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Does Professional Learning for High School Economics Teachers Improve
Student Achievement?

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Abstract:

Many believe that K-12 teachers are inadequately trained to teach economics. The National Council on Economic Education (NCEE) has developed numerous professional learning opportunities for teachers. Various state Councils and local Centers provide workshops and in-service training for teacher to deliver the Council's materials. This study utilizes new data from all Georgia high school students to assess the impact of workshops provided by the Georgia Council on Economic Education's (GCEE) on the performance of high school students on high stakes end-of-course economics exams. Our preliminary results suggest a positive impact of teacher attendance at workshops on student test scores.

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I. Introduction

Economics educators have long suggested that there be more economics training in the K-12 curriculum. In response to the suggestions of economists, 15 states now require their students to pass at least one high-school level course in economics for graduation. Georgia is one of the few states to also require students to take a high stakes end-of-course competency test to demonstrate an understanding of economic concepts. Unfortunately, few teachers have sufficient training to provide the desired level of economics education. As early as 1977, researchers called for more training of teachers (Mackey et al., 1977). More recently, Walstad (2001) finds that the average teacher who is teaching economics has no more than one course in economics. Mackey et al. suggest teachers at least minor in economics to be qualified to teach at the high school level. Unfortunately, the curriculum of most teaching degrees offer few opportunities for aspiring teachers to take the credit hours required to minor in economics – let alone master the subject. To fill the training gap, the National Council on Economic Education (NCEE), its state Councils, and college- and university-based Centers have offered in-service training and workshops to assist active teachers develop an understanding of economic concepts and to introduce them to teaching material that will aid them in preparing class lessons.

Since its inception in 1972, the Georgia Council on Economic Education (GCEE) has offered hundreds of workshops to thousands of Georgia's teachers. Workshops have introduced teachers to materials that cover all areas of economics from personal finance in kindergarten to AP economics in high school. There is some evidence that workshops similar to those offered by the GCEE help teachers improve students' test scores (see Highsmith, 1974; Thornton and Vredevelde, 1977; Walstad, 1979; Schober 1984; and Weaver et al., 1987 for examples).¹ Like many

¹ Workshops have changed dramatically since the videotape and conference call approaches in the 1970s. Today workshops introduce teachers to materials custom made for state and national testing goals. Workshops provide a vast amount of material that teachers can take directly into the classroom. Materials are available in the form of specific lesson plans and sophisticated DVDs. Often, the materials provide links to up-to-date web-based materials. Workshops not only introduce

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state Councils, the GCEE spends over a million dollars each year to provide workshops and materials for teachers. Yet, there is little current information concerning the effectiveness of these workshops.

We examine the test scores of Georgia students who take the end-of-course test (EOCT) in economics. Since Spring 2004, all Georgia students have had to take a comprehensive economics examination as part of their required economics course. The test counts for at least 15 percent of the each student's grade and, therefore, qualifies as a "high stakes" test. We compare the scores of students whose teachers have undergone training at GCEE workshops to those of teachers who have not undergone such training. We control for student factors that previous studies have shown to affect student performance. Our approach is similar to Bosshardt and Watts (1990, 1994) and Watts and Bosshardt (1991). Because there are many potentially important school influences that we cannot observe, we use panel data techniques to examine the impact of student and teacher characteristics while allowing the model to shift to accommodate unobserved school characteristics. We also adjust test scores to control for time trends within the data. We find first that the GCEE workshops do have a positive, statistically significant impact on student test scores. Second, we find that when we account for potential selection bias in the data, the positive impact remains. Even if GCEE workshops attract more conscientious teachers to its workshops, the teachers' students do better after the teachers have been to workshops.

II. Background Literature

Researchers of economic education during the last three decades or so have generally concluded that students are in desperate need of better economic education. Furthermore, the most effective avenue to reaching students is to improve the training of economic educators. As early as 1977, Thornton and Vredevelde note that there is a common assumption that students of teachers who had been recipients of in-service education benefit from their teachers' increased understanding of economics. Mackey et al. (1977) suggest eight "teacher training program needs." They call for a systematic analysis and sharing of results of in-

teachers to material but help them take the material for a test drive and come to a better understanding of the economic content in each lesson.

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service and pre-service teacher training. In 1985, Walstad and Watts note that most organizations involved in economic education make the general assumption that teacher training in economics has a direct impact on student output—measured, for example, by test scores. By 1988, Baumol and Highsmith state that the heart of the issue was the determination of the major influences on the effectiveness of teaching programs in high school economics. Brenneke et al. (1998) call for investigation of the impact of teacher training through economics courses and workshops on economics learning. These and other authors have, over time, made reference to this general belief that more and/or better training of teachers through pre-service and/or in-service efforts leads to improved quality of economics education.

If it is true that more and/or better training of teachers in economics leads to better economics education for students, one would expect that the amount of such training would have increased during the last few decades—with a corresponding improvement in the quality of economics education for students. As noted above, researchers called for more in-service training of teachers as early as 1977 (Mackey et al. 1977). In 1988, Baumol and Highsmith reported that over half of economics teachers have six semester or quarter hours or less of economics credit, with an average attendance of about three in-service programs lasting less than one day and about two lasting one to three days. Brenneke et al. (1998) state that, at the time of their writing, large-scale research needed to be done to learn the general level of economics knowledge of students and teachers and to learn how much economics instruction and training teachers are receiving. As recently as 2001, Walstad reports that only approximately one-half of the agencies certifying teachers had any requirement in economics for high school social science teachers—with the average requirement being one course. Walstad (2001) states that, “It would be useful to investigate methods for improving the teaching of high school economics other than having teachers take more economics courses.” He also points out that the objective of more training in economics for teachers of economics can be achieved not only by “increasing economics requirements in undergraduate education for social studies teachers but also by increasing the number of teachers who take a progressive set of in-service courses in economics after they complete their undergraduate education.”

Are pre-service and in-service programs of economics training for teachers of economics working? Is that “general assumption” noted by Walstad and Watts

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(1985) that teacher training in economics has a direct impact on student output turning out to be true? Research results in addressing this question have been mixed. Highsmith (1974) notes that a literature review at that time provided little empirical support for the belief that students learn more economics when their teachers have taken in-service courses. For his own study, Highsmith examined the effect of workshops on student outcomes in Minnesota. He sampled a small group of Minnesota teachers to see if the students of the teachers who had attended in-service workshops held by the St. Cloud State Center for Economic Education did better on the Test of Economic Understanding than did students of teachers who had not attended workshops. He found a statistically significant difference of 1.47 correct answers between the two groups—with the students of teachers who had completed the training scoring better on average than the students whose teachers had not undertaken the training.

After noting the common assumption that students of teachers who receive in-service training in economics benefit from this increased economics understanding, Thornton and Vredeveld (1977) state that few studies at that time had tested this. These authors view their own study as substantiating Highsmith's (1974) findings; their conclusions are that teacher in-service participants have more of a positive effect on their students' understanding of economics. Schober (1984) states that "to date, there exists relatively little research concerning the influence of these programs on participating teachers and even less research concerning their effects on students enrolled in classes subsequently taught by these teachers." Examining in-service workshops offered by the Louisiana Council on Economic Education, Schober finds a significant positive effect of teacher workshop participation on post-test scores of teachers and students.

Walstad (1979) reports that an in-service program involving a small sample of teachers had the total effect of increasing average post-test scores of the student experimental group by 2.36 points, about 23%, over the control group's scores. Weaver et al. (1987) state that one of the major purposes of in-service education for teachers is to increase their ability to raise the knowledge level of their students, but that there is little empirical evidence to support that this purpose is being achieved. They cite studies that have found such evidence and those that have not. These

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authors conclude from their own study that their results provide more convincing evidence of the effectiveness of in-service programs in economics education.

Stating that, “the availability of matched pre- and post-test data permitted us to estimate this model with a large, national sample of high school students for the first time in economic education research,” Walstad and Soper (1988) find from a large, national sample of students who took the Test of Economic Literacy (TEL) that teacher coursework in economics improves economic knowledge of students—with each course taken by the teacher adding 0.64 of a point to the student TEL score. In 1990, Bosshardt and Watts report their use of a panel data approach with teachers and pre- and post-test data for the TEL for over 3,000 high school students. Their results indicate that instructors do make a difference in student performance, with the best teachers being better trained in economics. Their conclusions include the recognition of benefits of programs like those of the Joint Council on Economic Education network. Bosshardt and Watts (1994) report results that indicate that, even at earlier grades, instructors do seem to make a positive difference in student performance in economics.

In the ten-plus years that have followed these studies, the environment of economics education has changed. A re-examination of the effect of teacher training in economics on student understanding of economics is long overdue. Maxwell et al. (2001) note the more widespread use of more active learning materials for teaching high school economics—including those of the NCEE. In addition, in response to the suggestions of economists, many states now require at least one high school level course in economics for graduation. As early as 1989, Rhine investigated whether performance differences existed between students in an economics instruction mandated environment as compared to a non-mandated one. Walstad (1992) points out areas deserving of additional research; included in his list is the effect of state-mandated economics courses on economics variables.

Also, some states require students to take an end-of-course competency test to demonstrate an understanding of economic concepts. Walstad (2001) states that, in 2000, twenty-two states used tests that included some economic items, with another nine states in the process of developing tests that include economics—with implementation between 2001 and 2004. Since 2004, Georgia, as one such state, has required students to take a comprehensive economics examination to graduate. This

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exam counts for at least 15 percent of the student's grade in the mandated economics course and, therefore, qualifies as a "high stakes" test.

Like many state Councils, GCEE has offered hundreds of workshops to thousands of Georgia's teachers. GCEE spends over a million dollars each year to provide the workshops and materials for teachers. However, there is little current information concerning the effectiveness of these workshops.

In our study, we examine the test scores of students who took the EOCT in the State of Georgia. We compare the scores of students whose teachers have undergone training at GCEE workshops to those of teachers who have not undergone such training. We control for school quality factors and student factors that previous studies have shown to affect student performance.

Until the Walstad and Walstad and Soper studies, much of the literature had examined teacher training as having a direct linear effect on student achievement. But little of the research goes beyond the OLS approach to modeling teacher impacts on test scores. Three studies fill this void: Bosshardt and Watts (1990 and 1994) and Watts and Bosshardt (1991) examine teacher effects on student outcomes using the panel data fixed-effect and random-effect techniques. They focus on the unobservable characteristics of teachers. We also employ a fixed-effects technique to control for unobservable differences in school characteristics while we examine the impact of teachers' attendance at GCEE workshops. We also use normal curve equivalent transformations of our dependent variable to allow us to compare test scores across schools and over time.²

III. Data

Our sample consists of all students who took an economics class in Georgia's schools in which students took the EOCT over a five semester period: Spring of 2004, Fall of 2004, Spring of 2005, Fall of 2005 or Spring of 2006. Our initial sample includes 174,601 student test scores within this period. Data come from two primary sources. Test data and class data come from the Georgia Department of Education (GaDOE). Workshop data come from the GCEE.

² In part, our approach allows us to address one problem raised in Watts (1985) by Hanushek that the impact of school level characteristics may affect individual students differently.

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The dependent variable is normal curve equivalent student test scores. The end-of-course-test (hereafter EOCT) is a 90 question multiple choice standardized test of economic knowledge.³ The GaDOE standardizes the test scores on a 200 to 750 point scale. The GaDOE also converts the test scores into three categories: P1, does not meet standard (scores lower than 400); P2, meets standard (scores from 400 to 450); and P3, exceeds standard (scores above 450). The EOCT covers five content domains: Fundamental Economic Concepts, Producers and Consumers, Microeconomics: Elements in the Marketplace, Macroeconomics: the National Economy, and the International Economy. The EOCT data are at the student level: We observe one test score for each student. The data allow us to include demographic information for each student including gender, race, economic status, and disability status as defined by the GaDOE. Gender is represented by a dummy variable that equal one for "male" and zero for "female". Race is a vector of four dummy variable that represent "Black," "Asian," "Hispanic," and "Other" respectively. "White, non-Hispanic" is the omitted comparison group. Economic status is a dummy variable that equals one if the student is categorized by the GaDOE as being "Economically Disadvantaged," (defined as eligible for a free or reduced price lunch). Similarly, Disability status is a dummy variable that equals one if the GaDOE defines student as one who is a "Student with Disabilities" which covers a broad range of disabilities. To address the observation that average test scores rose over the three years the test has been offered, we normalize the scores using a technique (Normal Curve Equivalent) devised by the U.S. Department of Education to compare scores over time and between different tests. Each student is matched to a teacher of record. We then match each teacher to a history of GCEE workshops. Our control group is comprised of students whose teachers have not attended a GCEE workshop in the past five years. Our treatment group is comprised of students whose teachers have attended at least one GCEE workshop.

We examine GCEE workshops that occurred from 2000 to the end of 2005. We focus on 37 different workshops with economic content. Most of the workshops are offered multiple times per year. Each year, about 19 percent of all teachers of

³ Of the 90 questions, 75 count toward the student's score. Each test also field tests 15 questions which do not count toward the student's score. After norming, 99 percent of the test scores will fall within the range of 1 to 99. One percent of the scores will fall in the extreme tails of the distribution.

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economics in Georgia's high schools attend at least one workshop. Of the teachers who had attended workshops, many had attended more than one workshop. Table 1 summarizes the attendance of GCEE workshops with economic content (excluding AP students). (For a list of workshops, see Appendix 1.)

Table 1

Percent of Students whose Teachers Attended Workshops	30.00%
Percentage of Teachers with Workshops	19.65%

Before preceding, it is interesting to examine the simple correlation between workshop attendance and EOCT scores and the performance level of students across the population:

Table 2: Correlation between workshops taken and end-of-course test scores

	Workshop	Performance Level	Scaled Score
Workshop	1		
Performance Level	0.0874	1	
Scaled Score	0.1015	0.8685	1

The correlation suggests that there is a positive link between teachers attending workshops and measures of student performance. Another way to see this linkage is to observe that as the performance level rises it becomes more likely that the teachers of the students had attended at least one GCEE workshop (Table 3). While such correlations are little more than suggestive of a linkage, they do demonstrate that it is worthwhile to look for causality.

Table 3: Workshop Attendance by Student Performance Level Test

Student Performance Level	Probability(workshop)
1 (Does not Meet Expectations)	40.7
2 (Meets)	42.9
3 (Exceeds)	47.0

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We also examine the performance of students who take AP classes in economics and compare their performance to all other students. We find, as expected, that the AP students do much better than their counterparts. But, almost all of the AP teachers take the AP economics workshops offered by the GCEE. Therefore, we limit our sample to non-AP students to address the potential upward bias that the inclusion of AP students might have on determining the effectiveness of GCEE workshops. The elimination of AP students leaves us with 166,836 observations.

One shortcoming of our data is that we do not pretest students in their knowledge of economics before they take their mandatory economics class. Most studies of teacher effects on learning examine the change in student test scores over a defined length of time (usually a semester). But, because we are looking at such a large population with large variation in characteristics and because the EOCT is a high stakes test, we believe that the EOCT score will provide useful information about teacher effects on student outcomes. It is the nature and coverage of the EOCT that is our greatest advantage. Summary statistics of the data we use appears in Appendix II.

IV. Model and Results

Although we observe student characteristics, in our data we cannot observe all of the school characteristics that might affect student performance. Therefore, like Bosshardt and Watt (1990, 1994) and Watt and Bosshardt (1991), we use a fixed-effects model to allow the intercept term to shift for different schools. Similarly, we know that the trend in test scores over the three year period we examine is upward. Therefore, we use normal curve equivalent (NCE) transformations of EOCT scores. The transformation allows us to compare test scores across time.

In our first model (Equations 1a and 1b) we specify a fixed-effects linear regression of student NCE EOCT scores conditioned on student characteristics which include gender, race, economic status and disability status and the teacher's workshop experience over the previous five years:

$$EOCTScore_{it} = \alpha_s + \sum_1^7 \beta_j \underline{Student}_{it} + \beta_8 numwork_t + \varepsilon_{it}. \quad (1a)$$

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Student level observations are indicated by a subscript i , and teacher level observations are indicated by a subscript t . The intercept term, α_s , represents the difference in unobserved school characteristics. While we assume that the slope coefficients are the same for each of the schools, we do not make the same assumption for the intercept term. The workshop variable, $numwork$, represents the number of workshops a teacher has attended since the year 2000.

The results of the regression represented in Equation (1a) appear in Table 4. All of the regressors have strongly significant effects on student outcomes. All of the coefficients on student characteristics have the expected. The model explains roughly 31 percent of the variation in the dependent variable. The F-statistic allows us to reject the null hypothesis of equal intercept terms. The reported intercept term is a representative intercept term – the value of the “omitted” school in comparing the different school effects.

Coefficients can be interpreted relative to the standard deviation of the dependent variable. For example, being economically disadvantaged (“Poor”) reduces the expected scaled score by 23 percent of a standard deviation of the scaled score. Of central interest is the effect teacher attendance at workshops has on student test scores. For each workshop a teacher attends the expected student scaled EOCT score rises by 0.63 points or about three percent of a standard deviation. While this effect appears small relative to the other effects presented in the data, it should be noted that most workshops represent one or two days of instruction. Of the teachers in our data base who have taken at least one workshop, more than half have taken multiple workshops. Therefore, the cumulative effect of attending workshops is likely to be significantly larger. To examine the impact of taking workshops in general, we alter Equation (1a):

$$EOCTScore_{it} = \alpha_s + \sum_1^7 \beta_j \underline{Student}_{it} + \beta_8 workdum_t + \varepsilon_{it}. \quad (1b)$$

The variable $workdum$ represents a dummy variable that is equal to one if the teacher has taken at least one workshop since the year 2000. The results of the regression represented by Equation (1b) also appear in Table 4. If we lump together

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teachers who have taken any workshops and compare them to teachers who have taken no workshops we can expect to see roughly a 2.5 point increase in student scaled test scores. This result represents roughly half of the impact of being poor. While the choice of comparison effect (we could have chosen any of the other impacts) is convenient, the implication is clear: Workshops offer teachers one way to overcome some of the obstacles their students otherwise face.

One potential shortcoming of our data selection process is that we do not know what motivates teachers to attend workshops. This may introduce a selection bias into our model. A priori we do not know if any bias would have an upward or downward effect on our coefficients. On the one hand, conscientious teachers may seek out programs that offer material for the classroom and support teaching efforts. On the other hand, principals of poor teachers may assign workshop attendance in an attempt to improve teacher performance. One way we examine selection bias is to limit our sample to those teachers whom we observe before and after attending their first workshop. By excising those teachers who attended workshops before the EOCT was first administered we are likely eliminating some of the more dedicated economics teachers in Georgia – those who have been taking workshops well before testing became a high-stakes facet of the Georgia curriculum. But, the results should better isolate the immediate impact of workshops on student test scores.

Within the restricted sub-sample we see that only eight percent of the students have had teachers who have attended any workshops. Of those teachers, the average number of workshops attended is 1.14. 89 percent of these teachers attended only one workshop in 2005. Our sampling procedure has eliminated the teachers who have been most impacted by the Georgia Council workshops. Furthermore, as noted by Rivkin et al. (2005) teachers become more effective in the first few years of teaching. It is not unreasonable to assume the same effect would carry over as a teacher learns new content at a workshop. Because we examine only recent (after 2004) attendees, the full impact of any economics teachers have learned may not have fully manifest itself within the time frame of our study.

We reexamine Equations (1a) and (1b) using the restricted data. The results appear in Table 5. In general, the results are similar to those found in Table 4. The biggest difference is the coefficient on *workdum* falls with the restricted data. This is not surprising. We have effectively eliminated from the analysis those teachers

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who have committed to GCEE workshops well before testing began. There are very few cases when a teacher takes more than one workshop within this sub-sample. Despite the restriction on the data, we still observe a positive impact of GCEE workshops on student test scores. Our approach does not completely rule out any selection bias. But, even if good teachers are more likely to attend workshops, student test scores improve after the workshop training.

V. Conclusions

The primary result of our research is that GCEE workshops have a positive impact on students' performance on Georgia economics EOCT. Even when we examine a sub-set of the data to address potential problems of selection bias we still find the workshops have a positive impact on student test scores. With this finding in mind it is interesting to note that more than two-thirds of the non-AP students in Georgia have economics teachers who have not taken any GCEE workshops within the past five years. This means that a modest increase in workshop attendance would have a profound affect on state-wide average student achievement.

While we find the results interesting, much work lies ahead. With the amount of data the GaDOE has made available, many opportunities exist to examine subsets of the data. This study looks at the very broad issue of the impact of workshops in general. We suspect that different workshops have different impacts and we suspect that there is much more to learn about what motivates teachers to attend workshops. The data the GaDOE has made available to us offers an unprecedented opportunity to examine determinants of student performance and the impact the GCEE can have on student outcomes.

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Table 4: NCE EOCT Score (obs = 166,836)

Equation (1a)			Equation (1b)		
	Coefficient	T-Stat		Coefficient	T-Stat
Constant	55.51	645.75	Constant	55.27	617.98
Poor	-4.82	-43.50	Poor	-4.82	-43.50
Male	3.38	38.88	Male	3.38	38.97
Black	-11.62	-94.97	Black	-11.61	-94.96
Asian	-1.84	-6.78	Asian	-1.88	-6.88
Hispanic (non-white)	-10.00	-43.77	Hispanic (non-white)	-10.00	-43.76
Other	-4.21	-11.65	Other	-4.22	-11.69
Disabled	-16.90	-99.37	Disabled	-16.82	-98.78
Numwork	0.63	17.69	Workdum	2.48	20.01
Adj R ²	0.3060		Adj R ²	0.3063	
F (8, 166,448)	3,527.64		F (8, 166,448)	3,540.41	

Table 5: NCE EOCT Score (obs = 90,399)

Equation (2a)			Equation (2b)		
	Coefficient	T-Stat		Coefficient	T-Stat
Constant	55.69	503.79	Constant	55.71	503.54
Poor	-4.94	-33.13	Poor	-4.94	-33.12
Male	3.51	29.93	Male	3.51	29.91
Black	-11.61	-69.77	Black	-11.61	-69.77
Asian	-1.70	-4.35	Asian	-1.70	-4.35
Hispanic (non-white)	-9.90	-31.64	Hispanic (non-white)	-9.90	-31.64
Other	-3.45	-7.00	Other	-3.44	-6.99
Disabled	-16.85	-72.04	Disabled	-16.86	-72.08
Numwork	0.68	3.03	Workdum	0.56	2.10
Adj R ²	0.2969		Adj R ²	0.2969	
F (8, 90,060)	1,892.80		F (8, 90,060)	7,892.10	

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Appendix I:

Workshop Names

AP Econ
American History
Atlanta City Workshop
Choices & Changes
Commodity Challenge
Consumer Economics
Demise of the Soviet Union
East Meets West
Economics
Economic Education for Teachers
Economic Systems Workshop
Economics at Work
Economics and the Environment
Economics in American History
Economics in Social Studies
Economics in Transition
Economics of Food Supply
Economics U\$A
European Union
Fed/GSU High School Workshop
Fed ICA Conference
Fed Workshop
Financial Fitness
Give & Take
Great Economic Mysteries
Heart of Georgia RESA Workshop
High School Econ
In-Service
International Trade
International Workshop
Introduction to GCEE
Monetary Policy
Online Course
School to Work
Stock Market Game
Tax Whys
Virtual Economics

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Appendix II: Data Summary Statistics – Full Sample

A:

		Obs=166,836		
Variable	Mean	s.d.	min	Max
EOCT Score	49.99	21.07	-28.46	172.85
Any Workshops	.3006	.4585	0	1
Total Workshops	0.8115	1.805	0	20
Poor	0.3229	0.4676	0	1
Disabled	0.0712	0.2572	0	1
Male	0.4797	0.4996	0	1
Black	0.3740	0.4839	0	1
Asian	0.0280	0.1649	0	1
Hispanic	0.0433	0.2036	0	1
Other	0.0148	0.1207	0	1

B: Sample with Teachers who Began Teaching Economics with No Workshops

		Obs=90,399		
Variable	Mean	s.d.	min	Max
EOCT Score	49.85	20.82	-28.24	172.85
Any Workshops	0.0834	0.2765	0	1
Total Worskops	0.0952	0.3387	0	3
Poor	0.3260	0.4688	0	1
Disabled	0.0710	0.2568	0	1
Male	0.4798	0.4996	0	1
Black	0.3678	0.4822	0	1
Asian	0.0246	0.1550	0	1
Hispanic	0.0428	0.2024	0	1
Other	0.0145	0.1196	0	1

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