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Whether All-English Teaching Improves Students' Academic Performance?

—Research on the All-English Teaching Classes in G University Based on Regression-Discontinuity Design Approach

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***Abstract*—Recently all-English teaching has been widely adopted in most universities in China. This study investigates the following two questions. First, does all-English teaching improves students' academic performance? Second, if it improves students' academic performance, is the effect the same for students of different academic levels? Taking advantage of the exogenous influence by the national college English test (CET), this paper examines the effect of all-English teaching on students' academic achievements in G University using the regression-discontinuity design (RDD) approach. This paper finds that there is no significant difference in CET-6 scores between the students from all-English teaching classes and students not from all-English teaching classes, although the scores of the all-English-class entrant examination between the two students groups are close. It shows that the advantage of all-English teaching is mainly for high-level students, and all-English teaching does not have a significant impact on all students. Moreover, when studying the effect of all-English teaching, it is necessary to consider the students' different levels of English in the analysis, otherwise, the effect of all-English teaching would be overestimated.**

Keywords—Regression-discontinuity design approach; all-English teaching; causal identification

I. INTRODUCTION

With the development of economic globalization, the training of comprehensive knowledge and skills for students in universities is playing an increasingly important role, especially in the field of financial accounting. There is a shortage of high-level accountants, especially those who are proficient in financial English and international accounting standards. This knowledge and skills should be adopted through inter-disciplinary teaching method, so the all-English teaching method has been widely used in many universities and colleges in China [1]. This method requires the teachers to combine professional knowledge with English. In this way, students can not only improve their English language skill, but also enrich their professional knowledge.

Recently scholars have researched on the effect of all-English teaching. The existing literature mainly focuses on the effect of all-English teaching and suggestions on the design of all-English teaching [2]. For example, Kong studies the improvement of English teaching modes of economic specialty courses in universities in China [3]. Other studies provide empirical evidence of the effect of all-English teaching on improving students' academic performance.

However, there are two problems. First, most of the literature is limited to qualitative analysis. They use research methods like documents, questionnaires, interviews, and observations to measure the effect of all-English teaching, which may be subjective and artificial [4]. Therefore, it is difficult to get a unified opinion on the evaluation system and results. It is necessary to use a more scientific and reasonable quantitative method to analyze the effect of all-English teaching.

Second, the existing literature mainly focuses on the correlation between all-English teaching and students' performance, while ignoring the endogenous problem [5]. Passing the all-English-class entrant examination is a necessary condition, but the students who pass the examination may also have strong learning ability and comprehensive skills, which in turn improve the all-English teaching effect. In this circumstance, it is difficult to separate the students' own learning abilities and the effect of all-English teaching.

Using the regression-discontinuity design (RDD) approach, we compare the academic performance of students of all-English teaching classes and the ones not in all-English classes,

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while the scores of the all-English-class entrant examination between the two groups are close. In this way, we remove the effect of students' intrinsic ability, and evaluate the effect of all-English teaching on students' academic performance with a more objective method. Therefore, the contribution of causal identification is that we can identify the reason for the improvement of students' academic performance. That is, whether it is due to the all-English teaching method, or the students' own abilities.

Our sample is from 247 students majoring in financial management in the accounting school in G University. Using the RDD approach, we analyze whether all-English teaching improves students' academic performance, in order to provide suggestions for the all-English teaching method. The RDD approach is a local random experiment, which can avoid the bias of the regression results caused by the endogeneity from the traditional regression method. Therefore, it identifies the truly causal relationship between the variables. Moreover, the assumptions of RDD approach are more relaxed, and it does not require the variables must be independent and subject to a specific distribution. The causal effect can be observed by a clear graph using this approach [6].

The RDD approach has been widely used in the research of education. Leake and Lesik use this approach to evaluate the effect of students' participation in the English tutoring program on the GPA of the first grade students in universities [7]. Dee and Penner use RDD approach to explore the impact of the cultural-association teaching method, and provide a strict causal evaluation of the effect of cultural-association teaching on the promotion of ethnic minority students' learning performance [8].

II. Research Design

In this paper, we focus on the 247 students majoring in financial management in the accounting school in G University, including 28 students in the all-English teaching class and 219 not in this class. There are two reasons for focusing on students majoring in financial management. First, with the trend of economic globalization, it is necessary for students to combine financial accounting knowledge with English language in their study. In this circumstance, the students majoring in financial management generally have a certain basic skill of learning English. Second, the framework of the course of financial management major in G University is the same in the all-English class and the non-all-English class, except that the all-English teaching class uses English as the teaching language.

We use the CET-6 score as the measure of students' academic performance. The two reasons are as the following. On the one hand, students' academic performance mainly presents in their test scores. On the other hand, the college English test (CET) is a national standard test held by China's Ministry of Education, which is joined by most colleges and universities in China. Therefore, students' scores of CET-6 can represent the students' academic performance.

We use RDD approach to evaluate the effect of all-English teaching on students' academic achievements. This method refers to using non-continuous changes in variables caused by exogenous factors to identify causal effects. The basic idea of RDD is that an external factor will cause one or more breakpoints of the explained variable, but the observations near the breakpoint will have a very strong homogeneity. Therefore, the causal relationship between variables can be identified by analyzing the observations near the breakpoint. Based on this, the RDD approach can be used to analyze the impact of all-English teaching on students' academic performance.

The G University uses the score of all-English-class entrant examination to select students, so the required score determines whether the student can enter the all-English class. Assuming the required score (*Score**) is 75, the student whose score is 75 or higher than 75 will enter the all-English teaching class (*the treatment group*), while the student whose score below 75 will enter the non-all-English class (*the control group*). Therefore, the test scores form a "breakpoint (D_i)" of the explained variable. On both sides near the breakpoint (D_i), observations include the students who just reach the required score of the all-English teaching class and those whose scores are only a little lower than the required score and do not enter the all-English teaching class. They may have the same level of English and no great difference.

Using RDD approach should meet the following two assumptions. First, the external factor (the required score of the entrant examination) cannot be manipulated, and the grouping of the explanatory variables (whether entering the all-English teaching class) should be random. Second, the explained variable (students' CET-6 scores) should be discontinuous at the breakpoint of the determinant factor (the required score of the entrant examination). However, except for the determinant factor (whether entering the all-English teaching class), other control variables should be continuous at the breakpoint in order to ensure the consistency of the estimation.

In this paper, we can satisfy the above two conditions. First, to divide the all-English teaching class and the non-all-English class, the required score of the entrant examination is an external factor, which is determined by the scores of all the students, so it meets the first assumption. Second, the scores of the entrant examination can affect the grouping of all-English teaching class and non-all-English class. However, the control variables such as the course content of the financial management major and the learning ability of the students are the same on both sides of the breakpoint, which satisfies the continuity assumption.

As shown in equation (1), if there is a jump of CET-6 scores at *Score**, the only reason for the jump would be the treatment effect of entering the all-English teaching class (D_i).

$$D_i = \begin{cases} 1, \ if \ \ Score_i \geq Score^* \\ 0, \ if \ \ Score_i < Score^* \end{cases} \tag{1}$$

We use Sharp Regression Discontinuity approach to estimate the jump. That is to say, the treatment effect of the sample individuals at the breakpoint entirely depends on whether students entering the all-English teaching class. We construct the following empirical model:

$$Y_i = \alpha_i + D_i * \delta + \varepsilon_i \tag{2}$$

We use the non-parametric regression to estimate the coefficient δ. The advantage of this method is that the optimal bandwidth can be chosen by minimizing the mean square error without depending on the specific function. We use the local linear regression method to estimate the following function:

$$\min_{\{\alpha,\beta,\delta,\gamma\}} \sum_{i=1}^{n} K\left[\left(x_i - c\right)/h\right]\left[y_i - \alpha - \beta\left(x_i - c\right) - \delta D_i - \gamma\left(x_i - c\right) D_i\right]^2 \quad (3)$$

In this function, *K(*)* means the kernel function. RDD approach generally uses the triangular kernel, and the estimator is the "local Wald estimator".

In addition to the Sharp Regression Discontinuity method shown above, we used fuzzy Regression Discontinuity method as well. That is to say, besides the determinant factor, other unobserved factors also affect the observations near the breakpoint. Specifically in this paper, taking into account of the factors such as students' willingness, there may be a situation where the students do not enter the all-English teaching class even if their score exceeds the required score. Therefore, based on the Sharp Regression Discontinuity, we further use fuzzy Regression Discontinuity approach to provide robust evidence. The practice of fuzzy Regression Discontinuity method is from Lee and Lemieux [4].

III. RESULTS

Fig. 1 shows the distribution of the density function of CET-6 scores of the students in both all-English teaching classes (solid line) and non-all-English classes (dotted line) majoring in financial management in G University. The results show that the median score of CET-6 of non-all-English classes is about 440, while that of all-English class is about 510. Most of them are concentrated on the right side, which means higher scores. The difference of the distribution of the two groups is about 70 points, and it is significant. Therefore, the students' CET-6 scores from the all-English teaching class are higher than those from the non-all-English class.

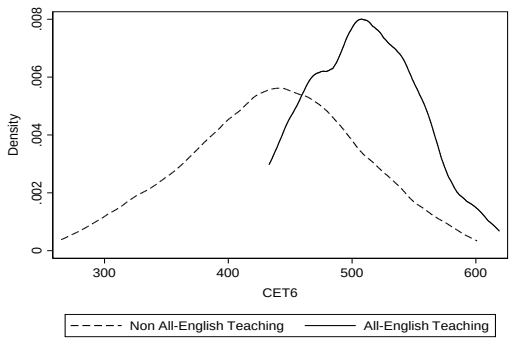

Fig. 1. The density function of the CET-6 scores in all-English and non-all-English classes

Comparing the total scores and separate scores (listening, reading, writing) of the two classes, we find that the average score of CET-6 of non-all-English classes is about 436, while that of all-English teaching classes is about 508. The difference between the two classes is 71 and significant at the 1% level. Moreover, the difference is mainly in listening and reading. The score of CET-6 of all-English teaching class is about 30 points higher than that of non-all-English teaching class, which clearly reflects the significant role of English teaching in improving students' listening and reading. The results indicate that the teaching method of the all-English teaching class provides students with a great English language and culture atmosphere, which enhances the students' language input and output ability, and students from the all-English teaching class perform better than students who are not in all-English teaching class.

TABLE I. T-TEST OF CET-6 SCORES IN ALL-ENGLISH TEACHING AND NON-ALL-ENGLISH TEACHING CLASSES

	Non-all-English Teaching	All-English Teaching	Difference	T-test
Total Scores	436.6	508.4	71.79	5.376***
Listening Scores	145.8	177.3	31.52	5.607***
Reading Scores	163.2	191.4	28.15	3.989***
Writing Scores	127.5	139.6	12.13	2.911***

Fig. 2. The effect of all-English teaching on students' CET-6 performance (sharp RDD)

As shown in Fig.2, the vertical axis is the CET-6 score. The CET-6 scores of all-English teaching class are the treatment group while those of non-all-English class are the control group. We report the total CET-6 scores, listening scores, reading scores and writing scores between the two groups.

We draw the following two conclusions. First, the CET-6 scores of the treatment group are generally higher than those of the control group both in the total scores and the separate scores.

Second, there is no significant difference in CET-6 scores between the students on both sides of the cutoff line. The scores of students near the breakpoint from all-English teaching class are similar with scores of students near the breakpoint but from non-all-English teaching class. Comparing the samples which near the required score in the treatment group with those in the control group, we find that the two groups of samples do not have a jump after receiving different teaching methods. It means that there is no significant difference in CET-6 performance among students with similar English level after receiving different teaching methods. In summary, the students with high-level English skill from all-English teaching class can benefit more from all-English teaching model. Their CET-6 scores are significantly higher than those low-level students. It means the students with high-level English skill are the main beneficiaries of the all-English teaching method.

Taking into account of the factors such as students' willingness, there may be a situation where the students do not enter the all-English teaching class even if their score exceed the required score. So we used fuzzy Regression Discontinuity approach to further estimate whether the average score of CET-6 has a jump. Fig. 3 shows the result of Fuzzy Regression Discontinuity method. It shows the result is the same as using the Sharp Regression Discontinuity approach.

For students with lower level of English, they do not benefit as much as the students with higher level of English. In summary, the beneficiaries of all-English teaching education are mainly students with higher level of English. It may be due to the following reasons. First, the students from all-English teaching class have higher English learning ability, and the teaching method of the all-English teaching class provides students with a good English language and culture atmosphere. Second, the culture formed in the students group themselves will also affect students' academic performance [9]. Researchers also find that higher peer-group average achievement or higher proportion of high-performing peers have a positive impact on the student's performance [10].

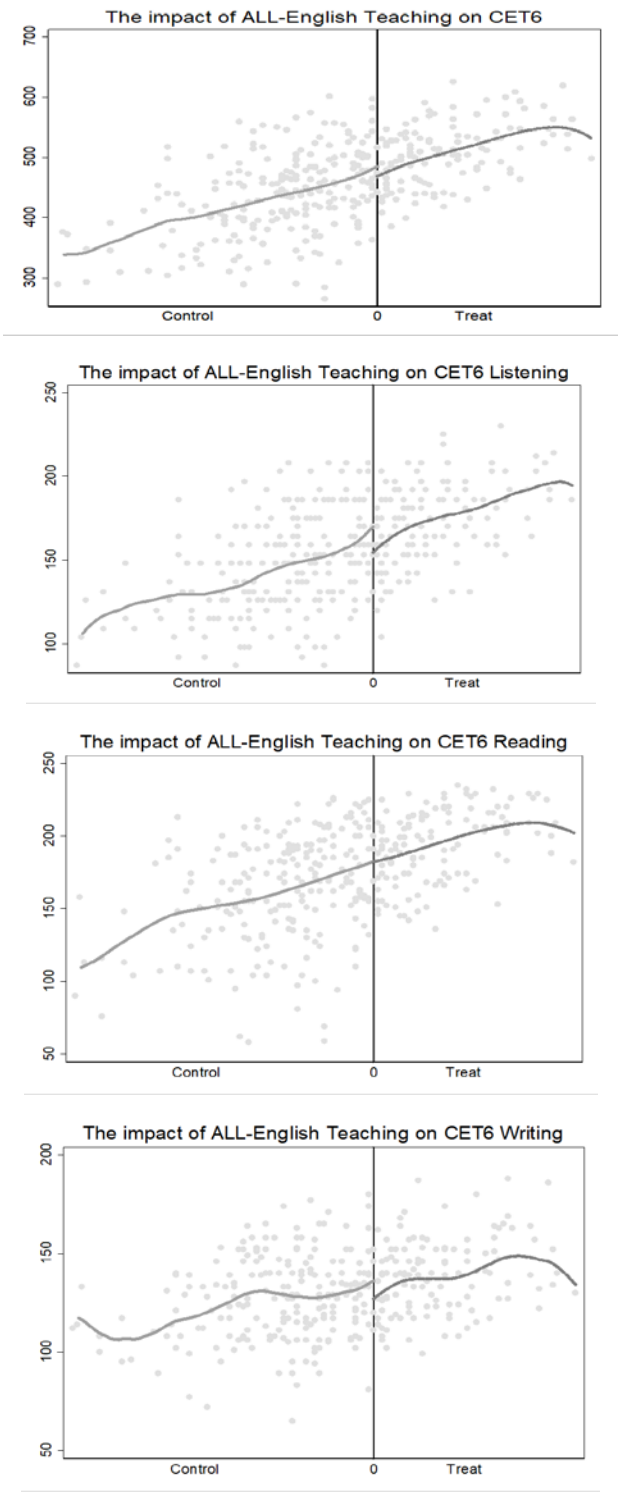

Fig. 3. The effect of all-English teaching on students' CET-6 performance (fuzzy RD)

IV. Conclusion

In this paper, we evaluate the impact of all-English teaching on undergraduate students' academic performance in G University using RDD approach. Based on the analysis, we can draw the following conclusions:

(1) We find that students who receive all-English teaching generally show higher academic performance than those who receive non-all-English teaching.

(2) The teaching method of the all-English teaching class provides students with a great English language and culture atmosphere, which enhances the students' listening and reading abilities.

(3) There is no significant difference of CET-6 scores between some students in the all-English teaching class and non-all-English teaching class. The common feature of these students is that their scores are near the required score in the entrant examination of all-English teaching class. All-English teaching education mainly benefit students with higher level of English.

(4) The students' own level of English needs to be considered, otherwise, it will overestimate the effect of the all-English teaching method.

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