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

## *University System of Ohio Institutions*

**Shoumi Mustafa and Paula Compton**

**Ohio** | **Board of Regents**
University System of Ohio

**John R. Kasich**, Governor
**John Carey**, Chancellor

**August 2013**

**Contents**

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

1. **Background:**

In 2007, the Ohio State Legislature passed legislation – Ohio Revised Code 3333.163 – mandating the Ohio Board of Regents (OBR) to recommend, and the Chancellor to adopt, standards for institutions in the University System of Ohio (USO) in awarding credit to students with passing scores in Advanced Placement (AP) tests. Accordingly, a committee comprising representatives from USO 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 class at USO institutions.

OBR directive 2008-010 to USO 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 within the USO 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 presents findings from an investigation of the impact of the AP policy on academic outcomes of policy beneficiaries at USO 4-year main campuses.

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. Completion rates in sequential courses when students receive AP credit for pre or co-requisites; these courses are attempted within two years of initial enrollment.

**7. Sample components:**

**Before policy:**  4-year university main campus freshman students from FY2007-08 and FY2008-09.
**After policy:**   4-year university main campus freshman students from FY2009-10 and FY2010-11.

**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, and completion rates in sequential courses 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 USO 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.

## I.    Introduction:

This report examines the impact of the Advanced Placement (AP) policy of the Ohio Board of Regents (OBR) on academic outcomes of the policy beneficiaries at 4-year university main campuses in the University System of Ohio (USO); the AP policy guarantees college credit for students with AP test scores of 3, 4 and 5. 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.

In 2007, the Ohio State Legislature passed legislation – Ohio Revised Code 3333.163 – mandating the Ohio Board of Regents (OBR) to recommend, and the Chancellor to adopt, standards for institutions in the University System of Ohio (USO) in awarding credit to students with passing scores in Advanced Placement (AP) tests. Accordingly, a committee comprising representatives from USO 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 OBR 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 class at USO institutions.

OBR directive 2008-010 to USO 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 within the USO according to transfer policy rules.

Prior to the implementation of the AP policy, USO institutions used discretionary choices regarding the cut-off values of AP test scores for which they would grant credit. Even when granting credit for AP tests, institutions decided the number of hours to grant, and the specific course to which those hours would apply. The foremost contribution of the AP policy, therefore, is the system-wide guarantee that students with AP test scores of 3, 4 and 5 receive college credit. The policy also eliminates uncertainties regarding other aspects of the process; institutions provide information on the number of hours they would grant in specific courses for scores of 3, 4 and 5 in each of the 30-plus AP tests. Because AP credits apply to meeting graduation requirements and also transfer among USO institutions, AP policy beneficiaries have the opportunity of saving on college costs as they face a reduced course-load and a shortened required time for graduation. Finally, the head-start received by AP policy beneficiaries could increase their subsequent academic success as well.

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 learning outcomes associated with the corresponding college courses. The ability of the AP policy in achieving the desired outcomes, namely reduced course-loads, shortened required graduation time, and increased savings, therefore, depends crucially on the validity of the assumption. If AP curricula are not adequate equals of college courses, subsequent academic performance of policy beneficiaries will be adversely affected.

In light of the benefits expected of the AP policy on the one hand, and the potential for compromised academic standards on the other, it is necessary to conduct an empirical investigation of how the policy influences academic outcomes. The *Ohio Articulation and Transfer Network* (OATN) has, accordingly, carried out an investigation of AP policy impacts on selected indicators of academic outcome of policy beneficiaries at 4-year university main campuses.[1] OBR *Directive 2008-010* had also specified a review of the AP policy within three years of implementation.[2]

At the outset, it is important to recognize that the AP policy is beneficial if it has positive impacts on academic outcomes of policy beneficiaries. More importantly, even if the AP policy does not influence academic outcomes, a likely scenario if AP test scores of 3, 4 and 5, and corresponding college courses confer equivalent learning outcomes, society still benefits because policy beneficiaries have opportunities of reducing college costs but without an adverse impact on their academic outcomes. A rethinking of the AP policy is necessary only if empirical findings reveal adverse impacts on academic outcomes of policy beneficiaries.

The report uses three specific indicators of academic outcome from students' first year of attendance: grade point average (GPA), the number of attempted hours, and the proportion of completed hours. The report also investigates the impact of the AP policy on completion rates in sequential higher level courses taken within two years of initial enrollment. Calculus II, calculus-based Physics I, and English Composition II are the three higher level courses considered in this report. AP policy stipulates that students with scores of 3, 4 or 5 in Calculus AB, an AP test, receive college credit in Calculus I which is a prerequisite course for Calculus II and a co-requisite course for calculus-based Physics I. Similarly students with scores of 3, 4 or 5 in English Language or English Literature (both AP tests) receive credit for English Composition I which is a prerequisite for English Composition II.

AP policy impacts are estimated using a method known as the 'difference-in-difference' (DID) estimator. The methodology requires identifying policy beneficiaries, i.e., students with scores of 3, 4 and 5 in AP tests, and students in the comparison group, i.e., those without AP tests. Average academic outcomes are compared before and after policy implementation for each group. For policy beneficiaries, any change in academic outcome after AP policy represents the impact of the policy itself plus effects of changes in other factors not related to the policy. For students from the comparison group, any change in academic outcomes after AP policy implementation represents only the effects of changes in non-policy factors. A comparison of the two differences nets out effects of non-policy factors, and AP policy impacts are quantified.

The sample used in this report is drawn on freshman 4-year university main campus students at USO institutions. Students from FY2007-08 and FY2008-09 cohorts represent the pre-policy period, and those from the FY2009-10 and FY2010-11 cohorts represent the post-policy period.

The recipients of AP credit are usually from more affluent family backgrounds. They are also academically more able, as reflected in their higher ACT scores. 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, academic, and economic characteristics of students, as well as of the overall influence of the institutions they attended.

---

[1] 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 presents descriptive results on those institutions.
[2] Some USO institutions may have made their FY2009-10 AP credit decisions prior to receiving *Directive 2008-010*; those institutions implemented the policy in FY2010-11, extending the three-year period to FY2012-13.

The results show that for the combined sample of 4-year university main campus students, the AP policy did not have an impact on academic outcomes. Estimated impacts of the AP policy on grade point average, the number of attempted hours, the proportion of completed hours, and completion rates in sequential higher level courses, namely Calculus II, Physics I, and English Composition II, are numerically small and statistically insignificant.

The no-impact results validate the basic assumption of the AP policy regarding the equivalency of learning outcomes between AP tests and college courses. However, do such results apply uniformly to different segments of the beneficiary group? In particular, it is of interest to know if the AP policy has the same no-impact result for students with test scores of 3 and those with test scores of 4 or 5. In a similar vein, one can ask if the no-impact result holds for policy beneficiaries attending different 4-year university main campuses within the USO.

Our investigations show that the 'no-impact' result holds for separate groups of policy beneficiaries with AP test scores of 3, 4 and 5, allaying concerns that students with a test score of 3 do not master the necessary learning outcomes. In a similar manner, the no-impact result is observed to hold in individual 4-year university main campuses, including those with more demanding academic requirements.

The no-impact result highlights 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 II provides brief descriptions of the methodology, the data, and the sample selection criteria, and 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 with similar AP test scores but before 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 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 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.

**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 a USO 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 a USO institution 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 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 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.D, II.E, and II.F. However, data considerations prevented the inclusion of students from one 4-year university main campus in the sample. 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 | |
| **Beneficiary Group:** Comprises students with: AP test scores of 3, 4 or 5, College credit for AP tests | Beneficiaries: Before Policy N=15,860 | | Beneficiaries: After Policy N=17,797 | |
| | FY2007-08 N=7,850 | FY2008-09 N=8,010 | FY2009-10 N=8,601 | FY2010-11 N=9,196 |
| **Comparison Group:** Comprises students with: No AP test No dual credit No alternative credit | Comparison Group: Before Policy N=46,606 | | Comparison Group: After Policy 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 |

Table 2 (continued). 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 |
| **Ethnicity** | | | | |
| 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% |
| **Academic and Economic Characteristics** | | | | |
| 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 [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 ages of students in the beneficiary and the comparison group were 19.4 and 19.5 years, respectively.

The two groups, however, differed substantially with respect to ethnicity, ACT scores, and family income. Columns [1] and [3] of table 2 show that before AP policy implementation, 86.5% of the students from the beneficiary group were White while 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 $117,454 and $82,954, respectively. Beneficiaries were also academically more able; they had average ACT score was 27.3 while average ACT score for the comparison group was only 20.8.

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 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, large differences in family income, ACT score, and ethnicity between beneficiaries and the comparison group become larger after AP policy implementation. 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. The difference in ACT scores also widened marginally between the two groups as average ACT scores increased from 27.3 to 27.4 for beneficiaries and declined from 20.9 to 20.8 for the comparison group.

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 partially to the absence of 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 |
| (1). Major urban – very high poverty | 3.5% | 2.8% | 7.1% | 8.2% |
| (2). Rural/Small Town – moderate to high income | 4.2% | 4.4% | 4.4% | 4.4% |
| (3). Rural/Agricultural – high poverty, low income | 2.0% | 1.8% | 4.3% | 4.2% |
| (4). Rural/Agricultural – small student population | 3.9% | 3.2% | 6.1% | 5.7% |
| (5). Urban – low income, high poverty | 5.9% | 5.0% | 9.7% | 10.2% |
| (6). Urban/Suburban – high income | 21.7% | 21.2% | 19.7% | 19.6% |
| (7). Urban/Suburban – very high income | 26.9% | 30.4% | 13.0% | 13.2% |
| (8). School information unavailable | 31.7% | 31.3% | 35.9% | 34.4.% |

Before policy implementation, 48.6% 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 32.7% 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 combined proportion of beneficiaries from 'low income and high poverty' communities – combined categories (1), (3) and (5) from 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.

The extent of differences in 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 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 'low income and high poverty' communities declined from 11.4% to 9.6% among students in the beneficiary group but increased from 21.1% to 22.6% 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 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 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 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 separately for the pre and post-policy periods.

Table 4 reports the summary statistics on Grade Point Average (GPA), the number of attempted hours, and the proportion of completed hours, all from students' first year of attendance. In a similar manner, table 5 reports summary statistics on completion rates in sequential higher level courses; students had attempted those courses in two years following initial enrollment as freshman students.

The comparison of the average values of academic outcome indicators by beneficiary-comparison status, and also 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. 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=15,860 | After Policy N=17,797 | Before Policy N=46,606 | After Policy N=45,047 |
| GPA | 3.252 | 3.242 | 2.434 | 2.382 |
| Hours attempted | 32.192 | 32.075 | 27.892 | 27.641 |
| Proportion of hours completed | 94.4% | 94.6% | 79.3% | 78.7% |

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 students from the comparison group – from column [3] – before AP policy implementation; the average GPA for beneficiaries and the comparison group was 3.252 and 2.434, respectively. Similarly, the average number of attempted hours for the two groups was 32.192 and 27.892 hours, respectively, and the proportion of completed hours was 94.4% and 79.3%, respectively.

Columns [2] and [4] of table 4 inform on the post-policy comparison of average academic outcomes for beneficiaries and the comparison group, respectively. Although average values of the three indicators changed marginally in the post-policy period for each group, the large difference between them

observed in the pre-policy period remained unchanged in the post-policy period. For example, average GPA declined marginally from 3.252 to 3.242 for the beneficiaries and from 2.434 to 2.382 for students in the comparison group. The average number of attempted hours declined marginally for both groups after the policy, while the proportion of completed hours increased slightly for beneficiaries, from 94.4% to 94.6%, and declined from 79.3% to 78.7% for the comparison group.

Table 5. Course Completion Rates in Sequential Higher Level Courses when Students Receive Credit for pre or co-requisite Courses: By Policy Beneficiary Status and the Timing of Policy Implementation.

| | Beneficiary | | Comparison | |
|---|---|---|---|---|
| | [1] | [2] | [3] | [4] |
| Course completion Rate: Calculus II | Before Policy N=1,426 | After Policy N=1,452 | Before Policy N=2,511 | After Policy N=2,544 |
| | 94.2% | 95.7% | 84.6% | 86.1% |
| Course completion Rate: Physics I | Before Policy N=1,012 | After Policy N=1,041 | Before Policy N=1,911 | After Policy N=1,838 |
| | 96.8% | 96.6% | 90.1% | 91.3% |
| Course completion Rate: English Composition II | Before Policy N=2,575 | After Policy N=2,777 | Before Policy N=26,619 | After Policy N=25,000 |
| | 97.8% | 97.2% | 90.2% | 89.2% |

Table 5 reports average values of completion rates in Calculus II, Physics I and English Composition II, all sequential higher level courses. For each of the three courses, students receive credit in respective pre or co-requisite courses for scores of 3, 4 or 5 in specific AP tests. For example, scores of 3, 4 or 5 in Calculus AB (an AP test) guarantee credit in Calculus I, which in turn is the pre-requisite course for Calculus II and a co-requisite course for Physics I. Similarly, scores of 3, 4 or 5 in English Language or English Literature, both AP tests, guarantee credit in Composition I, the pre-requisite course for Composition II.

Table 5 shows that before policy implementation, students from the policy beneficiary group recorded substantially higher completion rates – from column [1] – relative to students from the comparison group – column [3] – in any of the three sequential higher level courses. For example, before policy implementation, beneficiaries and comparison group students had average completion rates of 94.2% and 84.6%, respectively, in Calculus II. Similarly large pre-policy differences in completion rates are observed between the two groups for calculus-based Physics I and English Composition II.

Looking at columns [1] and [2] of table 5 for the beneficiary group, and columns [3] and [4] for the comparison group, it becomes clear that completion rates changed very little for either group in any of the three sequential higher courses from their respective pre-policy values. For example, after AP policy implementation, beneficiaries had average completion rates of 95.7% in Calculus II, marginally higher than the pre-policy value of 94.2%, while the pre and post-policy average completion rates in Calculus II for the comparison group were 84.6% and 86.1%, respectively.

In light of the common observation from table 4 and table 5 – of very small magnitude changes in academic indicators before and after AP policy implementation for either beneficiaries or the comparison group, it appears that AP policy exerted little influence on academic outcomes of policy beneficiaries.

## V. Analytical Results

### V.A. Aggregate Sample

This section presents analytical results – the estimated impacts of the Advanced Placement policy on indicators of academic outcome. The impacts are estimated using the difference-in-difference (DID) estimator on the sample of first-time freshman students attending 4-year university main campuses in the University System of Ohio.

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 academic, demographic, and economic characteristics, as well as of the overall influence of individual campuses the students attended. Moreover, the estimation also takes explicit account of the possibility that standard errors are correlated among clusters of students enrolled in the same 4-year university main campus.

**Results: AP policy does not influence GPA, attempted hours, or course completion rates**

Table 6 presents DID estimates of AP policy impacts on three indicators of academic outcome from students' first year of attendance: GPA, the number of attempted hours, and the proportion of completed hours.

There are three entries in the left-most column of table 6; 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) represents the impact of the AP policy.

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.

| | [1] | [2] | [3] |
|---|---|---|---|
| | **GPA Scale: (0-4)** | **Attempted hours** | **Completion Ratio** |
| | Coefficient (Std. Error) | Coefficient (Std. Error) | Coefficient (Std. Error) |
| **(1). Effect of Time:** (Difference between after & before policy, common to beneficiaries & comparisons). | -0.018 (0.021) | 0.012 (0.118) | 0.004 (0.004) |
| **(2). Effect of Group:** (Average difference between beneficiaries & comparisons). | 0.420*** (0.068) | 2.058*** (0.448) | 0.064*** (0.014) |
| **(3). Effect of Policy:** (Change in outcome for beneficiaries after policy). | Increase of 0.037 points. (0.023) | Increase of 0.058 hours. (0.131) | Increase of 0.003 points. (0.005) |
| Is the estimated impact statistically significant? | No. | No. | No. |
| **Policy Impact?** | **No impact.** | **No impact.** | **No impact.** |
| R-squared | 0.259 | 0.200 | 0.198 |
| Number of observations | 125,310 | 125,310 | 125,310 |

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

The entries in row (1) of table 6 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, or the proportion of completed hours; the estimates are small in magnitude and also statistically insignificant.

The entries in row (2), in contrast, 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, for example, had recorded a 0.420 higher first-year GPA, attempted 2.058 more hours, and completed 6.4 percentage points more of the attempted hours on average.

Finally, row (3) of table 6 reports estimated impacts of the AP policy on GPA, the number of attempted hours, and the proportion of completed hours. The coefficients show that the AP policy had small, positive and statistically insignificant associations with each of the outcome indicators. According to the numerical values of the coefficients, first-year GPA of policy beneficiaries increased by 0.037, equivalent to 1.2% of the pre-policy average GPA of 3.3, and the number of attempted hours increased by 0.058 hours, equivalent to 0.2% of the pre-policy average value of 32.1 hours. Finally, the proportion of completed hours increased by 0.3 percentage points, equivalent to 0.3% of the pre-policy average completion rate of 94.6%. However, since the estimated coefficients are all statistically insignificant, the AP policy did not have an impact on any of the three indicators of academic outcome in table 6.

**Results: AP policy does not influence completion rates in sequential higher level courses**

Although table 6 shows that the AP policy did not influence academic outcomes from the first year of attendance, it is possible that the policy influences outcomes in subsequent years and especially those in sequential higher level courses when credit for pre or co-requisite courses are guaranteed under the policy. AP policy impacts on course completion rates in Calculus II, calculus-based Physics I, and English Composition II are investigated in this regard. Table 7 reports the estimated impacts; estimates in rows (1) and (2) represent time and group effects, respectively, and row (3) represents AP policy impacts.

The estimates in row (1) of table 7 show that the effect of time, i.e., changes in non-policy determinants of academic outcome, had little influence on course completion rates in Calculus II, calculus-based Physics I or English Composition II; the estimated impacts of time are small and statistically insignificant. The entries in row (2), in contrast, are large and statistically significant, meaning that regardless of the AP policy, students in the policy beneficiary group had substantially higher completion rates in the higher level courses, relative to their counterparts from the comparison group. For example, beneficiaries recorded 7.2, 5.0, and 2.4 percentage point higher completion rates in Calculus II, Physics I, and English Composition II, respectively, relative to students from the comparison group.

Row (3) of table 7 reports estimates of AP policy impacts on course completion rates. The three reported coefficients are all statistically insignificant, meaning that the AP policy did not influence completion rates of the AP policy beneficiaries in any of the three sequential higher level courses. Numerical values of the estimates are rather small as well; completion rates of policy beneficiaries in Calculus II and English Composition II increased by 0.012 and 0.003 points, respectively, and completion rate in Physics I declined by 0.008 points.

Table 7. Estimated Effects of the AP Policy on Sequential Higher Level Courses when Students Receive Credit for Pre or Co-Requisite Courses.

| | [1] | [2] | [3] |
|---|---|---|---|
| | **Calculus II** | **Physics I** | **Composition II** |
| | Coefficient (Std. Error) | Coefficient (Std. Error) | Coefficient (Std. Error) |
| **(1). Effect of Time:** (Difference between after & before policy, common to beneficiaries & comparisons). | 0.008 (0.014) | 0.013 (0.009) | -0.003 (0.011) |
| **(2). Effect of Group:** (Average difference between beneficiaries & comparisons). | 0.072*** (0.014) | 0.050*** (0.012) | 0.024** (0.010) |
| **(3). Effect of Policy:** (Change in academic outcome for beneficiaries after policy). | 0.012 (0.026) | -0.008 (0.015) | 0.003 (0.004) |
| Is the estimated impact statistically significant? | No | No | No |
| **Policy Impact?** | **No Impact** | **No Impact** | **No Impact** |
| R-squared | 0.054 | 0.044 | 0.047 |
| Number of observations | 7,933 | 5,802 | 56,971 |

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

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 receive 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 college credit for AP tests are guaranteed under the new policy? The results in tables 6 and 7 provide direct answers to the question, and clearly show that the AP policy did not influence academic outcomes of policy beneficiaries. These results are in exact consonance with 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 the corresponding college courses.

It is important in this regard to consider the fact that outcome indicators used in this report involve those from the first year of attendance as well as completion rates in sequential higher level courses attempted within two years of initial enrollment. The sequential nature of the higher level courses is of particular importance because policy beneficiaries are eligible to receive AP credit for the relevant prerequisite courses. The results, therefore, show that students manage a similar degree of mastery of the necessary learning outcomes when they receive scores of 3, 4 and 5 in an AP test or when they complete the corresponding college course.

**V.B. Are the no-impact results uniform?**

The results in section V.A demonstrate that the AP policy did not influence academic outcomes of students receiving college credit for AP tests, validating the fundamental underpinning of the policy that learning outcomes associated with AP test scores of 3, 4 and 5 are equivalent to learning outcomes associated with the corresponding college courses.

Although the no-impact result applies to all indicators of academic outcomes used in the report, it remains to be seen whether such results apply uniformly to different segments of the policy beneficiary group. In particular, it is important to know if the no-impact result applies to separate groups of students with AP test-scores of 3, 4 and 5, respectively, or to separate groups of students attending different 4-year university main campuses in the University System of Ohio.

**Testing the uniformity of no-impact results: Policy impacts do not vary by AP test scores**

Although the AP policy is found not to influence academic outcomes when students with AP test scores of 3, 4 and 5 are included in the policy beneficiary group, there are concerns that the policy may have adverse impacts for students with AP test scores of 3. The underlying hypothesis is that students with scores of 3 cannot master the necessary learning outcomes although those with scores of 4 and 5 can. If the hypothesis is true, then the no-impact result is observed because the academic success of students with scores of 4 and 5 offset the adverse result for students with scores of 3.

Tables 8.a, 8.b, and 8.c present conclusive evidence against the hypothesis that the no-impact result is not uniform across test-scores. The tables show that the AP policy does not have an impact on academic outcomes for separate groups of students with AP test scores of 3, 4 or 5.

Table 8.a presents estimated impacts of the AP policy on the first-year grade point average (GPA) separately for students with scores of 3, 4 and 5. Tables 8.b and 8.c present similar sets of estimated impacts of the AP policy on the number of attempted hours and the proportion of completed hours, respectively.

Table 8.a. Impacts of the AP Policy by AP Test Scores: Grade Point Average (GPA).

| AP Test scores | GPA: Before Policy | GPA: After Policy | GPA(After Policy) – GPA(Before Policy) | Policy impact on GPA | Statistically significant? |
|---|---|---|---|---|---|
| 3 | 3.118 | 3.038 | 3.038 – 3.118 = -0.080 | -0.080 – (**-.052**)= -0.028 points | No |
| 4 | 3.241 | 3.220 | 3.220 – 3.241 = -0.021 | -0.021– (**-.052**)= 0.031 points | No |
| 5 | 3.469 | 3.458 | 3.458 – 3.469 = -0.011 | -0.011– (**-.052**)= 0.041 points | No |
| Score not known* | 3.253 | 3.261 | 3.261 – 3.253 = 0.018 | 0.008– (**-.052**)= 0.060 points | No |
| **No AP test** | 2.434 | 2.382 | 2.382 – 2.434 = **-0.052** | - | - |

\* Identification information is not available for a subset of AP test-takers who went on to attend USO institutions. Consequently, their AP test scores cannot be known. However, the institutions report such students as recipients of AP credit.

Table 8.a shows that the AP policy has numerically small and statistically insignificant effects on the first-year GPA for students with test scores of 3, 4 and 5. Similarly, tables 8.b and 8.c show that the AP policy did not influence the number of attempted hours or the proportion of completed hours for any of the

three separate groups considered. For each group of student (with scores of 3, 4 and 5), the AP policy has numerically small and statistically insignificant impacts on the number of attempted hours and the proportion of completed hours.

Table 8.b. Impacts of the AP Policy by AP Test Scores: Number of Attempted Hours.

| AP Test scores | Hours: Before Policy | Hours: After Policy | Hours (After Policy) – Hours (Before Policy) | Policy impact on attempted hours | Statistically significant? |
|---|---|---|---|---|---|
| 3 | 31.7 | 31.4 | 31.4 – 31.7 = -0.3 | -0.3 – (**-0.3**)= 0.0 hours | No |
| 4 | 32.4 | 32.0 | 32.0 – 32.4 = -0.4 | -0.4– (**-0.3**)= **-0.1** hours | No |
| 5 | 32.7 | 33.0 | 33.0 – 32.7 = 0.3 | 0.3– (**-0.3**)= 0.0 hours | No |
| Score not known | 32.2 | 32.1 | 32.1 – 32.2 = -0.1 | -0.1– (**-0.3**)= 0.2 hours | No |
| **No AP test** | 27.9 | 27.6 | 27.6 – 27.9 = **-0.3** | - | - |

Table 8.c. Impacts of the AP Policy by AP Test Scores: Proportion of Completed Hours.

| AP Test scores | Comp. Ratio: Before Policy | Comp. Ratio After Policy | Ratio (After Policy) – Ratio (Before Policy) | Policy impact on Completion Ratio | Statistically significant? |
|---|---|---|---|---|---|
| 3 | 0.930 | 0.922 | 0.922 – 0.930 = -0.008 | -0.008 – (**-.006**)= -0.002 (0.2 percentage points) | No |
| 4 | 0.944 | 0.945 | 0.945 – 0.944 = 0.001 | 0.001– (**-.006**)= 0.007 (0.7 percentage points) | No |
| 5 | 0.961 | 0.963 | 0.963 – 0.961 = 0.002 | 0.002– (**-.006**)= 0.008 (0.8 percentage points) | No |
| Score not known | 0.946 | 0.950 | 0.950 – 0.946 = 0.004 | 0.004– (**-.006**)= 0.010 (0.1 percentage points) | No |
| **No AP test** | 0.793 | 0.787 | 0.787 – 0.793 = **-0.006** | - | - |

The uniformity of the no-impact result by test scores is further tested using completion rates in sequential higher level courses. The results on completion rates in Calculus II, University Physics I, and Composition II are presented in tables 9.a, 9.b, and 9.c, respectively.

Tables 9.a shows that the AP policy has numerically small and statistically insignificant impacts on completion rates in Calculus II for separate groups of students with scores of 3, 4 and 5 in Calculus AB; under the AP policy, these scores guarantee college credit in Calculus I, the pre-requisite for Calculus II. Calculus I is also the co-requisite for University Physics I and table 9.b shows that completion rates in University Physics I are not affected for any of the separate groups of students with scores of 3, 4 or 5 in Calculus AB; the estimated impacts are all numerically small and statistically insignificant. Finally, table 9.c shows that the AP policy does not influence completion rates in English Composition II for any of the separate groups of students with scores of 3, 4 or 5 in English Language or English Literature (AP tests); these students receive credit for Composition I, the pre-requisite course for Composition II.

Table 9.a. Impacts of the AP Policy on Completion Rates in Calculus II: By Test Scores in Calculus AB.

| AP Test scores | Comp. Ratio: Before Policy | Comp. Ratio After Policy | Ratio (After Policy) – Ratio (Before Policy) | Policy impact on Completion Ratio | Statistically significant? |
|---|---|---|---|---|---|
| Calculus AB: 3 | 0.922 | 0.936 | 0.922 – 0.936 = -0.014 | -0.014–(**-0.016**)= 0.002 (0.2 percentage points) | No |
| Calculus AB: 4 | 0.941 | 0.956 | 0.956 – 0.941 = 0.015 | 0.015 – (**-0.016**)= 0.031 (3.1 percentage points) | No |
| Calculus AB: 5 | 0.971 | 0.982 | 0.982 – 0.971 = 0.011 | 0.011 – (**-0.016**)= 0.027 (2.7 percentage points) | No |
| **No AP test** | 0.846 | 0.862 | 0.846 – 0.862 = **-0.016** | - | - |

Table 9.b. Impacts of the AP Policy on Completion Rates in Physics: By Test Scores in Calculus AB.

| AP Test scores | Comp. Ratio: Before Policy | Comp. Ratio After Policy | Ratio (After Policy) – Ratio (Before Policy) | Policy impact on Completion Ratio | Statistically significant? |
|---|---|---|---|---|---|
| Calculus AB: 3 | 0.934 | 0.947 | 0.947 – 0.934 = 0.013 | 0.013 – (**0.012**)= 0.001 (0.1 percentage points) | No |
| Calculus AB: 4 | 0.968 | 0.957 | 0.957 – 0.968 = -0.011 | -0.011– (**0.012**)=- 0.023 (-2.3 percentage points) | No |
| Calculus AB: 5 | 0.990 | 0.986 | 0.986 – 0.990 =- 0.004 | 0.004– (**-0.012**)= -0.008 (-0.8 percentage points) | No |
| **No AP test** | 0.901 | 0.913 | 0.913 – 0.901 = **0.012** | - | - |

Table 9.c. Impacts of the AP Policy on Completion Rates in Composition II: By Test Scores in Language or Literature.

| AP Test scores | Comp. Ratio: Before Policy | Comp. Ratio After Policy | Ratio (After Policy) – Ratio (Before Policy) | Policy impact on Completion Ratio | Statistically significant? |
|---|---|---|---|---|---|
| Lang. /Lit.: 3 | 0.975 | 0.966 | 0.966 – 0.975 = -0.009 | 0.009 – (**-0.010**)= 0.001 (0.1 percentage points) | No |
| Lang. /Lit.: 4 | 0.987 | 0.977 | 0.977 – 0.987 = -0.010 | -0.010– (**-0.010**)= 0.0 (0 percentage points) | No |
| Lang. /Lit.:5 | 0.977 | 0.989 | 0.989 – 0.977 =- 0.012 | -0.012– (**-0.010**)= -0.002 (-0.2 percentage points) | No |
| **No AP test** | 0.902 | 0.892 | 0.892 – 0.902 =**-0.010** | - | - |

**Testing the uniformity of the no-impact result: Do policy impacts vary by campus?**

Four-year university main campuses in the University System of Ohio differ with respect to the size of the 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 USO 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 and generate the observed no-impact result.

An investigation of the hypothesis is presented in table 10. Table 10 presents estimated impacts of the AP policy on first-year GPA, the number of attempted hours, and the proportion of completed hours for a subset of the 4-year university main campuses in the University System of Ohio. Table 10 clearly shows that the AP policy does not have adverse effects on GPA and the proportion of completed hours in any of the 10 campuses reported in the table; among the 10 campuses, GPA increases in two and remains unchanged in eight. Moreover, completion rates do not change in any of the 10 campuses reported in table 10. Table 10 also shows that the number of attempted hours increases in four campuses, declines in two, and remains unchanged in four other campuses. Table 10, therefore, demonstrates that the AP policy has small positive or no impact on the two important indicators of academic outcome, GPA and the proportion of completed hours.[3]

Table 10. Estimated Impacts of the AP Policy on Selected Indicators of Academic Outcomes for Policy Beneficiaries: By Individual 4-Year University Main Campuses.

| Institution | Estimated impacts | GPA Scale: (0-4) | Attempted hours | Completion Ratio |
|---|---|---|---|---|
| University of Akron | Numerical value | Increase of 0.061 points | Increase of 0.064 hours. | Increase of 0.9 percentage points |
| | Statistically significant? | No. | No. | No. |
| | **Impact** | **No impact.** | **No impact.** | **No impact.** |
| Bowling Green State University | Numerical value | Decline of 0.004 points. | Increase of 0.069 hours. | Decline of 0.1 percentage points. |
| | Statistically significant? | No. | No. | No. |
| | **Impact** | **No impact.** | **No impact.** | **No impact.** |
| Kent State University | Numerical value | Increase of 0.025 points. | Decline of 0.229 hours. | Increase of 0.08 percentage points. |
| | Statistically significant? | No. | No. | No. |
| | **Impact** | **No impact.** | **No impact.** | **No impact.** |
| Miami University | Numerical value | Decline of 0.007 points. | Increase of 0.537 hours. | Decline of 0.1 percentage points. |
| | Statistically significant? | No. | Yes. | No. |
| | **Impact** | **No impact.** | **Increase of 0.537 hours.** | **No impact.** |
| Ohio State University | Numerical value | Increase of 0.040 points. | Decline of 0.359 hours. | Decline of 0.6 percentage points. |
| | Statistically significant? | Yes. | Yes. | No. |
| | **Impact** | **Increase of 0.040 points.** | **Decline of 0.359 hours.** | **No impact.** |

---

[3] Negative impacts on the number of attempted hours mean that AP credits substitute for college credit.

Table 10 (continued). Estimated Impacts of the AP Policy on Selected Indicators of Academic Outcomes for Policy Beneficiaries: By Individual 4-Year University Main Campuses.

| Institution | Estimated impacts | GPA Scale: (0-4) | Attempted hours | Completion Ratio |
|---|---|---|---|---|
| Ohio University | Numerical value | Increase of 0.029 points. | Decline of 0.239 hours. | Increase of 0.03 percentage points. |
| | Statistically significant? | No. | No | No. |
| | **Impact** | **No impact.** | **No impact.** | **No impact.** |
| Shawnee State University | Numerical value | Decline of 0.269 points. | Decline of 2.747 hours. | Decline of 5.4 percentage points. |
| | Statistically significant? | No. | Yes. | No. |
| | **Impact** | **No impact.** | **Decline of 2.747 hours.** | **No impact.** |
| University of Toledo | Numerical value | Increase of 0.100 points. | Increase of 0.676 hours. | Increase of 1.6 percentage points. |
| | Statistically significant? | No | Yes. | No. |
| | **Impact** | **No impact.** | **Increase of 0.676 hours.** | **No impact.** |
| Wright State University | Numerical value | Decline of 0.032 points. | Increase of 1.003 hours. | Decline of 0.9 percentage points. |
| | Statistically significant? | No. | Yes. | No. |
| | **Impact** | **No impact.** | **Increase of 1.003 hours.** | **No impact.** |
| Youngstown State University | Numerical value | Increase of 0.209 points. | Increase of 1.663 hours. | Decline of 2.1 percentage points. |
| | Statistically significant? | Yes. | Yes. | No. |
| | **Impact** | **Increase of 0.209 points.** | **Increase of 1.679 hours.** | **No impact.** |

**Apparently adverse policy effects: Cleveland State University and the University of Cincinnati**

The AP policy, however, appears to have an adverse effect on first-year GPA at the Cleveland State University. The policy also appears to have adverse effects on both first-year GPA and the proportion of completed hours at the University of Cincinnati.

The numerical values of the estimated impacts are presented in table 11. Table 11 suggest that first-year GPA declined by 0.249 points at Cleveland State University as a result of the AP policy; the extent of the apparent decline is equivalent to 7.7% of the pre-policy GPA of AP test-takers at the institution. Table 11 also suggests that first-year GPA declined by 0.098 points at the University of Cincinnati, equivalent to 2.9% of the pre-policy GPA of 3.3, and first-year course completion rates appeared to decline by 2.6 percentage points, equivalent to 2.8% of the pre-policy completion rate of 93.3%.

Table 11. Estimated Impacts of the AP Policy on Academic Outcome Indicators: University of Cincinnati and Cleveland State University.

| Institution | Estimated impacts | GPA Scale: (0-4) | Attempted hours | Completion Ratio |
|---|---|---|---|---|
| Cleveland State University | Numerical value | Decline of 0.249 points. | Increase of 0.372 hours. | Decline of 4.6 percentage points. |
| | Statistically significant? | Yes. | No. | No. |
| | **Impact** | **Decline of 0.249 points.** | **No impact.** | **No impact.** |
| University of Cincinnati | Numerical value | Decline of 0.098 points. | Decline of 0.333 hours. | Decline of 2.6 percentage points. |
| | Statistically significant? | Yes. | No. | Yes. |
| | **Impact** | **Decline of 0.098 points.** | **No impact.** | **Decline of 2.6 percentage points.** |

**Apparently negative results at Cleveland State University: Data anomaly is the cause**

Given that AP policy effects at Cleveland State University appear to be negative and large, the initial focus is on that campus. An examination of the data reveals that the result is due entirely to data anomalies. The Higher Education Information (HEI) system, the data source for the report, had identified some students at the institution as recipients of AP credit. However, additional investigations revealed that those students had not actually taken AP tests. Once those records were corrected using updated information directly from the institution, the AP policy ceased to have an effect on GPA at the institution, similar to the results observed for the aggregate sample and for other institutions in the USO. The corrected results for Cleveland State University are presented in table 12.

Table 12. Estimated Impacts of the AP Policy at the Cleveland State University: Corrected for Data Anomalies.

| Institution | Estimated impacts | GPA Scale: (0-4) | Attempted hours | Completion Ratio |
|---|---|---|---|---|
| Cleveland State University | Numerical value | Decline of 0.004 points. | Decline of 0.306 hours. | Increase of 0.001 percentage points. |
| | Statistically significant? | No. | No. | No. |
| | **Impact** | **No impact.** | **No impact.** | **No impact.** |

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

Because the AP policy appear to have negative impacts on GPA and the proportion of completed hours at the University of Cincinnati, it is crucial to know whether the results are due to the policy itself or if they are driven by other factors. For example, data anomalies were behind the apparently negative results at the Cleveland State University. Investigations confirm that the results at the University of Cincinnati, as reported in table 11, are due to the combination of two elements: the properties of the difference-in-difference estimator used in the study, and, substantial improvements in the quality of the incoming freshman classes at the institution during the policy years.

The difference-in-difference estimator identifies AP policy impacts by comparing two differences. The first difference shows changes in outcome indicators such as GPA both 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 and 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 cause the GPA of the comparison group to increase but do not influence the GPA of the program group, the difference-in-difference estimator ascribes negative impacts to the policy although there are no impacts.

The above is exactly the scenario that has given rise to the apparently negative impact of the AP policy at the University of Cincinnati. The data show that changing non-policy factors caused academic outcome indicators to improve at the institution but only for the comparison group. Additional investigations of the data confirm that two specific factors were responsible for increased GPA and course completion rates of the comparison group at the University of Cincinnati. The first factor is a specific example of anomaly in the data while the second factor is tied to the overall increase in student quality at the institution.

The first factor, data anomaly, is due to the closing down of the *Center for Access and Transition (CAT)* at the University of Cincinnati; *CAT* provided academic instruction and advising to undergraduates who did not meet the criteria for direct admission to the baccalaureate program. *CAT* was closed down in FY2010-11, a year after the AP policy was implemented. Because they did not qualify for direct admissions to the institutions, *CAT* students, present mostly in the comparison group, had lower GPA than other students in the comparison group.[4] Moreover, given their considerable presence in the sample, CAT students managed to pull down the average GPA of the comparison group.[5] Consequently, when CAT was closed down in FY2010-11, after AP policy implementation, average GPA of the comparison group increased. Importantly, the closing down of *CAT* did not influence the GPA of the program beneficiary group. It is very likely that the apparently negative result from the difference-in-difference estimator is due to the closing down of *CAT*.

Data anomalies with the closing down of *CAT* were corrected with help from the University of Cincinnati. The results from the corrected data are presented in table 13. Table 13 shows that removing *CAT* students from the sample changed the estimated impact of the AP policy at the University of Cincinnati; the numerical value of the estimated policy impact on GPA changed from -0.089 (in table 11) to -0.070 in table 13. Similarly, the numerical value of the estimated policy impact on completion rates changed from -0.026 percentage points (in table 11) to -0.015 percentage points (in table 13). The estimated AP policy impacts on GPA and the proportion of completed hours, as reported in table 13, however, appear to be negative and statistically significant, meaning that the inclusion of *CAT* students in the sample was not the only reason behind the results at the University of Cincinnati.

---

[4] AP test-takers are typically high achieving students. In our sample, students with scores of 3, 4 and 5 in AP tests have higher family income, ACT scores, and are also from higher quality schools, all correlates of measures of academic performance such as grade point averages.

[5] *CAT* students accounted for almost 21% of the comparison group before AP policy implementation at the University of Cincinnati.

Table 13. Estimated Impacts of the AP Policy at the University of Cincinnati: Corrected for Data Anomalies.

| Institution | Estimated impacts | GPA Scale: (0-4) | Attempted hours | Completion Ratio |
|---|---|---|---|---|
| University of Cincinnati | Numerical value | Decline of 0.070 points. | Decline of 0.256 hours. | Decline of 1.5 percentage points. |
| | Statistically significant? | Yes. | No. | Yes. |
| | **Impact** | **Decline of 0.070 points.** | **No impact.** | **Decline of 1.5 percentage points.** |

So what caused the specific results at the University of Cincinnati? Table 14 presents an insight into the causes; the table reports average GPA and course completion rates before and after AP policy implementation for policy beneficiaries and the comparison group. Table 14 clearly shows that the observed results are due to the simple fact that both GPA and course completion rates increased by more for the comparison group than for the program beneficiary group. The top panel of table 14 shows that GPA declined by 0.025 for the program group after AP policy implementation but increased by 0.048 for the comparison group over the same period of time. Similarly, the bottom panel shows that completion rates increased by 0.005 for the program group but increased more, by 0.019, for the comparison group.

Table 14. Changes in GPA and the Proportion of Completed Hours 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 | 1,722 | 3.254 | 2,018 | 3.229 | 3.229 – 3.254 = -0.025 |
| Comparison | 3,672 | 2.719 | 3,816 | 2.767 | 2.767 – 2.719 = **+0.048** |
| **Policy Impact (on GPA)** | | | | | -0.025 – **0.048** = -0.073 **(Statistically Significant)** |
| Completion Ratio | | | | | |
| | N | Before | N | After | Completion Ratio(after) – Completion Ratio (before) |
| Program | 1,722 | 0.934 | 2,018 | 0.939 | 0.939 – 0.934 = +0.005 |
| Comparison | 3,672 | 0.847 | 3,816 | 0.865 | 0.865 – 0.847 = **+0.019** |
| **Policy Impact (on Completion Ratio)** | | | | | 0.005 – **0.019** = -0.014 **(Statistically Significant)** |

Note: Estimated policy impact on GPA and completion rates in table 14 are slightly different from corresponding estimates presented in table 13 because the latter controls for influence of individual and institutional characteristics.

Although table 14 provides conclusive evidence that it is the relatively large increase in GPA and completion ratio for the comparison group that caused the apparently negative impacts of the AP policy at the University of Cincinnati, it is still important to examine why GPA declined at the institution after AP policy implementation. Accordingly, table 15 presents average GPA before and after AP policy implementation separately for students with AP test scores of 3, 4 and 5. Table 15 shows that while GPA

declined by only 0.008 points for students with AP test-scores of 3, the extent of the decline in GPA was almost seven-fold larger (0.054 points) for students with AP test-scores of 5.[6]

Table 15. Changes in GPA before and after the AP Policy at the University of Cincinnati: By AP Test Scores for the Program Group.

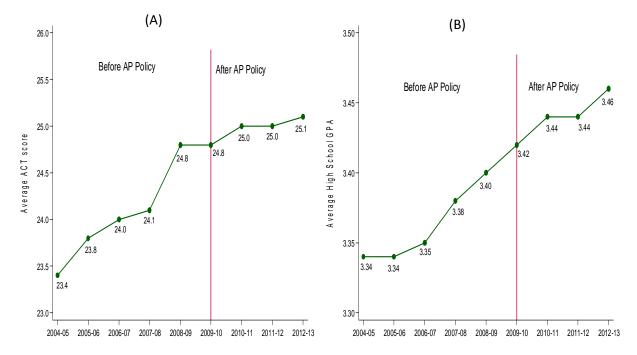| AP scores | Before | | After | | GPA(after) – GPA(before) |
|---|---|---|---|---|---|
| | N | GPA | N | GPA | |
| 3 | 596 | 3.037 | 692 | 3.029 | 3.029 – 3.037 = -0.008 |
| 4 | 605 | 3.264 | 731 | 3.245 | 3.245 – 3.264 = -0.019 |
| 5 | 517 | 3.493 | 593 | 3.439 | 3.439 – 3.493 = -0.054 |
| Comparison Group | 3,672 | 2.719 | 3,816 | 2.767 | 2.767 – 2.719 = **+0.042** |

It is important to consider the implication of the information. The AP policy guarantees credit for AP test scores of 3, 4 and 5. However, it is a well-known fact that students with scores of 5 in AP tests had received college credit even before the policy was implemented, and a significant contribution of the AP policy was to guarantee credit for test scores of 3. As such, the decline in GPA for students with scores of 5 is related not to the AP policy but to the influence of other factors not related to the policy. Unfortunately, the role of non-policy factors related to the declining GPA for the program group cannot be eliminated using information from the comparison group. The difficulty arises because there are specific other factors causing the GPA of only the comparison group to increase (by 0.048), and generating the apparently negative policy impact in the process.

In light of the above, it is clear 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 what caused academic outcomes of the comparison group to improve after AP policy implementation.

Although the scope of the current study does not allow a full-scale investigation of the specific factors responsible for improvements in academic outcomes for students in the comparison group, an improvement 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.

---

[6] The decline of 0.008 in GPA for students with AP test-scores of 3 was statistically insignificant as well. However, the decline of 0.054 for students with AP test-scores of 5 was statistically significant.

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.

While panels (A) and (B) of graph 1 provide clear evidence that student quality improved substantially at the University of Cincinnati during the policy implementation years, it needs to be known how an increase in the overall quality of the incoming freshman class was concentrated among students in the comparison group. The answer to the question is linked to the following facts. First, students in the comparison group accounts for almost 70% of the freshman class in a given year at the University of Cincinnati main campus. Second, the AP students are typically the highest achieving component of any freshman class in the institution before (or after) AP policy implementation. Taken together, the two facts make it clear why an improvement in overall quality has to disproportionately influence the comparison group.

**VI. Conclusion**

This report examines the impact of the Advanced Placement (AP) policy of the Ohio Board of Regents (OBR) on academic outcomes of policy beneficiaries at 4-year university main campuses in the University System of Ohio (USO). In 2007, Ohio Legislature mandated USO institutions to adopt standards in awarding college credit for AP tests. Subsequently, the AP policy was formed with inputs from USO institutions 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 was expected to coincide with the arrival of the FY2009-10 freshman class at USO 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 students face reduced

course loads and a shortened required time for graduation. The head-start accorded by the policy could also improve students' college performance.

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. However, if the assumption is not valid, and AP tests are not true equals of college courses, the AP 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, it is necessary to investigate how the AP policy influences academic outcomes of the beneficiaries.

It is important to recognize that the AP policy is beneficial if academic outcomes of policy beneficiaries improve as a result of the policy. More importantly, the policy remains beneficial even if academic outcomes do not change as a result of the policy, a likely scenario if learning outcomes associated with AP test scores of 3, 4 and 5 are indeed equivalent to learning outcomes of corresponding college courses. If the AP policy does not influence academic outcomes, society still benefits because students have an opportunity of reducing college costs but without compromising academic standards. A rethinking of the AP policy is in order only if academic outcomes are adversely affected.

AP policy impacts are estimated using the difference-in-difference estimator which compares average academic outcomes over time, and between beneficiary and comparison groups. Using data on a sample drawn on freshman students from FY2007-08 though FY2010-11 cohorts at 4-year university main campuses, the estimates show that the AP policy did not influence any of the four academic outcome indicators used in the report, namely, grade point average, number of attempted hours, proportion of completed hours, and completion rates in higher level courses.

The no-impact results validate the basic assumption of the AP policy regarding the equivalency of learning outcomes between AP tests and college courses. However, do such results apply uniformly to different segments of the beneficiary group? In particular, does the policy have the same no-impact result for students who have test scores of 3 and those who have scores of 5? In a similar vein, does the no-impact result hold for policy beneficiaries attending different 4-year university main campuses?

Our investigations show that the 'no-impact' result holds for separate groups of policy beneficiaries with AP test scores of 3, 4 and 5, allaying concerns that students with a test score of 3 do not master the necessary learning outcomes. In a similar manner, the no-impact result holds by campus as well. Although estimated AP policy impacts appear to be negative in two campuses, additional investigations confirm that those results are due to a combination of data anomalies and estimator properties, and not due to the policy itself.

The results highlight the beneficial role of the AP policy; the policy provides students increased potentials for saving resources, but without any adverse impact on academic standards. Future expansions of the current study will consider the impact of the AP policy on course specific grades in sequential higher level courses.