policy on 4-year graduation rates. Although additional students from the freshman cohorts would graduate beyond the fourth year of attendance, the 4-year rate is a very good measure of long-term academic outcome for the present study on account of the following. First, a lack of a change in the 4-year graduation rate as a result of the AP policy would validate the assumption of equivalent learning outcomes. Second, if 4-year graduation rates decline as a result of the AP policy, it can be interpreted as the policy having adverse impacts on long-term academic outcomes, thus invalidating the equivalency of

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<sup>4</sup> The Ohio Board of Regents reports 6-year graduation rates of first-time, full-time bachelor degree seeking 4-year university students. The report, *Six-Year Graduation Rates Fall 2006 Cohort of First-Time, Full-Time, Bachelor's Degree-Seeking Students at Ohio's 4-year Public Universities* is available at <https://www.ohiohighered.org/data-reports/graduation-retention>.

learning outcomes. Finally, if 4-year graduation rates increase as a result of the policy, it would indicate that the AP policy promotes early graduation.

Table 4 reports the number of AP credit hours granted to students before and after the AP policy. Column [1] of table 4 shows students with AP test-scores of 3, 4 and 5 had received 8.5 hours of AP credit on average before the implementation of the policy. Column [2] of table 4 shows that students with scores of 3, 4 and 5 in AP tests after the implementation of the AP policy received 11.2 hours of AP credit on average. A comparison of column [1] and column [2] suggests that the AP policy increased the number of AP credit hours by 2.7 hours. However, it is possible that some of the increase in the number of AP credit hours is driven by the changing characteristics of the students in the policy beneficiary group. Column [4] of table 4 shows that AP credit hours increased by 2.5 hours once the influence of individual and institutional characteristics are taken into account.

Table 4. Number of AP Credit Hours Approved by Institutions for AP Credit Recipients: Before and After AP Policy Implementation.

	[1]	[2]	[3]	[4]
	Before AP policy (FY2007-08 & FY2008-09)	After AP policy (FY2009-10 & FY2010-11)	Increase in the average number of AP credit hours after AP policy	Increase in the number of AP hours (adjusted for other factors)
	N = 15,860	N= 17,797		
Number of AP credit hours	8.5 hours	11.2 hours	2.7 hours ***	2.5 hours ***

\*\*\* Increases in the number of AP credit hours after AP policy implementation are statistically significant at 1.0%.

Does the increase in the number of AP credit hours lead to a decline in the number of on-campus completed hours at graduation? Table 5 provides a comparison of completed on-campus hours for the eventual 4-year graduates in the sample. Column [1] and column [2] show that the number of on-campus completed hours at graduation declined from 128.3 to 126.0, by 2.3 hours, for students with scores of 3, 4 and 5 after the AP policy implementation. In contrast, although the number of on-campus completed hours at graduation declined for students without AP credit as well, the extent of the decline – from 129.4 hours to 128.5 hours or 0.9 hours – is much smaller for them. Table 5 suggests that the AP policy reduced the number of on-campus completed hours by a small margin.

Table 5. Comparison of Credit Hours Completed on-campus for 4-Year Graduates Only: AP Policy Beneficiaries and the Comparison Group before and after the Policy.

	[1]		[2]	
	Before AP policy (FY2007-08 & FY2008-09 cohorts)		After AP policy (FY2009-10 & FY2010-11 cohorts)	
Students with AP credit	N=8,774	128.3 hours	N=9,723	126.0 hours
Students without AP credit	N=9,486	129.4 hours	N=8,622	128.5 hours

The major question raised in this section is how 4-year graduation rates change after the implementation of the policy. Table 6 provides a comparison of 4-year graduation before and after the AP policy implementation. Column [1] and column [2] of table 6 show that 4-year graduation rates declined marginally, from 55.3% to 54.6% (by 0.007 points), for students with scores of 3, 4 and 5 in AP

test scores after the implementation of the AP policy. For students without AP tests, graduation rates also declined, from 20.4% to 19.1% (by 0.013 points). Table 6 suggests that 4-year graduation rates changed little for either the beneficiary or the comparison groups after the implementation of the AP policy. As such, it appears that the AP policy did not affect 4-year graduation rates for students with scores of 3, 4 and 5 in AP tests.

Table 6. Comparison of 4-Year Graduation Rates: AP Policy Beneficiaries and the Comparison Group before and after the Policy.

	[1]		[2]	
	Before AP policy (FY2007-08 & FY2008-09 cohorts)		After AP policy (FY2009-10 & FY2010-11 cohorts)	
Students with AP credit	N=15,860	55.3%	N=17,797	54.6%
Students without AP credit	N=46,606	20.4%	N=45,047	19.1%

Note: Differences in graduation rates over time are statistically insignificant for both groups.

## V. Analytical Results

This section presents analytical results – the estimated impacts of the AP policy on 4-year graduation rates and on the number of accumulated on-campus hours at graduation. For estimating the impact of the policy on 4-year graduation rates, the full sample of first-time freshman cohorts from FY2007-08, FY2008-09, FY2009-10, and FY2010-11 is used. In contrast, the impact of the AP policy on the number of on-campus completed hours at graduation is estimated using a smaller group of the eventual 4-year graduates. The impacts are estimated using the difference-in-difference (DID) estimator.

Because AP policy beneficiaries and students from the comparison group differ substantially in academic and socio-economic characteristics, both important determinants of college success, the difference-in-difference estimates of AP policy impacts have been obtained controlling for the influence of a large number of demographic and economic characteristics, as well as of the overall influence of individual campuses the students attended. Moreover, the estimation also takes account of clusters of data in different campuses.

### Results: AP policy does not have an adverse impact on graduation rates

Table 7 presents the DID estimates of the AP policy impacts on 4-year graduation rates. Columns [1], [2], and [3] report estimated values of the differences between the beneficiary and the comparison groups, the time effect, and the AP policy effect, respectively. The group difference in column [1] represents how graduation rates differ between students from the AP group and those from the comparison group, independently of time and policy. The time effect in column [2] represents the effect of time – changes in 4-year graduation rates between the pre and the post-policy periods independently of the policy and the groups; the time effect is common to policy beneficiaries and the comparison group. Finally, column [3] presents the estimated impact of the AP policy on 4-year graduation rates.

Table 7 shows that the AP policy did not influence the 4-year graduation rates for policy beneficiaries. The numerical value of the coefficient is very small, – 0.001 – and the coefficient is also statistically insignificant. Table 7 also shows that graduation rates for either the policy beneficiary group or the comparison group changed little over time. The numerical value of the coefficient is 0.001 and it is statistically insignificant as well. Finally, column [1] of table 7 shows a large difference in graduation

rates, of 17.2 percentage points, between students with scores of 3, 4 and 5 in AP tests and students without AP tests (the comparison group).

Table 7. Estimated Effects of the AP Policy on 4-Year Graduation Rates.

	[1]	[2]	[3]
	Group Effect	Time Effect	AP Policy Effect
Coefficient	0.172	0.001	-0.001
Statistically Significant?	Yes	No	<b>No</b>
R-squared	0.242		
Number of observations	125,310		

The result from table 7, of the AP policy having no impact on 4-year graduation rates provides strong support to the hypothesis of equivalent learning outcomes. In other words, the no-impact result shows that learning outcomes associated with AP test scores of 3, 4, and 5 are indeed equivalent to learning outcomes of corresponding college courses for which students received credit. Otherwise, if the AP curricula were not adequate equals of college courses, the AP policy would have an adverse impact on long-term academic outcomes including 4-year graduation rates.

The same no-impact result, however, also shows that the AP policy did not increase early graduation rates. While the AP policy increased the number of AP credit hours, it apparently did not reduce the number of on-campus completed hours sufficiently to increase early graduation rates.

An investigation of the impact of the AP policy on on-campus completed hours at graduation is presented in table 8. From column [3] of table 8, the AP policy reduced the number of completed on-campus hours at graduation by 1.68 hours. Column [1] of table 8 also shows that students with AP test scores of 3, 4 and 5 generally completed fewer on-campus hours at graduation, although there was no statistically significant impact of time, as observed in column [2] of table 8.

Table 8. Estimated Effects of the AP Policy on the Number of On-Campus Hours at Graduation: 4-Year Graduates Only.

	[1]	[2]	[3]
	Group Effect	Time Effect	AP Policy Effect
Coefficient	-1.353	-0.540	-1.680
Statistically Significant?	Yes	No	<b>Yes</b>
R-squared	0.081		
Number of observations	36,605		

When taken together, the no-impact (on graduation rates) result, the increase in the number of AP credit hours, and the decline in the number of on-campus completed hours at graduation as a result of the AP policy tell the following story.

First, learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to the learning outcomes of college courses for which students received credit. If AP tests were not equals of college curricula, the policy would have led to a decline in graduation rates. Second, the increase in AP credit hours testifies to the direct impact of the policy – students are receiving more credit for scores of 3, 4,

and 5 in AP tests. Third, the decline in the number of number of completed on-campus hours at graduation suggests that students do substitute college credit with AP credit. However, for the particular sample used in the study, neither the extra AP credit nor the consequent decline in the number of on-campus completed hours is not large enough to justify an increase early graduation rates.

**Are AP policy impacts the same for AP test scores of 3, 4 and 5?**

The impacts of the AP policy are estimated on a sample of 125,310 freshman students attending 4-year university main campuses. The estimates showing no impacts on graduation rates and reduced on-campus completed hours, therefore, apply to all AP policy beneficiaries in the sample.

However, there are important differences among the AP policy beneficiaries, especially with respect to the test scores. Prior to the implementation of the AP policy, institutions used discretionary choices in granting AP credit, and although a majority of them used to grant credit for scores of 4 and 5, the granting of credit for a score of 3 was not guaranteed. As such, a major contribution of the AP policy appears to be the guarantee of credit for an AP test score of 3. Consequently, it can be argued that although the AP policy does not influence 4-year graduation rates when students with scores of 3, 4 and 5 are combined, it is possible that the result does not apply uniformly to groups with differential test scores. In particular, if the assumption of equivalent learning outcomes is not valid for students with a score of 3, the AP policy could have an adverse impact on their graduation outcome.

In order to check if the impacts of the AP policy differ by AP test-scores, the impacts of the policy are estimated separately for students with scores of 3, 4 and 5. Table 9 reports the estimates of the policy impact on 4-year graduation rates. Columns [1], [2], and [3] report estimated impacts of the AP policy on graduation rates for students with scores of 3, 4, and 5, respectively. Column [4] reports estimated policy impacts for students in the beneficiary group but without known AP test scores.

Table 9. Estimated Impacts of the AP Policy on 4-Year Graduation Rates: By AP Test Scores.

	[1]	[2]	[3]	[4]
	Test score: 3	Test score: 4	Test score: 5	Test score: NA
AP Policy Effect	0.002	0.011	-0.013	-0.009
Statistically Significant?	<b>No</b>	<b>No</b>	<b>No</b>	<b>No</b>
Group Effect	0.105	0.153	0.209	0.173
Statistically Significant?	Yes	Yes	Yes	Yes
Time Effect	0.002	0.002	0.002	0.002
Statistically Significant?	No	No	No	No
R-squared	0.185	0.196	0.207	0.223
Number of observations	98,814	98,074	96,472	106,409

Columns [1], [2], [3], and [4] of table 9 show that the AP policy did not influence 4-year graduation rates for any of the groups under consideration. The estimated coefficients are all statistically insignificant and the numerical values of the estimates are also very small – 0.002, 0.011, -0.013, and -0.009 for students with scores of 3, 4, 5, and those without known AP test scores, respectively. Based on the results from tables 7 and 9, the AP policy did not influence 4-year graduation rates for the entire group of AP policy beneficiaries, or for separate groups of students with AP test scores of 3, 4 and 5.

### Are AP policy impacts the same for different campuses?

An important related concern is if the no-impact result observed in table 7 holds for different campuses in the sample. The sample includes students from 12 Ohio 4-year public university main campuses. These institutions differ widely with respect to the size of their student populations, the characteristics of their students, and most importantly, with respect to the demands the institutions place on their students. Consequently, it is possible that the AP policy has adverse impacts on graduation rates in academically demanding campuses. If the policy has positive impacts on graduation rates in the less demanding campuses, the contrasting impacts across individual campuses may give rise to the no-impact result when all campuses are combined.

The possibility of differential impacts of the AP policy across campuses is investigated by estimating policy impacts by campus. The results, presented in table 10 show that the AP policy does not influence graduation rates in 10 of the 12 campuses included in the study. For the remaining two campuses, Kent State University and the Ohio University, the AP policy actually increased 4-year graduation rates. For Kent State University, the AP policy impact has a numerical value of 0.051, meaning that the policy increased 4-year graduation rates for policy beneficiaries by 5.1 points. Relative to the pre-policy average 4-year graduation rates of students with AP test scores of 3, 4 and 5 of 48.8%, the 5.1 point increase is equivalent to an increase of 10.5%. For Ohio University, the AP policy increases 4-year graduation rates by 3.6 points. Relative to the pre-policy 4-year graduation rates of students with AP test scores of 3, 4 and 5 of 62.0%, The 3.6 point increase is equivalent to an increase of 5.8%.

Table 10. Estimated Impacts of the AP Policy on 5-Year Graduation Rates: By Campus

	[1]	[2]	[3]
	Group difference	Time Effect	AP Policy Impact
<b>University of Akron</b>			
Estimated Coefficients	0.179	0.001	-0.008
Statistically Significant?	Yes	No	No
<b>Bowling Green State University</b>			
Estimated Coefficients	0.274	0.028	-0.048
Statistically Significant?	Yes	Yes	No
<b>University of Cincinnati</b>			
Estimated Coefficients	0.091	0.043	-0.014
Statistically Significant?	Yes	Yes	No
<b>Cleveland State University</b>			
Estimated Coefficients	0.144	0.020	0.091
Statistically Significant?	Yes	No	No
<b>Kent State University</b>			
Estimated Coefficients	0.211	0.004	0.052
Statistically Significant?	Yes	No	Yes
<b>Miami University</b>			
Estimated Coefficients	0.128	-0.029	0.017
Statistically Significant?	Yes	Yes	No
<b>Ohio State University</b>			
Estimated Coefficients	0.123	-0.043	0.023
Statistically Significant?	Yes	Yes	No

Table 10 (Continued). Estimated Impacts of the AP Policy on 5-Year Graduation Rates: By Campus

	[1]	[2]	[3]
	Group difference	Time Effect	AP Policy Impact
<b>Ohio University</b>			
Estimated Coefficients	0.173	-0.033	0.037
Statistically Significant?	Yes	Yes	Yes
<b>Shawnee State University</b>			
Estimated Coefficients	0.140	0.002	-0.088
Statistically Significant?	Yes	No	No
<b>University of Toledo</b>			
Estimated Coefficients	0.172	0.008	-0.0001
Statistically Significant?	Yes	No	No
<b>Wright State University</b>			
Estimated Coefficients	0.217	0.0002	0.036
Statistically Significant?	Yes	No	No
<b>Youngstown State University</b>			
Estimated Coefficients	0.276	0.003	0.072
Statistically Significant?	Yes	No	No

Finally, although the estimates are statistically insignificant, numerical values of the estimated AP policy impacts for the Bowling Green State University (-0.048), and the Shawnee State University (-0.088) are negative and relatively large.

## VI. Conclusion

This report estimates the impact of the Advanced Placement (AP) policy on long-term indicators of academic outcomes for freshman students attending Ohio public 4-year university main campuses. In 2007, the Ohio Legislature mandated the Ohio Board of Regents (OBR), currently known as the Ohio Department of Higher Education, to adopt standards in awarding college credit for AP tests in Ohio public institutions of higher education. Subsequently, the AP policy was formed with inputs from the institutions of higher education and the OBR. The policy was approved by the *Ohio Articulation and Transfer Advisory Council* and endorsed by the OBR Chancellor. The implementation of the policy coincided with the arrival of the FY2009-10 freshman classes at the institutions. The AP policy guarantees college credit for students with AP test scores of 3, 4 and 5, and is expected to help students save on college costs because the accumulation of early credit helps them face reduced course loads.

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 learning outcomes associated with the corresponding college courses. However, if the assumption of *equivalent learning outcomes* is not valid, and AP tests are not true equals of college courses, the policy will have adverse impacts on academic outcomes of policy beneficiaries. In light of the expected benefits of the policy on the one hand, and the potential for compromised academic standards on the other, a previous investigation had found that the AP policy did not influence a number of indicators of short-term academic outcomes including grade point average (GPA), the number of attempted hours, and course completion rates.

The current study extends the investigation as it considers the impact of the AP policy on long-term academic outcomes such as graduation rates. The study uses the sample used in the previous report: freshman cohorts of 4-year university main campus students from FY2007-08 and FY2008-09 from before the implementation of the policy, and FY2009-10 and FY2010-11 from post-policy period.

The results show that the AP policy does not influence long-term indicator such as 4-year graduation rates. The results also show that the policy led to a small increase in the number of credit hours granted to students for their AP tests, and to a slightly smaller decline in the number of credit hours completed on campus for students who graduated in four years. Additional investigations show that the AP policy did not influence graduation outcomes for separate groups of students with AP test scores of 3, 4 and 5. Moreover, for a majority of campuses, 10 out of the 12 campuses considered in the report, the AP policy does not have an impact on the 4-year graduation rate, and has a positive impact in the two remaining campuses.

In light of the findings, it appears that the AP policy involved some substitution of on-campus college courses with AP credit. Students have an increased opportunity of saving resources but without compromising long-term academic outcomes.