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The Production of Economic Knowledge in Urban and Rural Areas: The Role of Student, Teacher, and School Characteristics

Roger Butters, Carlos Asarta, and Eric Thompson

Many states are adopting economic education standards for the K–12 curriculum, mandating economic education courses in rural and urban schools. We examine economic education outcomes for rural and urban students using test scores gathered during a national high school academic competition and by estimating a production function for economic education. We find only limited differences between the education production function in urban and rural settings and lower average scores for rural students. To close this gap, results suggest that rural schools should place economic content in the senior-year curriculum and provide teachers with increased postgraduate training in economics.

Key Words: economic education, rural, production function

JEL Classifications: A21, R5

Economic education is a crucial component in preparing students for their future roles as employees, entrepreneurs, and voters. Economically literate individuals save a larger fraction of their income, have a more sophisticated understanding of risk, and are more likely to make good financial decisions (Danes, Huddleston-Casas, and Boyce, 1999). Likewise, recent studies have identified a widespread lack of economic literacy in the United States as a "crisis" and have documented its role in recent financial problems (Czelusniak, 2009). As a result, an increasing number of states are requiring coursework in economic education for high school students.

The lack of economic literacy and declining rural populations may be a significant barrier to improving economic conditions in rural communities (Borland and Howsen, 1999). Given the importance of vibrant economic growth in rural areas, it is surprising that only a limited body of research has tangentially examined differences in economic learning between rural and urban students (Butters and Fischer, 2008; Walstad and Soper, 1982, 1989). In this study, we conduct a more comprehensive analysis of urban and rural economic education outcomes using contemporary national data. We compare rural and urban student understanding in detailed areas of study, including microeconomics, macroeconomics, and international economics topics. This is the first time such a detailed comparison has been made in the economic education literature. We also document differences in student, school, and teacher characteristics in urban and rural settings and test for heterogeneity in urban and rural education production functions.

In the next section, we review the economic education literature that examines the influence of student, teacher, and school characteristics such as gender, race, and class size on learned

Roger Butters is an assistant professor, Department of Economics, University of Nebraska–Lincoln, Lincoln, Nebraska. Carlos Asarta is an assistant professor of practice, University of Nebraska–Lincoln, Lincoln, Nebraska. Eric Thompson is an associate professor, University of Nebraska–Lincoln, Lincoln, Nebraska.

economic knowledge. In the third section, we discuss the characteristics of our sample and provide a detailed comparison of rural and urban student understanding of key economic concepts. In the fourth section we estimate a production function for economic education, allowing for differences in the production technology between urban and rural students. Finally, in the fifth section, we provide a summary of our findings and discuss possible policy recommendations suggested by our research.

Literature Review

We begin by reviewing the handful of economic education studies that have at least touched on differences in rural and urban test scores for secondary students. We then summarize the extensive literature that addresses the influences of student, teacher, and school characteristics on student learning.

Urban and Rural Academic Achievement

In a recent study, the U.S. Department of Education (Provasnik et al., 2007) examined the status of education in rural America. Using the results from the 2006 National Assessment of Educational Progress (NAEP), the study found a larger proportion of students in rural America scoring at or above a proficient level in mathematics than in cities. Although mathematical ability is a good predictor of achievement in economic education (Ballard and Johnson, 2004), NAEP results in economics show that there were no significant differences between the proportion of 12th-grade students scoring at or above proficient level in rural areas and all other classifications (U.S. Department of Education, 2006). In an earlier national study in economic education at the high school level, Walstad and Soper (1982) found rural students perform significantly better on the Test of Economic Literacy (TEL) than similar students in urban settings (Walstad and Rebeck, 2001a). The authors used a pooled sample of students and dummy variables to identify economic literacy differences among urban, suburban, and rural students.

In a later similar study, however, Walstad and Soper (1989) found no significant differences in the performance of urban, suburban, and rural students on economic knowledge. The authors suggested that this later finding could have been influenced by the addition of income variables in their model to control for socioeconomic background. The 2006 NAEP results also use the proportion of students on free or reduced-price lunch as an indicator of socioeconomic status. Generally, students from higher socioeconomic tiers are found to outperform students from lower socioeconomic backgrounds in tests of economic knowledge and literacy (Butters and Fischer, 2008; Rebeck, 2002; Walstad and Soper, 1989). Furthermore, individuals from higher socioeconomic backgrounds are more likely to emigrate from rural areas and the remaining individuals may not view education as a valuable investment given its perceived low return (Borland and Howsen, 1999; Broomhall and Johnson, 1994). Butters and Fischer (2008) examined a sample of Nebraska high school students and found that urban students score significantly higher than rural students on the TEL. The authors controlled for the percent of students who participated in the free or reduced-price school lunch under the National School Lunch Program but only conducted an initial analysis of differences between urban and rural students. Rural and urban students were pooled in the sample and a rural dummy term was used to identify urban and rural differences. Coefficients from dummy variables can be difficult to interpret in such a setting because urban and rural students may have a different underlying production technology.

Gender

Gender is one of the most researched student characteristics in the economic education literature. Much of the literature suggests that male students outperform their female peers in economics (e.g., Bolch and Fels, 1974; Siegfried, 1979; Williams, Waldauer, and Duggal, 1992). This gender gap has been attributed to social and cultural (Walstad and Robson, 1997), cognitive (Anderson and Benjamin, 1994; Hirschfeld et al., 1995), and instructional differences (Ferber, 1990; Horvath, Beaudin, and Wright, 1992) as well as test format (Ferber et al., 1983; Lumsden, Scott, and Becker, 1987). Although a more recent body of literature seems to suggest that the gender gap in student performance on tests of economic knowledge or the entire economics curriculum no longer exists (e.g., Hirschfeld, Moore, and Brown, 1995; Swope and Schmitt, 2006; Ziegert, 2000), the 2006 NAEP results corroborate previous findings at the national level with males scoring on average 4 points higher and exhibiting a greater proportion of students performing at or above the proficient level than females.

Ethnicity and Race

Ethnicity and race are also student characteristics that have been researched in economic education. Lopus and Maxwell (1993) examined the preparation and learning styles of students from different ethnic and race backgrounds and found that the achievement of white students in economic education at the principles level is better than that of nonwhites. A similar finding is suggested by Laband and Piette (1995) in more advanced-level courses. On the other hand, Borg, Mason, and Shapiro (1989) found no statistically significant differences between races and ethnic groups in principles of macroeconomics. Several other studies (Borg and Shapiro, 1996; Borg and Stranahan, 2002; Ziegert, 2000) found similar results after controlling for personality types. More recently, however, the 2006 NAEP results indicated that although white and Asian/Pacific Island students performed equally well in economics at the national level, students in these two groups performed, on average, significantly better than black, Hispanic, and Native American students.

School and Class Size

The relationship between class size (school input) and achievement in economics has received considerable attention in the economic education literature. The results are mixed with some studies finding no relationship between class size and student performance (Hancock, 1996; Kennedy and Siegfried, 1997), studies finding a significant positive relationship between the two (Lopus and Maxwell, 1995), and studies reporting a negative and significant class size effect (Arias and Walker, 2004; Becker and Powers, 2001). Furthermore, after conducting an extensive review of the economic education literature on teaching, Siegfried and Walstad (1998) came to the conclusion that class size does not matter once the student–teacher ratio reaches 20. Better learning in small classes has been attributed to better critical thinking (Raimondo, Esposito, and Gershenberg, 1990) or student accountability (Siegfried and Kennedy, 1995). On the other hand, Lopus and Maxwell (1995) suggested that the positive and significant class size effect could be linked to better instructors being assigned to larger classes. It seems clear that the class size question is unresolved and deserves further exploration. Looking at the relationship between school size and achievement tests in Oklahoma school districts, Jacques, Brorsen, and Richter (2000) found that achievement test scores declined with school size for achievement tests covering reading, science, and math.

Teacher Ability

Becker, Green, and Rosen (1994, p. 93) indicate that teacher ability may be one of the most important predictors of student learning. Previous research findings suggest that teacher knowledge and preparation are significantly related to better student achievement in economics (Allgood and Walstad, 1999; Bosshardt and Watts, 1990; Butters and Fischer, 2008). These studies have controlled for teacher ability and preparation by introducing variables such as years teaching economics, postgraduate credit hours earned, and the number of general in-service hours completed. Although the positive impact of teacher quality on student achievement is a consistent finding in economic education, Rockoff (2004) suggests that the effect could be driven by less effective teachers simply leaving the profession. Also important is the finding by Rivkin, Hanushek, and Kain (2005) indicating that most student achievement gains from teacher experience are exhibited during the first few years of teaching.

The overall consensus of the existing literature documents the role of gender, race, school size, student affluence, and teacher preparation in the education production function. The literature also reveals that the differences in the rural and urban education production functions have not been extensively investigated and are not fully understood. In the balance of the article, we use a unique, contemporary data set to compare education production functions for urban and rural students and identify similarities and differences in student, teacher, and school characteristics that influence student achievement in high school economics. We also provide a detailed discussion of TEL results among urban and rural economics students.

National Economics Challenge Data

We describe the National Economics Challenge data in this section. We first discuss the sample design. We then review sample statistics for our data set followed by a detailed discussion of urban and rural test scores.

Sample Description

The data for our research consist of test results collected during the Spring of 2009 as part of the National EconChallenge competition and an online survey completed by participating teachers. The EconChallenge is a national online competition for high school economics students in 21 states.[1] A breakdown of urban and rural schools in our sample, by state, is presented in Table 1. As a result of the ongoing trend of states mandating economic education, every state in our sample has established standards in economic education for students in grades K–12 (Council on Economic Education, 2009). Participation in the competition is voluntary and is sponsored by state-level organizations that promote economic education in the K–12 school system. Students in our sample were enrolled in single (or less) semester courses in economics, general economics, or courses that included introductory economic concepts. Thus, the sample represents a broad cross-section of students from 102 public schools being taught basic economics. Unfortunately, the data do not allow us to further disaggregate students by class type (e.g. history, business, civics, etc.) nor do they allow us to control for other student and home factors such as work outside school, sports or club involvement, parents' education, etc.

Table 1. Urban and Rural Schools by State

	Urban Schools	Rural Schools
Arizona	1	4
California	1	7
Hawaii	0	1
Idaho	0	2
Illinois	1	3
Indiana	1	0
Iowa	2	0
Kansas	4	0
Maryland	0	1
Massachusetts	2	1
Michigan	0	2
Minnesota	8	1
Mississippi	15	4
Nebraska	14	3
New York	1	2
Oregon	1	0
South Carolina	1	0
Texas	1	5
Virginia	0	4
Washington	1	1
Wisconsin	4	3
Totals	58	44

Teacher characteristics were collected through an online survey. The survey asked teachers to report the number of years in teaching and hours of postgraduate education in economics but did not collect data on teacher certifications, specializations, or other types of courses taught. School characteristics were obtained from the National Center for Education Statistics (NCES). Our data are a unique sample consisting of student, teacher, and school characteristics that make it possible to investigate the differences in rural and urban educational outcomes with a precision not possible in previous research. However, like with most national achievement tests, the sample is not random but does represent a diverse national sampling of urban and rural students (Baglin, 1981; Walstad, Rebeck, and Butters, 2010a, 2010b).

[1] Arizona, California, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, New York, Oregon, South Carolina, Texas, Virginia, Washington, and Wisconsin.

Test results were collected through an online competition website in which participating teachers register, create student teams, and download unique student access codes. Students then enter the testing portal and complete an examination in economics under the supervision of teachers or school principals. High scoring participants receive cash, travel, and other prizes in addition to local, state, and national recognition. As a result, students have a competitive incentive to accurately demonstrate their level of economic understanding while taking the test.

Based on the same technology used to perform the national normings of the Test of Economic Knowledge and the Basic Economics Test, the online portal is an effective method of administering testing materials and collecting student data (Walstad and Butters, 2011; Walstad, Rebeck, and Butters, 2010a, 2010b). Questions, from the TEL were randomly drawn and randomly ordered for each student. A total of 1840 students completed examinations. The TEL is a nationally normed, standardized, reliable, and valid measure of understanding of basic economics (Walstad and Rebeck, 2001a).

Summary Statistics

Summary statistics for students completing the TEL as part of the EconChallenge competition and self-reported teacher characteristics are presented in Table 2. The mean test score for urban students was 58% compared with 54% among rural students. Mean values for urban and rural students are similar in a number of characteristics including gender and time, in minutes, spent taking the test but also differ in several ways. For example, 84.5% of all of rural students self-identify as white compared with 49.0 percent among urban students. Previous research (Lopus and Maxwell, 1993) suggests that this would imply higher aggregate test scores among rural students. Other differences, however, suggest lower test scores should be observed for rural students. For example, 76% of urban students taking the test were in 12th grade vs. just 57% of rural students. Because older students generally achieve higher test scores, this fact would bias the overall rural score downward (Walstad and Soper, 1989). Additionally, the fraction of students eligible to participate in a free or reduced-price lunch program is higher in rural schools. To the extent

Table 2. Means and Standard Deviations Student, School, and Teacher Characteristics

	Full Sample		Rural Sample		Urban Sample	
Test Data	Mean	SD	Mean	SD	Mean	SD
Test of economic literacy score	0.56	0.21	0.54	0.20	0.58	0.22
FTE teachers	73.63	53.56	41.97	26.56	96.88	56.41
Pupil–teacher ratio	17.17	4.27	14.60	2.99	19.06	4.09
Percent reduced lunch	0.29	0.20	0.32	0.20	0.26	0.20
Time on test (minutes)	16.42	6.48	16.38	6.21	16.45	6.67
Gender (1 = male)	0.51	0.50	0.51	0.50	0.50	0.50
Race (1 = white)	0.64	0.48	0.85	0.36	0.49	0.50
Rural (1 = rural)	0.42	0.49	1.00	0.00	0.00	0.00
Grade 9	0.07	0.25	0.07	0.25	0.07	0.25
Grade 10	0.08	0.28	0.13	0.34	0.05	0.22
Grade 11	0.17	0.38	0.24	0.42	0.13	0.33
Grade 12	0.68	0.47	0.57	0.50	0.76	0.43
Survey Data	Mean	SD	Mean	SD	Mean	SD
Tenure (years teaching)	18.57	10.91	15.04	10.52	21.79	10.26
Postgraduate hours (credit hours)	2.23	1.36	1.41	0.80	2.97	1.34

SD, standard deviation; FTE, full-time equivalent.

that free and reduced-priced lunch participation is a proxy for the household income of students, this would imply lower test scores among rural students.

The number of full-time equivalency (FTE) teachers was substantially larger in urban schools. The impact of FTE teachers on test scores, however, is ambiguous. An increase in the number of teachers would allow more differentiation in classes taught, which could contribute to higher test scores by allowing students to take economics from a teacher who specializes in the subject. At the same time, monitoring by school management could become more difficult as the number of teachers rises, negatively impacting learning outcomes and test scores. Therefore, it is unclear how the difference between the number of teachers in urban and rural schools would influence student test scores.

Approximately half of teachers responded to the online survey with responses representing 52% of students (965 students). Survey results indicate large differences in teacher characteristics. Generally speaking, urban teachers had more years of teaching experience and more postgraduate study. Teaching experience was 40–50% higher for urban teachers than for rural teachers, and urban teachers had twice as many hours of postgraduate study. Overall, differences in student, school, and teacher characteristics indicate that urban and rural students have different inputs into the education production function. In the next section, we examine test scores for rural and urban economics students.

Urban and Rural Test Scores

Test scores are reported in Table 3 by overall, concept, and content categories for rural and urban students. Whether or not students are designated as urban or rural is based on a U.S. Department of Education classification that categorizes all U.S. schools as urban, suburban, town, or rural. In this study, we define rural to mean students in schools located either in towns or in rural areas. We define urban to mean students in schools located either in urban or suburban areas (NCES).

In the subsequent text, percentage point differences are reported within parentheses. Overall, urban students score significantly higher than rural students (3.49). Similar results are found within individual content categories. Urban students perform statistically better on topics within the fundamentals (4.68), macroeconomics (4.89), and international categories (2.71). In the microeconomic content category, urban and rural score differentials are not significantly different from one another.

The data allow us to further disaggregate student scores by economic content areas and examine performance differentials between rural and urban students on a topic by topic level. Within the fundamentals category, urban students scored significantly higher than rural students in four of the six concept areas with the largest differentials being in the scarcity items (8.83). Rural students scored similarly to urban students in the economics systems and exchange, money, and interdependence areas. Within the microeconomics category, students perform remarkably similar to one another regardless of being from urban or rural schools. Only the market failures concept area is significantly different for the two groups.

Urban students perform better than rural students in four of six macroeconomic concept areas. Of particular note, the largest score differential for any concept is found in monetary policy (10.96). Traditionally, monetary policy is seen as one of the most difficult concepts for students to learn and for teachers to teach (Walstad and Rebeck, 2001b). In a similar fashion, the two concept areas in which students post similar scores, unemployment and fiscal policy, are generally considered relatively easy to teach and master and are traditionally associated with high scores on standardized tests (Butters and Asarta, 2011).

Items within the international content category are generally taught at the end of the class or not at all (Walstad and Rebeck, 2001b). As a result, the finding that urban students perform better than rural students by a statistically measurable amount is curious. There are no significant differences between the two groups for two of the three concept areas and scores are generally low. However, for the international

Table 3. Urban and Rural Performance by Content Category

	Test Items	Rural (% correct)	Urban (% correct)	Difference
Overall	1–40	54.28	57.77	3.49***
Fundamentals		59.37	64.05	4.68***
1. Scarcity	1, 2, 3	63.84	72.67	8.83***
2. Opportunity costs/tradeoffs	4, 5	55.31	59.66	4.35**
3. Productivity	6, 7	61.15	65.80	4.65**
4. Economic Systems	8, 9	69.85	71.22	1.37
5. Economic institutions and incentives	10, 11, 12	62.31	66.51	4.20**
6. Exchange, money, and interdependence	13, 14	40.02	42.65	2.63
Microeconomic economic concepts		53.52	54.49	0.96
7. Markets and prices	18	54.05	55.65	1.60
8. Supply and demand	16, 17, 19	56.06	55.42	–0.64
9. Competition and market structure	15, 20	59.94	58.61	–1.33
10. Income distribution	21	47.32	47.48	0.15
11. Market failures	22, 23	50.00	55.94	5.94***
12. Role of government	24	45.81	46.67	0.86
Macroeconomic economic concepts		49.81	54.70	4.89***
13. Gross domestic product	25	54.69	60.56	5.86*
14. Aggregate supply and demand	26, 27	41.47	46.29	4.82**
15. Unemployment	28	85.92	88.19	2.27
16. Inflation and deflation	29, 30	48.34	53.72	5.39**
17. Monetary policy	31, 32	22.15	33.12	10.96***
18. Fiscal policy	33, 34	67.10	65.69	–1.41
International economic concepts		50.92	53.64	2.71**
19. Comparative advantage/barriers to trade	35, 36, 37	52.63	54.53	1.90
20. Balance of payments and exchange rates	38, 39	42.77	44.63	1.86
21. International growth and stability	40	62.80	69.33	6.54**
Results for 12th-grade subsample	**Test Items**	**Rural**	**Urban**	**Difference**
Overall	1–40	57.79	57.67	–0.11
Fundamentals	1–14	63.39	63.98	0.59
Microeconomic economic concepts	15–24	56.73	53.97	–2.76**
Macroeconomic economic concepts	25–34	53.36	54.76	1.40
International economic concepts	35–40	53.67	53.98	0.30

*$p < 0.10$, **$p < 0.05$, ***$p < 0.010$.

growth and stability concept area, urban students score significantly higher than rural students (6.54). On further inspection, we find that the question in this section is a general economic growth question whose content would have been covered as part of the materials in the fundamentals section of the course.

In summary, when examining raw test scores for a large sample of urban and rural students participating in an academic competition, we observe statistically significant differences in performance between rural and urban students with urban students scoring higher on overall test scores, content category, and concept area levels in economics. However, as seen at the bottom of Table 3, these differences appear to result from differences in the grade when students take economics in rural and urban schools. We find no statistically significant differences in the overall economic performance of urban and rural students when the analysis is restricted to 12th-grade students. This finding is consistent at a more disaggregate level with only the microeconomic category being the exception: 12th-grade rural students significantly outperformed their urban counterparts in microeconomics by 2.76 percentage points, a result significant at the 5% level.

Production of Economic Education Knowledge in Urban and Rural Areas

We use an education production function to estimate the relationship between educational resources (inputs) and educational outcomes (outputs) documented in the literature review shown previously. An education production function represents the maximum amount of output achievable for given levels of inputs, and it is of the general form:

$$Q = f(X,S) \tag{1}$$

There are two general types of inputs at the precollege level that have been identified and used in previous education studies, inputs provided by the school (school inputs) and those that are innate or provided to students through their homes or societal interaction (nonschool inputs) (Cohn and Geske, 1990; Walden and Sisak, 1999). For the purposes of this study, in Equation 1, Q is a vector of educational outputs (standardized test scores), X is the vector of school-related inputs (e.g. pupil/teacher ratio or teacher tenure), and S is the vector of nonschool inputs (e.g. race or student gender). We use a Box-Cox procedure to test for proper specification and employ a double log model for estimation.

The regression includes a series of interaction terms to test for differences in the production functions for economic education courses taken by rural and urban students. A rural dummy variable and a rural interaction term are included for all variables to examine differences in coefficient estimates between students in rural and urban schools. Coefficient estimates for uninteracted variables are interpreted as applying to urban students. Estimates for interacted variables test for heterogeneity between the coefficients for rural and urban students, and coefficient estimates for the uninteracted and interacted variables can be summed to provide the estimated coefficient for rural students. We fail to reject joint significance tests of the rural intercept and rural interaction terms suggesting some parameter heterogeneity in the rural and urban education production functions.

Regression Results

Regression results for our sample are provided in Table 4 and include student and school characteristics but exclude those of teachers. As noted earlier, approximately half of teachers responded to the follow-up survey. Results that include teacher characteristics are reported in Table 5. We find that student demographics, grade, time on the test, and school characteristics influence test scores among urban students. Male urban students scored higher than female students, consistent with the findings of Bolch and Fels (1974) and Walstad and Robson (1997) but in contrast to the findings of Swope and Schmitt (2006) and Ziegert (2000) . White urban students scored higher than urban students in other racial groups, consistent with the findings of Laband and Piette (1995) and Lopus and Maxwell (1993) but in contrast to the findings of Borg, Mason, and Shapiro (1989). Grade level is also a significant predictor of student performance with students in lower grades achieving lower tests scores. Students in 9^{th}, 10^{th}, and 11^{th} grade averaged lower scores than 12^{th}-grade students with scores improving steadily as students advanced in grade. Student effort on the test also influences results as urban student scores rose with time spent completing the test.

We find a negative relationship between test scores and participation in free or reduced-price school lunch programs. For students in our sample, a 10% increase in the share of students participating in reduced-price lunch programs is associated with a 7.4% decrease in test performance. Larger schools, as measured by the number of FTE teachers, imply lower scores for urban students. The pupil–teacher ratio at a school had no impact on test scores. Because average class size in urban schools is close to 20, this finding is consistent with Siegfried and Walstad (1998).

Coefficients on the interaction terms in Table 4 indicate whether the influence of student or school characteristics on test scores differs

Table 4. Full Sample Regressions

	All Students	12^{th}-Grade Students
FTE teachers	–0.151***	–0.257***
	(0.022)	(0.026)
FTE teachers–I[a]	0.176***	0.355***
	(0.038)	(0.047)
Gender (1 = male)	0.074***	0.035
	(0.024)	(0.027)
Gender (1 = male)–I	–0.005	0.018
	(0.037)	(0.044)
Pupil–teacher ratio	0.016	0.163
	(0.094)	(0.105)
Pupil–teacher ratio–I	0.181	–0.004
	(0.131)	(0.153)
Race (1 = white)	0.154***	0.135***
	(0.025)	(0.028)
Race (1 = white)–I	–0.023	0.037
	(0.048)	(0.057)
Percent reduced lunch	–0.074***	–0.161***
	(0.013)	(0.018)
Percent reduced lunch–I	0.004	0.117***
	(0.024)	(0.029)
Time on test	0.215***	0.192***
	(0.025)	(0.028)
Time on test–I	0.191***	0.203***
	(0.042)	(0.054)
Rural (1 = rural)	–1.798***	–1.918***
	(0.422)	(0.495)
Grade 9	–0.405***	
	(0.064)	
Grade 9–I	0.064	
	(0.087)	
Grade 10	–0.196***	
	(0.060)	
Grade 10–I	0.028	
	(0.075)	
Grade 11	–0.098***	
	(0.037)	
Grade 11–I	0.047	
	(0.051)	
Constant	–0.806**	–0.797**
	(0.367)	(0.406)
R^2	0.247	0.275
N	1840	1246
p	5.5e-102	1.58e-79

FTE, full-time equivalent.

[a] I indicates an interaction of the indicated variable with rural students.

between urban and rural areas. We find limited evidence that the influence of student or school characteristics on tests scores differs in urban and rural settings. Interaction coefficient estimates for race and gender are insignificant as are the coefficients on interaction terms for grade and participation in free or reduced-price school lunch programs. However, the coefficient on the time spent on test interaction term is positive and significant, indicating that rural test scores are even more sensitive to time spent on the test than urban test scores. The coefficient on the rural interaction term for the number of FTE teachers is positive and significant. This result suggests that test scores do not fall in rural schools as school size rises. In particular, the sum of the coefficients of the variable and interaction term is near zero, suggesting that student test scores are not affected by school size in rural areas. To check the robustness of our results, we re-estimate the model using disaggregate urban and suburban classifications as the comparison group and find results that are qualitatively similar to those reported in Table 4.

Twelfth-grade Subsample Results

Given the large difference in the proportions of 12^{th}-grade students completing their economics courses in urban and rural areas, and their similar overall test performance, we re-estimated the model using a subset of the data consisting of 12^{th}-grade students. The results are reported in the second column of Table 4 and are similar to those for all students. Coefficients on race, school size, pupil–teacher ratio, time on test, and their interaction terms have similar magnitude and significance as in the overall student sample regression. We do, however, find differences between the estimated coefficients for a number of variables. Among demographic characteristics, gender was not found to influence test scores among 12^{th}-grade students in either urban or rural schools. Student income was found to have nearly twice as large an influence on test scores for urban students in the 12^{th}-grade sample. For urban 12^{th}-grade students, a 10% increase in the share of all students participating in reduced-price lunch programs is associated with a 16% decrease in test performance. Among rural students, the influence

Table 5. Sample with Survey of Teacher Characteristics

	Without Teacher Characteristics	With Teacher Characteristics	With Tenure Categories
FTE teachers	–0.348***	–0.278***	–0.275***
	(0.066)	(0.068)	(0.067)
FTE teachers–I[a]	0.365***	0.333***	0.300***
	(0.088)	(0.093)	(0.093)
Gender (1 = male)	0.016	0.021	0.016
	(0.034)	(0.033)	(0.032)
Gender (1 = male)–I	0.046	0.037	0.051
	(0.049)	(0.049)	(0.047)
Pupil–teacher ratio	0.125	0.289**	0.057
	(0.133)	(0.138)	(0.145)
Pupil–teacher Ratio–I	0.211	0.006	0.286
	(0.195)	(0.208)	(0.216)
Race (1 = white)	0.102***	0.079**	0.063*
	(0.035)	(0.035)	(0.034)
Race (1 = white)–I	–0.008	0.018	0.058
	(0.068)	(0.068)	(0.066)
Percent reduced lunch	–0.192***	–0.176***	–0.178***
	(0.028)	(0.028)	(0.036)
Percent reduced lunch–I	0.176***	0.146***	0.165***
	(0.040)	(0.042)	(0.047)
Time on test	0.144***	0.158***	0.163***
	(0.041)	(0.041)	(0.040)
Time on test–I	0.220***	0.182***	0.179***
	(0.061)	(0.062)	(0.060)
Rural (1 = rural)	–2.551***	–2.164***	–2.636***
	(0.559)	(0.568)	(0.598)
Grade 9	–0.085	–0.200**	–0.255**
	(0.095)	(0.100)	(0.099)
Grade 9–I	–0.280**	–0.146	–0.022
	(0.116)	(0.119)	(0.122)
Grade 10	0.032	–0.063	–0.163*
	(0.080)	(0.085)	(0.085)
Grade 10–I	–0.210**	–0.116	–0.006
	(0.105)	(0.108)	(0.107)
Grade 11	0.074	–0.036	–0.137*
	(0.067)	(0.071)	(0.071)
Grade 11–I	–0.165**	–0.044	0.082
	(0.082)	(0.087)	(0.085)
Tenure		–0.134***	
		(0.042)	
Tenure–I		0.113**	
		(0.051)	
Tenure 10			0.114*
			(0.066)
Tenure 10–I			–0.02
			(0.086)
Tenure 20			–0.277***
			(0.068)

Table 5. Continued

	Without Teacher Characteristics	With Teacher Characteristics	With Tenure Categories
Tenure 20–I			0.227**
			(0.099)
Tenure 30			–0.243***
			(0.078)
Tenure 30–I			0.172
			(0.105)
Postgraduate hours		–0.038	–0.003
		(0.035)	(0.039)
Postgraduate hours–I		0.160**	0.122*
		(0.064)	(0.067)
Constant	–0.131	–0.476	–0.112
	(0.476)	(0.483)	(0.510)
R^2	0.206	0.224	0.274
N	965	965	965
p	5.79E-40	9.17E-43	6.30E-54

*$p < 0.10$, **$p < 0.05$, ***$p < 0.010$.
FTE, full-time equivalent.
[a] I indicates an interaction of the indicated variable with rural students.

is substantially less but still statistically significant. A 10% increase in the share of all students in a reduced-lunch program is associated with just a 4% decrease in test performance.

Teacher Characteristics

Regression estimates for an augmented education production function including teacher characteristics are reported in Table 5. The regression results are reported both with and without teacher characteristics variables to isolate whether differences in regression results reported in Table 4 arise from the narrowing of the sample or from the inclusion of teacher variables. The first column of results in Table 5 presents estimates using the same model as in Table 4 but with the narrower sample. The magnitude and significance of coefficient estimates differ from coefficients reported in Table 4, but the results are broadly similar. As a robustness check, the full sample was estimated using a dummy variable indicating whether a teacher completed the online survey to determine if any significant bias existed between teachers who completed the survey and those who did not. The point estimate on the dummy variable was positive but highly insignificant and the signs and significance of the other independent variables were unchanged.

Teacher characteristics are included in the regression results reported in the second column of Table 5. These variables were found to have only a limited impact on student test scores. Teacher postgraduate hours had a positive and significant impact on test scores in rural schools consistent with the findings of Allgood and Walstad (1999), Bosshardt and Watts (1990), and Butters and Fischer (2008) but not in urban schools. The number of years spent teaching exhibited a negative and significant effect in explaining test scores in urban schools and had no impact on rural schools. These latter results are surprising but may be consistent with Rivkin, Hanushek, and Kain's (2003) finding that the gains from additional teaching experience occur in the first years of employment. We test for this possibility in the last column of Table 5 by replacing the continuous teaching experience variable with a set of categorical variables indicating level of teaching experience. The omitted category is 1–9 years of teaching experience and the remaining categories are 10–19 years of experience (Tenure 10), 20–29 years of experience (Tenure 20), and 30 or more years of teaching experience (Tenure 30). The coefficient on the variable for teachers with 10–19 years of experience is positive and significant, suggesting that the second decade of teaching experience contributes to higher student test scores in urban schools. The finding is the same for rural schools, given that the coefficient on the interaction term for rural teachers with 10–19 years of experience is close to zero and statistically insignificant.

Further teaching experience, however, works against student test scores. The coefficients on the variables Tenure 20 and Tenure 30 are negative and statistically significant rather than positive. In other words, all else equal urban school students of teachers with 20 or more years of teaching experience will have lower test scores than urban school students of teachers with 1–9 years of experience. There is a different result for students in rural schools. Coefficients on interaction terms for these two categories of most experienced teachers are positive and large. Furthermore, statistical tests indicate that the sum of the coefficients of each variable and its interaction terms is statistically insignificant.

Conclusion

This study uses a unique, current data set to provide a more comprehensive analysis of the production of economic education literacy in rural and urban settings and adds to a body of research that has only tangentially addressed this issue. The study provides a detailed discussion of economic test scores for students participating in the 2009 National EconChallenge competition. The study also compares education production functions for urban and rural students and identifies similarities and differences in student, teacher, and school characteristics that influence student achievement in high school economics. This study's findings have several policy implications for rural education.

Student grade has an important influence on test scores among both urban and rural students. Test scores are significantly higher for high school seniors than for juniors, sophomores, or freshmen. This result suggests that economics courses are better suited for high school seniors, yet only 57% of rural students participating in the EconChallenge were seniors compared with 76% of participating urban students. From a policy standpoint, this finding suggests that the observed differential between urban and rural test scores may be eliminated simply by requiring rural students to complete economic coursework later in their academic careers. Because this is a timing issue, not a funding issue, it may be resolved with relative ease. Given the importance of economic literacy for future financial success, such a change would have significant positive impacts on the students and their communities.

Next, several other student, school, and teacher characteristics vary between urban and rural areas. Rural areas have higher free and reduced-price lunch program participation than urban schools, have a higher percentage of white students, and have less experienced teachers with fewer postgraduate hours of training. Each of these characteristics was found to influence the production of economic knowledge for high school students. We also found heterogeneity between the education production function for high school economics in rural and urban settings. Coefficient estimates were not found to differ for a number of educational inputs such as race, age, pupil–teacher ratio, and time on test. School size, however, was found to reduce test scores in urban areas but did not affect test scores in rural areas. The percentage of students participating in free or reduced-lunch programs consistently influenced test scores in urban areas but the impact was smaller, or sometimes absent in rural schools, depending on the specification.

Next, the level of teacher training through postgraduate education influences test scores in rural schools. Increased teacher training may be an effective way to increase economic literacy for high school students in rural areas. From a policy standpoint, as states adopt economic curricula for secondary education, it is critical that they also adopt certification or other training standards to ensure that teachers have the skills needed to teach the challenging content of introductory economics.

Finally, categorical teaching experience variables demonstrate a complex relationship between teaching experience and student test scores. The second decade of teaching experience contributes to higher student test scores in both urban and rural schools, but additional teaching experience reduces student test scores overall. In urban schools, the decline is large enough that students of teachers with 20 or more years of teaching experience would have lower test scores than students of teachers with less than 10 years of experience. In rural schools, no difference is found between the student tests scores of teachers with 20 or more years of experience and teachers with less than 10 years of experience. This finding suggests a policy response to ensure that senior educators remain current with pedagogical advances and changes to the economics curriculum.

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