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Recruitment and Retention of Agriculture Teachers in the Southeast: An Empirical Analysis of the STAR Program.

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Abstract

This article describes the collaborative efforts of various state and national agencies working together to recruit and retain agriculture teachers in the states of Kentucky, South Carolina, and Ohio. We contrast multiple measures of recruitment and retention in these states with those from the comparator states of Arkansas, West Virginia, and Alabama. The strategies outlined market to new agriculture teachers and maintain current teachers in the profession targeting work-life balance, emotional, physical and social health. These have been a focal point in the federal State Teach Ag Results (STAR) program, but the effects of participation in STAR on recruitment and retention require additional investigation. Using a difference-in-differences regression model, we assume parallel trends and no spillovers (SUTVA) between participating and non-participating states in the Southeastern US and Ohio Valley regions to model changes in multiple measures of recruitment and retention of agriculture teachers. We find a positive and significant effect of STAR participation on recruitment, an insignificantly positive effect of participation on retention, and an insignificantly negative impact of participation on creation of new agricultural positions in public schools. Our results suggest that recruitment is lagged behind existing positions, which necessitates further work investigating new policy aimed at filling those positions before creating any new ones.

Keywords: STAR, agriculture education, recruitment, retention, difference-in-differences

Introduction

Throughout the nation, the shortage of qualified teachers in numerous disciplines has negatively impacted public education. Many school districts have closed programs, left vacancies, or turned to alternative certification. Career and technical education (CTE) throughout the nation provides students an opportunity to be college and career ready (CTE, n.d.), and has topped the US Department of Education teacher shortage list in every region of the multiple states for the past 7 years (Cross, 2017). In agriculture education, a part of CTE, has been fortunate thus far by meeting most of the demands of open positions. However, through a grant with the National Teach Ag Campaign and NAAE, National Association of Agricultural Educators, multiple states are making progress to create key initiatives to recruit and retain teachers in agriculture.

In 2009, an initiative with the National Council for Agriculture Education, National Association of Agricultural Educators (NAAE), and the National FFA Foundation was established to bring awareness to the need to recruit and retain teachers in agriculture (NAAE, 2019). Agriculture corporations throughout the country have partnered with the National Teach Ag campaign to ensure the qualified, diverse, and successful recruitment and retention of agricultural science and technology teachers (AST). Throughout the country, individual states applied for funding and assistance through this grant program. In order to address the shortage of qualified AST or teachers in general, new teachers must be recruited by qualified teachers in the classroom (Lemons, Brashears, Burris, Meyers & Price, 2015). An old adage states that quality begets quality. Therefore, quality, retained teachers will recruit quality, pre-service teachers. Studies have been done on teacher retention and the desire to understand the motives of those that continue in the profession. Chapman's (1984) model of teacher retention focused on what made them stay in the profession. The result of his study included several key aspects such as: personal characteristics, educational preparation, initial commitment, quality of first teaching assignment, integration into the profession, external influences, and career satisfaction (Chapman, 1984). These factors are pivotal in developing the strategies necessary to recruit quality teachers and then retain them in the profession.

In 2017, the states of Kentucky, Ohio, and South Carolina were all awarded the State Teach Ag Results (STAR) program funding. Following this enrollment, the state selects a committee of key stakeholders to serve a two-year term. The committee develops a set number of strategies within the context of the recruitment and retention of certified agricultural science and technology teachers. These strategies are aligned with the National Teach Ag Campaign to address the shortage of teachers entering the profession and retaining those currently in the profession.

To speak to the value of this effort, we propose testing the following null hypotheses with regards to the STAR program:

H_0^A: *There is no systematic difference between participating and non-participating states in the recruitment of recently-graduated agricultural science and technology teachers.*

H_0^B: *There is no systematic difference between participating and non-participating states in the retention of existing agricultural science and technology teachers.*

Recruitment

Working with institutions that service agriculture education throughout the state, the committee above developed strategies to target students of agriculture at popular events. Examples include the state FFA convention, FFA career development events, and leadership workshops. These were considered prime recruitment areas along with social media, specifically to target potential teachers throughout the STAR-participating states. The committee allocated resources to pay for student teachers or teacher candidate's registration to a state's Association of Agriculture Educators conference, promotional materials for high school and college classrooms, signing event pull-ups, and for booth space at the FFA convention. The allocated funds are then administered and distributed either by one state's FFA Foundation, FFA Alumni, or the Department of Education.

Pre-service workshops were held at one participating state's annual agriculture teachers conference and the winter professional development workshop. The goal was to pair pre-service teachers with seasoned agricultural teachers who were heavily involved with the professional organization and had received awards in teaching and learning. This strategy was designed to recruit pre-service teachers to continue in the discipline of agricultural education. McGee (2019) developed a three-part mentor program training mentors to provide support to pre-service teachers. The program provided online training for mentors, face-to-face orientations, and modules focused on procedures, co-teaching, and high, quality feedback (McGee, 2019). The goal in this particular state was to provide quality mentoring, support systems, and professional development to the future educators.

At the state convention, the signing day, similar to an athlete's college signing day but for future agriculture teachers, were held during a designated session. Family, teachers, and friends received invitations to the event along with the university teacher educator. Another method of recruitment was paid aid adds through social media markets of Facebook, Instagram, and Twitter which ran for a period during the National Teach Ag week, National FFA week, and the convention highlighting the signing events. Specific targeting segmentations included geography, keyword searches, and time of day.

Retention

Camp (2000) discussed the shortage of agriculture teachers could be identified as early as the 1970's and has continued for the past few decades. The desire to retain quality teachers is imperative to the success of one of the largest industries in our nation, agriculture. Crutchfield (2009) discussed the issue of finding the ideal balance in the teaching profession. The struggle to find balance between teaching, community events, advising the organization, and family has been the central component to the workshops, stress tests and health screenings at conventions and conferences offered for teachers. Designing calendars with due dates, event dates, deadlines, and inspirational quotes were created and distributed for agriculture teachers in their perspective state. Sessions on yoga and breathing techniques have even been provided at teacher's conference. Professional development in Master Agriculture Teacher's program which targets teachers who have 5-15 years of teaching experience, centers on work-life balance. All of the initiatives address Crutchfield's point that balance is the key to retention of teachers.

As far back as Chapman (1984), personal characteristics were the initial reason for a person deciding to enter the teaching profession. It is often characterized that certain behavior or personality traits lends itself more so to the teaching field which aligns with Chapmans model. In Lemons, et. al. (2015) study of agriculture teacher attrition factors, the high expectations whether real or perceived contributed to teacher attrition. The demand for high test scores, successful FFA chapters, community involvement and other responsibilities creates a "make it or break it" mentality within the profession.

The professional development, work life balance, and mentoring program are the key initiatives developed to assist with retention. The impact that the profession has on molding and educating young agriculturists is without question. However, due diligence must be done to ensure quality teachers are being recruited and retained in the classroom.

Data

In order to test our hypotheses, factors considered are the number of agriculture education graduates throughout the states participating and those who have not who have received positions to teach agriculture. Another factor worth considering is the changes in new positions added within each state. Lastly, we examine changes in the number of alternative certified hires in agriculture education. Initially, the data are reported by individual states to the US Department of Education, which is mined directly be the NAAE. The NAAE ultimately provided our aggregated teacher supply and demand data for all states with agriculture education programs. The reporting of the data was derived from the stakeholders from each state gathering information concerning agriculture education graduates, graduates teaching in-state, out of state, or in another field. The data showed teaching full time, part time, new programs, positions lost, positions to fill, and programs closed for 2015-2018 (NAAE, 2019).

The variables measured for the purpose of this study were alternatively certified teachers, teaching agriculture in-state, new positions, enrollment into the STAR program, beginning average salary, institutions reported, non-licensed teachers, and female teachers. An alternatively-certified teacher is one who has a bachelors or a master's degree in the field of study pertaining to the position but lacks the educational credentials to teach. Through a program at a university, the teacher takes a series of courses while teaching to gain their certification. When looking at the teaching agriculture in-state, the universities reported those students who had graduated with an agricultural education degree and had accepted positions within the state.

Each state reported to NAAE the number of new agricultural education positions that had been added to the state. The number of positions would include those that are full time and part-time positions. Universities that offer an educational certification program vary from state to state, taking into account those states that had five agricultural education institutions reporting compared to one certification institution was important in this study. Utilizing the National Education Association's average teaching salaries, each state's beginning salary were recorded within the data set (NEA, 2018).

A non-licensed teacher is an individual who does not have certification and may not have the proper bachelors or master's degree to teach the subject. Non-licensed teachers may not be able to move into the alternative certification route due to lack of content knowledge courses taken during the undergraduate or graduate degree. The non-licensed teacher will be requested to receive a waiver granted by the school superintendent to teach more than thirty days in the position. Out of the 50 reporting states, those who had entered the program and those who had not entered the program were considered. The last two variables for control looked at female teachers and the years of service to retirement. The amount of years of service a state requires to retire with full benefits varied based on years of experience, age, and degrees awarded.

Simple statistics for these variables are shown in Table 1

Table 1
Summary Statistics for Non-Participating States' Dependent and Independent Variables

	Mean	Median	Standard Deviation	Min	Max
Alt Certified Teachers	8	4	10.18	0	34
Teaching Ag in-state	6.33	7	3.92	2	14
New Positions	3.33	4	2.39	0	6
Beginning Salary	$33,872	$33,470	$2,768	$29,244	$38,491
Institutions Reported	1	2.08	1.62	1	5
Non-Licensed Teachers	0.75	0	1.48	0	5
Female Teachers	51.42	46	16.06	34	80
Years of Service Retirement	27.67	28	2.15	25	30

Note. The treatment group is a balanced panel with $n_0 = 3$ and $T_0 = 4$.

Table 2
Summary Statistics for Participating States' Dependent and Independent Variables

	Mean	Median	Standard Deviation	Min	Max
Alt Certified Teachers	3.67	0.50	7.02	0	19
Teaching Ag in-state	11.25	12	3.77	5	16
New Positions	5.79	5	3.34	1	13
Beginning Salary	$34,335	$33,955	$1,593	$32,306	$36,752
Institutions Reported	2.67	2	1.77	1	5
Non-Licensed Teachers	0.33	0	0.78	0	2
Female Teachers	132.30	106	78.19	51	275
Years of Service Retirement	29	30	1.48	27	30

Note. The treatment group is a balanced panel with $n_1 = 3$ and $T_1 = 4$.

Model

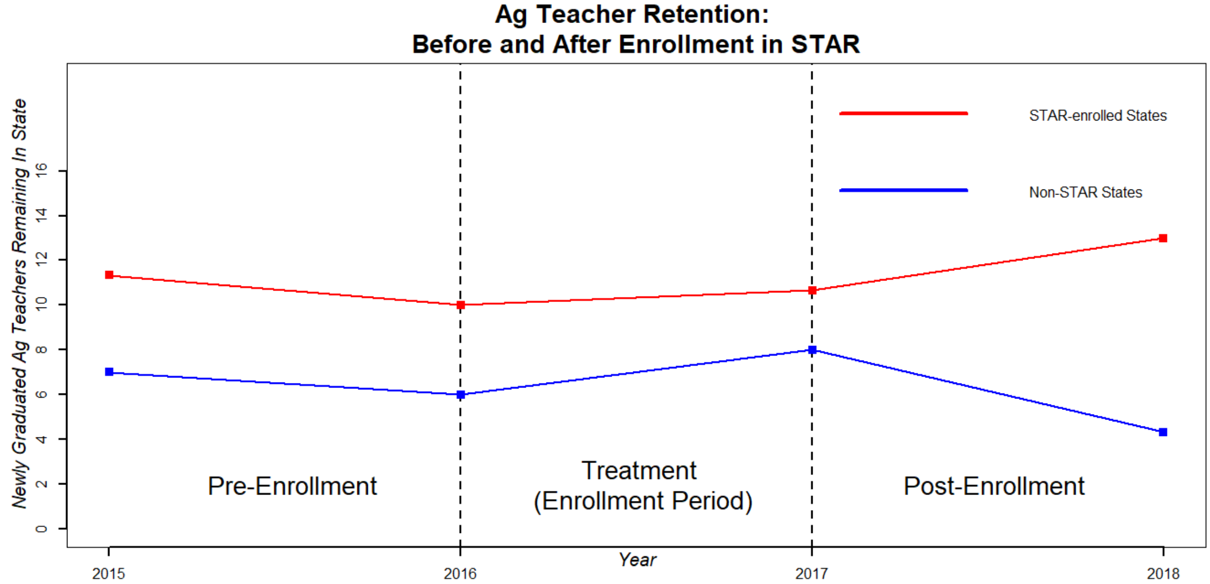
The framework we use for this study is a difference-in-differences regression (DID). This particular model exploits the pre-treatment similarities in the experimental units (states) and compares the differential effect of the treatment (STAR enrollment) across the treatment group (states enrolled) and control group (states not enrolled). The quasi-experimental nature of our problem makes DID an ideal method for assessing the treatment effect of enrollment. Furthermore, there is a clean distinction between states that participate and states that do not, as well as a distinct pre-post timing of enrollment. Upon estimating the effects of interest, we can identify the changes in a state's ability to recruit new agricultural science and technology teachers and retain existing ones as a direct result of participation in this program. This chiefly informs policy and aids in planning of future programs.

Given that enrollment in STAR is not random, the data used herein run the risk of selection bias. In this context, states enrolled in the program largely for the purpose of resource augmentation rather than between-state competition for hiring of graduates in the state agriculture programs. It seems unlikely that graduates from these programs select institutions based on the state in which they wished to teach, at least not in a meaningful, systematic pattern. This should help to alleviate concerns that nonrandom assignment to the treatment (STAR enrollment) results in baseline differences between the two groups, potentially confounding effects on the outcomes of interest (recruitment and retention). To this end, we include state-level regressors to help absorb state-level heterogeneity likely to affect recruitment and retention of agriculture teachers, specifically years of service required for retirement, state average beginning salary for that position, institutions in-state qualified to participate in STAR, the number of non-licensed agriculture teaching hires, and the number of female agriculture teachers currently employed. A distinct advantage of using the DID approach with fixed effects is that state fixed effects help us to control also for any unobserved, time-invariant, state differences.

Another assumption underlying our use of the DID estimator is that of parallel trends. If this holds, then we attribute a divergent evolution of the STAR-participating states over time, if observed, to the impact of participating. Since we have two pre-enrollment and two post-enrollment time periods, this assumption can be informally tested by way of visual inspection. Moreover, this is no reasonable argument against parallel trends not holding: states are in the same regions of the US, with similar cultures, agricultural influences, populations, and demographic and socioeconomic characteristics – regardless of their participation in STAR. As evidenced in Figure 1 below, we argue that this assumption holds to a reasonable enough degree to proceed.

Figure 1

Visualizing the 'Parallel Trends' Assumption in Ag Teacher Retention



Our final assumption is the Stable Unit Treatment Value Assumption (SUTVA). This requires no interference or "spillover effects" between the treatment and control groups. Since differences (before STAR) in recruitment and retention of agricultural science and technology teachers were largely attributed to idiosyncrasies (e.g. a teacher's family lives in another state) or differences in salary and benefits, it is therefore reasonable to expect minimal spillover effects from one state to another. That is, to argue that state A's enrollment in STAR impacts state B's recruitment of agricultural science and technology teachers does not make as much sense as saying differences in beginning salary for agricultural science and technology teachers (which we control for) impact recruitment. Hence, we argue that SUTVA is satisfied as well.

Under these assumptions, we estimate equation (1) using Ordinary Least Squares (OLS),

$$y = \beta_0 + \beta_1 STAR + \beta_2 \mathbf{1}\{2017,2018\} + \beta_3 STAR * \mathbf{1}\{2017,2018\} + \boldsymbol{X}\delta + \epsilon \qquad (1)$$

Where y is either a state's recruitment or retention of agricultural science and technology teachers, $STAR$ is an indicator variable for a state's participation, $\mathbf{1}\{2017,2018\}$ is an indicator variable for the years 2017 and 2018, or the "post" period, and $\boldsymbol{X}$ is a matrix containing the control variables: years of service required for retirement, state average beginning salary for that position, institutions in-state qualified to participate in STAR, the number of non-licensed agriculture teaching hires, and the number of female agriculture teachers currently employed.

From equation (1), our effect of interest using the DID framework is the slope on the interaction term, β_3. This is the average treatment effect of STAR enrollment on a state's recruitment and retention, all else being unchanged – pending which y is used for that particular estimation.

From the first null hypothesis, H_0^A, we expect a state's participation not to affect its recruitment or retention of agricultural science and technology teachers, and for the second, H_0^B, we would expect to find $\hat{\beta}_3$ insignificantly different from zero.

We also estimate state-by-state comparisons using equation (2) below:

$$y = \beta_0 + \beta_1 STAR + \beta_2 \mathbf{1}\{2017{,}2018\} + \beta_3 STAR * \mathbf{1}\{2017{,}2018\} + \epsilon \quad (2)$$

with the absence of further controls due to limitations of sample size. The point estimate has a similar interpretation as in equation (1), which is our estimated average treatment effect of STAR enrollment.

Results

Estimating equation (1) via OLS, we obtain estimates for the parameters for the three versions of the equation: recruitment, retention, and both together. The results are displayed in Table 2

Table 2
Equation (1) Results

	Dependent Variable: Recruitment	Dependent Variable: Retention	Dependent Variable: Both
Intercept	105.50 (1.21)	59.42* (2.10)	62.75** (2.29)
$\mathbf{1}\{2017{,}2018\}$	-3.76 (-0.77)	-1.10 (-0.69)	0.11 (0.07)
STAR	-8.43 (-1.59)	4.02** (2.33)	2.64 (1.58)
STAR* $\mathbf{1}\{2017{,}2018\}$	10.48* (1.84)	2.17 (1.17)	-1.10 (-0.62)
Beginning Salary	-0.00 (-0.07)	-0.00 (-1.20)	-0.00 (-1.65)
Licensing Institutions	-2.57** (-2.15)	0.46 (1.19)	-0.11 (-0.29)
Non-Licensed Agricultural science and technology teachers	-0.83 (-0.57)	1.33** (2.80)	0.15 (0.33)
Female Agricultural science and technology teachers	0.05* (1.94)	0.03*** (2.99)	0.03*** (3.72)
Retirement Service	-3.23* (-1.96)	-1.38** (-2.59)	-1.36** (-2.63)
R^2	0.84	0.61	0.69

Note. the OLS parameter estimates are listed on top, the t-statistics are reported in parentheses beneath. Statistical significance (0.10, 0.05, and 0.01) are denoted with asterisks (*, **, and ***).

Evidently, the results of equation (1) are mixed. Note particularly that the DID estimate of our average treatment effects, $\hat{\beta}_3$, are positive in the cases of recruitment and retention by themselves, but not in the creation of new Ag programs. Indeed, enrollment in STAR only significantly increases recruitment of Agricultural science and technology teachers, given that the number of alternate-certified Agricultural science and technology teachers increases by more than ten. While the retention of existing Agricultural science and technology teachers in a given state is not significantly different from zero, the economic significance cannot be overlooked: STAR did not decrease the number of certified Agricultural science and technology teachers in that state, but increased by more than two retained teachers. Similarly, STAR-enrolled states added insignificantly fewer new positions than those who declined to enroll.

It is also interesting to note the consistently positive effect of increased female teachers: across the board, the more female agriculture teachers a state has, the better recruitment and retention of agriculture teachers in general, but also more positions are being created, all else being the same. Similarly, states requiring more years of service for retirement consistently do worse in recruitment, retention, and adding new positions. The outcomes are generally unresponsive to changes in beginning salary. The lone exception (nearly) being for new positions, whose point estimate indicates that states with lower beginning salaries for agriculture teachers tend to add more new positions. The fit is quite good in each case – with R^2 ranging from 0.61 to 0.84.

The state-by-state comparisons from equation (2) yielded qualitatively equal results as those in Table 2, and are detailed in the appendix. The states compared on an "enrolled" versus "not enrolled" basis are KY vs. AR, KY vs. WV, KY vs. AL, SC vs. AR, SC vs. WV, SC vs. AL, OH vs. AR, OH vs. WV, and OH vs. AL. The mean of these 9 average treatment effects is 9.75 for recruitment (standard error 3.91, average $R^2 = 0.73$), 1.57 for retention (standard error 3.21, average $R^2 = 0.68$), and -1.24 for both jointly (standard error 1.92, average $R^2 = 0.82$). As before, the number of alt-certified Agricultural science and technology teachers increases significantly, the number of Agricultural science and technology teachers increases insignificantly, and the number of new positions decreases insignificantly as a result of STAR enrollment. The implications of these empirical findings are discussed below.

Conclusions & Discussion

More teachers are leaving the profession and less are entering. Lemons (2015) study attributed to the high expectations and stress as one factor for teachers leaving the AST profession. It is imperative that the gap be closed by making intentional decisions in our recruitment and retention strategies. The STAR program targeted key areas of improvement and strategies to address the issues facing the field of agriculture education. From the years 2015-2019, nearly all states have seen more individuals leave the profession than those graduating. The biggest signature of promise are the numbers of those projected to graduate in agriculture education in the years to come. Working with those institutions to provide promotional materials, financial resources, mentoring, and support mechanisms, with the ultimate goal being to maintain those majors into the profession.

The econometric models found modest evidence of improved recruitment in that the number of unfilled positions in STAR-enrolled states are being filled by alternatively-certified Agricultural science and technology teachers, about 10 such teachers per state. However, retention and creation of new positions shows little response to STAR enrollment, only about 2 teachers per state (statistically zero). This could be due to a true lack of efficacy in the policy itself, the small sample size used in this study, the short time frame capturing post-enrollment variation, or a combination of the three. Future research could shed light on the reason for the lack of robustness. However, it is reasonable to conclude that states participating in STAR did not fare any worse than those not participating in STAR. Indeed, this by itself justifies additional work on the matter, given the large investment of government resources in the program.

Additional – and more critical – future research should evaluate whether the significant increase in alternatively certified teachers has any negative consequences to the workload, curriculum design, graduation rates, and other important downstream outcomes directly tied to the individuals doing the teaching. Indeed, it is unknown at present whether states where agriculture teaching is increasingly in the hands of alternatively certified instructors experience adverse outcomes in the long run, relative to states that largely employ traditionally certified agricultural science and technology teachers. If this is the case, then the effect of STAR is arguably destructive and is a candidate for restructuring if not elimination. Similarly, more insight is needed regarding the failure of STAR to improve retention of existing agricultural science and technology teachers.

The combined efforts of local, state and national organizations focused on the recruitment and retention of teachers is commended in agriculture education. Offensive strategy to mitigate downturns and pitfalls in agriculture education has allowed for states to fill positions with qualified and certified teachers. Reducing the number of alternative certified and non-licensed teachers while increasing the amount of positions, is rare in most disciplines (another justification for future work on the impacts of increasing alternatively certified teachers). However, concerted efforts of teacher educators and state staff across the various states have yielded some positive results in the short run. It is possible that STAR, while seemingly not a long-run solution, might serve as a framework for enhancing these efforts.

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Appendix

Table A1

State-by-state comparisons from equation (2)

	Dependent Variable: Recruitment	Dependent Variable: Retention	Dependent Variable: Both
KY vs. AR	-3.50 (-1.61) R^2=0.79	4.50 (0.69) R^2=0.48	-4.00*** (-2.53) R^2=0.74
KY vs. WV	-1.00 (-0.82) R^2=0.25	2.00 (1.27) R^2=0.98	-3.00* (-1.90) R^2=0.94
KY vs. AL	15.00** (2.13) R^2=0.91	2.00 (1.27) R^2=0.96	0.00 (0.00) R^2=0.81
SC vs. AR	-4.00 (-1.37) R^2=0.57	5.50 (0.83) R^2=0.20	3.00* (1.73) R^2=0.78
SC vs. WV	-1.50 (-0.66) R^2=0.18	3.00 (1.42) R^2=0.86	4.00** (2.31) R^2=0.85
SC vs. AL	14.50** (1.99) R^2=0.89	3.00 (1.42) R^2=0.58	7.00*** (3.74) R^2=0.79
OH vs. AR	15.50*** (7.11) R^2=0.98	-0.50 (-0.08) R^2=0.23	-7.75*** (-3.28) R^2=0.84
OH vs. WV	18.00*** (14.63) R^2=0.99	-3.00* (-1.90) R^2=0.97	-6.75*** (-2.86) R^2=0.93
OH vs. AL	34.00*** (4.83) R^2=0.89	-3.00* (-1.90) R^2=0.90	-3.75 (-1.52) R^2=0.85

Note. the OLS parameter estimates are listed on top, the t-statistics are reported in parentheses beneath. Statistical significance (0.10, 0.05, and 0.01) are denoted with asterisks (*, **, and ***).