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# The Labor-Market Returns to Community College Degrees, Diplomas, and Certificates

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Abstract

This paper provides the first detailed empirical evidence of the labor-market returns to community college diplomas and certificates. Using detailed administrative data from Kentucky, we estimate panel-data models that control for differences among students in pre-college earnings and educational aspirations. Earnings returns are almost 40 percent for associate's degrees and diplomas for women, compared to returns of closer to 20 percent for men. Certificates have small positive returns for men and, in most specifications, for women. There is substantial heterogeneity in returns across fields of study. Degrees, diplomas, and certificates all correspond with higher levels of employment.

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## 1. Introduction

In July 2009, President Obama announced a $12 billion initiative to increase assistance to the nation's community colleges (Kellogg and Tomsho, 2009).[1] The announcement, delivered at Macomb Community College in Michigan, illustrates the administration's view that community colleges are an essential component of the nation's economy. Nationally, over 45 percent of undergraduate students in higher education were enrolled in public community colleges during the 2006-2007 school year (Knapp et al., 2008). Community college enrollment exceeded 2.4 million full-time students and 3.8 million part-time students.

Community colleges are diverse institutions that offer several opportunities for individuals to gain human capital. Community colleges offer a variety of each of the three types of awards: degrees, diplomas, and certificates. Certificates are primarily awarded in technical programs and typically require one or two semesters of course work. Examples include medical records coding specialist, IT network administrator, automotive mechanic, and electrician. Diplomas typically require a year or more of study, and are also most common in technical fields such as surgery technology, accounting, and practical nursing. Associate's degrees require the most number of credits, 60 to 76 depending on the field of study. The curriculum for associate's degree programs have much in common with that of the first two years of a four-year college, with liberal arts and general education courses as well as those geared to specific vocations, such as a registered nurse. Associate's degree credits generally are transferrable to a four-year college towards a bachelor's degree.

[1] In comparison, existing federal government assistance to community colleges is around $2 billion.

Recent economic research on the labor-market returns for community colleges has focused almost exclusively on the returns to associate's degrees or the returns to additional years of schooling or credits. Although community colleges emphasize the benefits of diplomas and certificates, these benefits are based on anecdotal evidence rather than rigorous empirical analysis. A few studies look at the effects of certificates on labor-market outcomes, but these results are often inconclusive and are based on small samples of certificate recipients drawn from national longitudinal surveys. Given the growing importance of these awards and of community colleges in general, it seems important to document the economic returns associated with this form of human capital investment.

This paper provides the first detailed empirical evidence of the labor-market returns to community college diplomas and certificates, as well as providing additional information on the returns to associate's degrees and credits earned. One unique aspect of our analysis is that to estimate these returns we exploit detailed administrative data from Kentucky, following two cohorts of 17 to 60 year-old students who entered the state's community college system during the 2002-2003 and 2003-2004 school years. The student-level, panel data contain information on student goals and number of classes taken in the first term. These student intentions are used to provide comprehensive controls for potential differences in labor-market outcomes between students who complete different levels of community-college schooling. Such controls have not been included in previous studies of community college returns and therefore provide a valuable contribution to the returns literature.

Consistent with previous work, we find that labor-market returns to schooling are larger for women than for men. On average, women receive nearly 40 percent higher earnings for degrees or diplomas, compared to an 18 to 20 percent increase in earnings for men. The returns to associate's degrees for men are similar to previous studies. The returns to associate's degrees for women are somewhat larger than previous work but are less than the estimated returns in previous studies of bachelor's degrees. For women, the 40 percent increase in earnings translates into an annual increase in earnings of around $8,000 due to the low average earnings of women in our sample. The returns to certificates are around nine percent for men and three percent for women. Consistent with previous research, we also find positive returns for credits earned. All three award levels are associated with higher probabilities of employment, although again the largest gains are for degrees and diplomas.

Our results strongly support the claims made by community colleges that associate's degrees and diplomas have large labor-market returns. Even though the returns to certificates are much more modest, the benefits to certificates likely still outweigh the costs. The large overall returns mask substantial heterogeneity in returns. For example, health and vocational awards have much higher returns than business or services awards. Overall, human capital investments in community colleges lead to large gains in earnings and employment, particularly for women.

**2. Relation to Previous Work**

Many researchers have studied the relationship between schooling and earnings. Census data show that workers with higher education levels have higher earnings. Card (1999) summarizes the vast literature on the labor-market returns to schooling, with

discussions of several of the econometric techniques used to control for potential endogeneity. Straightforward, single-equation estimates of the labor-market returns to schooling find that an additional year of schooling raises yearly earnings between five and ten percent. More complex analyses that use instrumental variables or within-family estimators (such as identical twins) tend to find returns at or above ten percent per year.

The overall rate of return generally assumes that an additional year of schooling has a similar effect on earnings whether that additional year is the 10th year of schooling or the 15th year of schooling.[2] Other researchers have looked specifically at the types of schooling received, focusing in particular on high school graduation and college degrees. Kane and Rouse (1995) find that an additional year of community college corresponds with an increase of four to seven percent in annual earnings, whereas an additional year at a four-year institution produces a six to nine percent increase in annual earnings. They also find that receiving a college degree raises earnings even when compared to having completed an equivalent amount of schooling (such as four-years) without completing a degree. Marcotte et al. (2005) obtain similar results for community colleges from a more recent cohort of students. Both studies use national data.

Jacobson, LaLonde, and Sullivan (2005a, 2005b) look at the labor-market returns to community colleges for a specific population, workers who have been "displaced" because their employers have closed down or moved out of the state of Washington. Although these papers have the advantage of looking at an exogenous shock to earnings, their results are not necessarily representative of the labor-market returns for all community college students. They find that an additional year of community college

[2] Card (1999) notes a couple of exceptions to this statement, such as the lower return to the 11th year of schooling.

increases long-term earnings by approximately nine percent for men and 13 percent for women, with slightly lower returns for older workers (age 35 or older). They also show that workers derived more benefits from technical courses and math/science courses and fewer benefits from less technical courses. Most of the increase in annual earnings came from additional hours of work rather than from higher hourly wages.

Another metric for studying labor-market returns is to look at the highest degree received rather than the number of years of schooling. Kane and Rouse (1995) report that associate's degrees are associated with earnings increases of 24 percent for men and 31 percent for women. Leigh and Gill (1997) find similar returns, and they find that the returns are similar between continuing students and returning students. For comparison, the returns for a bachelor's degree are 42 percent for men and 51 percent for women (Kane and Rouse, 1995). The comparison group in all cases is a high school graduate.

Although most of the work on community colleges focuses on the number of credits earned and on the receipt of associate's degrees, a few papers examine labor-market returns for certificates from public and private community colleges. Marcotte et al. (2005) and Bailey et al. (2004) fail to find a consistent effect of certificates on various labor-market outcomes using longitudinal surveys from the U.S. Department of Education. In a summary of the literature, Grubb (2002a) also finds insignificant effects of certificates on wages and earnings in several earlier studies. In contrast, Grubb (1997) finds a positive association between community college certificates and earnings in the 1984 to 1990 waves of SIPP data. Jacobson and Mokher (2008) find positive effects of certificates on earnings using administrative data on recent high school attendees in

Florida.[3] Similarly, there is some descriptive evidence from administrative data that certificates are associated with higher earnings (Grubb, 2002b). There are several explanations for the discrepancy in results such as the time period, the length of time between education and labor-market outcomes, and the availability of controls for factors such as ability and parental education.

The current paper contributes to the returns to schooling literature in two ways. First, it provides one of the first estimates of labor-market returns for community college outcomes other than associate's degrees received or credits earned. Community colleges offer a large number of certificates and diplomas, in areas such as radiologic technologist or industrial electrician. Community colleges market these programs as providing valuable, marketable skills, but the labor-market returns of these programs are not well known. Second, we study the labor-market returns for credits and associate's degrees using a large administrative data set on the population of students in one state (Kentucky). Most previous work uses Census data or survey data. The Census data are large but are a cross section with no pre-college information. Survey data typically have small populations of community college students, and they often lack data on pre-college earnings. The administrative data allow us to control for pre-college earnings as well as for differences among students in educational goals and course enrollment in the first college term. Although Jacobson, LaLonde, and Sullivan (2005a, 2005b) also use administrative data for the state of Washington, they do not study the returns to awards because so few displaced workers receive awards.

[3] They also find positive effects for associate's degrees, but these results become insignificant once they control for the field of study. However, it is unclear how they account for students who receive associate's degrees and then transfer to four-year institutions.

## 3. Data

The administrative data we use came from the Kentucky Community and Technical College System (KCTCS). The student demographic file contains student-level information such as age, race, and gender. The course level data contain descriptive information on the type of course as well as the grade and the number of credits received. Data are available for each course taken by each student.

The outcome data identify each degree, certificate, and diploma awarded. Certificates are specialized programs where students can demonstrate a specific set of skills to potential employers. Schools offer certificates in several program areas. Diplomas tend to target broader areas than certificates and usually require more credits (often more than one year of full-time studies). For example, KCTCS offers a diploma titled medical office assistant, which requires 44 to 47 credits; a medical administrative certificate from KCTCS requires 33 to 35 credits. More generally, diplomas require between 36 and 68 credits, and certificates typically require between 12 to 36 credits. A course load of approximately 30 credits is considered a full-time course load for one year.

The outcome data also contain transfer information from the National Student Clearinghouse. The transfer data identify the date and name of transfers to all participating four-year institutions from 2002 to 2006. The National Student Clearinghouse contains nearly 90 percent of all students, including all four-year schools in Kentucky and most schools in neighboring states.[4]

[4] This information comes from the National Student Clearinghouse webpage (www.studentclearinghouse.org).

KCTCS receives quarterly earnings data from the state's unemployment insurance program. Total earnings are reported for each person and job. Data are from the first quarter of 2000 through the third quarter of 2008.

Our focus is on two cohorts of students: those who started at KCTCS from summer 2002 to spring 2003 (i.e. the 2002-2003 school year) and those who started at KCTCS from summer 2003 to spring 2004 (i.e. the 2003-2004 school year).[5] For evaluating the labor-market returns to KCTCS, we exclude students who attend KCTCS while in correctional institutions, are less than 17 years old or more than 60 years old at the start of their first school year, or who transfer to a four-year school. These students are excluded in order to study the labor-market returns of individuals most likely to be in the labor market immediately after their KCTCS attendance. An additional reason for dropping the transfer students is that we do not observe their educational attainment at the subsequent institution, so the relationship between educational attainment and labor-market outcomes is impossible to measure for these students.

Table 1 contains the descriptive statistics for the KCTCS sample. The average quarterly earnings over the entire period (2000 to 2008) is $8,286 for men and $4,951 for women (in 2008 dollars), illustrating a large gender disparity in earnings. The average age[6] is around 29 years, and approximately 20 percent of the sample is nonwhite. Nearly 18 percent of women receive associate's degrees as their highest award, compared to only nine percent for men. The percentage of women receiving diplomas (5.7 percent) is also higher than the percentage for men (4.4 percent), and women have a slightly higher

[5] We identify initial enrollment using the course enrollment data. In other words, each student's initial enrollment is the first term in which he or she is enrolled in a KCTCS course.
[6] For Table 1, age is measured as of June 1, 2002 for the 2002-2003 cohort and June 1, 2003 for the 2003-2004 cohort.

percentage receiving certificates: 6.5 percent for women and 5.8 percent for men. Health is the most popular field of study for women, compared with vocational (and academics) for men.

## 4. Method

### *4.1 Traditional Human Capital Method*

The KCTCS database provides detailed information on the cohort of students who entered KCTCS during the 2002-2003 and 2003-2004 school years. Our analysis begins with a traditional Mincer-type schooling equation because this type of model is commonly estimated in the returns to school literature. Therefore, the returns from this model can be easily compared to previous estimates of the returns to community college. Equation (1) contains the model:

(1) $$LOGEARN_i = \beta \cdot KCTCS_i + \delta \cdot DEMOG_i + \varepsilon_t \, .$$

In this cross-sectional model, the dependent variable is log earnings from the most recent one-year period, the fourth quarter of 2007 through the third quarter of 2008. *KCTCS* is a set of three dichotomous variables for highest award (Associate's degree, diploma, or certificate), and *DEMOG* is a set of person-specific demographics such as age and race/ethnicity.

### *4.2 Preferred Student Fixed Effect Method*

Because the KCTCS database is a detailed panel data set with pre- and post-KCTCS earnings data, we use these data to estimate the change in earnings associated with KCTCS attendance. Specifically, we compare the post-KCTCS earnings with the pre-KCTCS earnings for two groups, those who receive awards and those who do not. The major difference between the two groups is KCTCS awards. In terms of program

evaluation, our estimation technique resembles a treatment-on-the treated model. Because we are using administrative data from KCTCS, we are unable to include individuals who did not attend KCTCS.

More formally, we estimate the multivariate regression given in equation (2) to measure the effect of KCTCS attendance on earnings.

$$(2) \qquad LOGEARN_{it} = \beta \cdot KCTCS_{it} + \lambda \cdot ENROLL_{it} + \delta \cdot DEMOG_{it} + \gamma \cdot INTENT_{it} + \eta_i + \tau_t + \varepsilon_{it} .$$

In this equation, *i* denotes a person and *t* denotes a quarter.

*LOGEARN* is the log earnings for the quarter. Quarters with zero earnings have missing log earnings and are not included in the estimation. The spring semester is assigned a start date of the first quarter and an end date of the second quarter; the summer term is assigned a start date of the second quarter and an end date of the third quarter; and the fall semester is assigned a start date of the third quarter and an end date of the fourth quarter.

The variable of interest is the highest award received at KCTCS. The vector *KCTCS* contains the three dichotomous variables (equal to zero or one): one for having an associate's degree as the highest award, one for having a diploma as the highest award, and one for having a certificate as the highest award. For each KCTCS outcome (degree, diploma, or certificate), the estimated change in earnings should be interpreted as the change relative to the same person's earnings before she completed the award. This variable is discussed in more detail below.

*ENROLL* contains four dichotomous variables: the first is equal to one when the individual is attending KCTCS and zero otherwise. This variable accounts for the opportunity cost (in terms of earnings) for students while they attend KCTCS. The

second variable is equal to one after the individual has finished attending KCTCS. This variable accounts for any general post-schooling changes in earnings. The third variable is equal to one for the time period two quarters before KCTCS attendance, and the fourth variable is equal to one for the time period one quarter before KCTCS attendance. These two variables control for possible pre-KCTCS dips in earnings shortly before KCTCS attendance. Figure 2 in the next section shows earnings patterns relative to KCTCS enrollment. The figure illustrates that an "Ashenfelter dip" seems to occur for award recipients in the two quarters before KCTCS enrollment.[7]

*DEMOG* is a set of demographic variables that change over time. Specifically, the variables are age and age squared (at the start of the quarter), as well as interactions of age and age squared with dichotomous variables for nonwhite and for being in the 2002-2003 cohort.

*INTENT* is a set of variables measuring students' intentions. All these variables are measured in the first semester and are interacted with age and age squared. Students intentions are measured by the number of courses taken in the first KCTCS term and a set of dichotomous variables for each student's area of study (non-award is the omitted category). By including controls for the number of classes taken in the first term and students' initial aspirations (whether or not to pursue an award, and what field of study in which to pursue an award), we are able to compare labor-market outcomes for students with very similar intentions upon entry at KCTCS. Therefore, we can address the concern that students who receive a degree, diploma, or certificate have different motivations and intentions than students who do not receive an award.

[7] We do not include additional controls beyond two quarters because the data show little evidence of earnings declines beyond that period.

Unlike most studies of labor-market returns to education, we include a set of person fixed effects ($\eta$). The person fixed effects, used by Jacobson, LaLonde, and Sullivan (2005a, 2005b), capture all person-specific components that are constant over time, such as race/ethnicity or innate ability.[8] In fact, the fixed effects can be thought of as the overall effect of all these time-invariant person characteristics. All such characteristics are captured in these variables, and the effects of specific time-invariant characteristics such as race/ethnicity cannot be measured separately from the overall fixed effect. The inclusion of the fixed effects has the advantage of controlling for time-invariant measures of ability and other factors that affect earnings and are correlated with community college schooling. It is a useful, alternative approach to other strategies such as instrumental variables for estimating the causal effect of education on earnings. The limitation of the fixed effects approach is the assumption that the pre- and post-KCTCS earnings comparison is similar between students who received an award and students who did not receive an award.

The model contains controls for each quarter ($\tau$). The last component ($\varepsilon$) is the unobservable component of earnings. There are 35 quarters, from the first quarter of 2000 through the third quarter of 2008. Separate equations are estimated for men and women.

Our primary interest is in $\beta$, the coefficient on the three KTCS variables in equation (1). Again, these variables are defined as the highest award received as of that time period. For individuals who do not receive a degree, diploma, or certificate during our observation period, these three variables are equal to zero in all time periods. For

[8] Jacobson, LaLonde, and Sullivan (2005a, 2005b) also include controls for short-run earnings deviations as well as its interaction with the number of credits obtained (their measure of community college schooling). The results presented in the next section are not sensitive to the inclusion of these additional variables.

individuals with one of these outcomes, then the variable associated with the highest award is equal to one after the award is received, and the other two variables are equal to zero for all time periods. An associate's degree is considered the highest award offered; a diploma is considered the second highest award offered; and a certificate is considered the third highest award offered. For example, a person with a certificate and a diploma would have a value of one for diploma and a value of zero for associate's degree and for certificate.

As mentioned above, the KCTCS variables are only equal to one in the time periods after which the person has received the award. In other words, if a person receives an associate's degree in May 2005, then the dichotomous variable for an associate's degree would equal zero for every quarter before May 2005 because the person has not yet received the award. The associate's degree variable is also zero for the period in which the person receives an award, since the individual has only had the award for part of the period. In our example, the associate's degree variable would equal zero in the quarter from April to June of 2005. Finally, our example person would have a value of one for the associate's degree variable for each quarter starting with the July to September quarter for 2005. The general strategy is that this highest award variable is equal to one in quarters when the person has the highest award for the entire quarter. It is equal to zero for quarters when the person does not have the highest award for any part of the quarter.

Jacobson, LaLonde, and Sullivan (2005a, 2005b) measure human capital accumulation in community college as the number of credits completed because few individuals in their sample of displaced workers complete an award. We follow their

protocol and estimate additional models where KCTCS attendance is measured by credits earned rather than by the highest award received.

Because we measure earnings in logs, we treat earnings observations with zero earnings as missing observations. As a result, the earnings returns from these models are conditional on participation in the labor market. We also consider an alternative model that looks directly at participation in the labor market. In this model, the dependent variable is a dichotomous variable equal to one for quarters with positive earnings. The dependent variable is zero for quarters with zero earnings or missing earnings. Earnings that are not reported to the Kentucky UI system, such as self-employment earnings and out-of-state earnings, are interpreted as not participating in the Kentucky labor market. Although the dependent variable is dichotomous, we estimate a linear probability model because it is less sensitive to distributional assumptions and it is easier to interpret (Wooldridge, 2001).

## 5. Results

### *5.1 Comparison with Other Data Sets*

As mentioned previously, most analyses of returns to community college compare community college students to individuals outside the community college system. Often, the comparison group is a set of individuals with a high school education but no post-secondary schooling. In contrast, our sample – and therefore our comparison group – is limited to individuals who attend community college at some point during the sample period. Because this comparison group is atypical compared with the returns to schooling literature, we compare our sample of KCTCS students with other earners in Kentucky.

First, we compare average quarterly earnings of individuals in the KCTCS sample with the statewide average quarterly earnings for all other Kentucky workers using aggregate UI earnings data (individual-level data are not available). Figure 1 contains average quarterly earnings from the first quarter of 2002 through the first quarter of 2008. All dollars are measured in 2008 dollars, deflated by the CPI-U. The figure combines men and women because the UI data are not available by gender (or any other category, such as age). We report average quarterly earnings for three groups: KCTCS award recipients (labeled "KCTCS award"), KCTCS attendees who do not receive an award (labeled "KCTCS non-award"), and all other Kentucky workers (labeled "UI (Non KCTCS)").

Average earnings are higher for the non-KCTCS sample than for either KCTCS sample. The higher wages for non-KCTCS UI workers is to be expected because the average age and experience in the KCTCS sample are probably lower than the average age and experience of all Kentucky workers. Average wages show little if any growth for the non-KCTCS sample. Average wages for the non-KCTCS sample drop in the summer likely due to summer-only workers such as high-school and college students. In contrast, we see that average wages grew substantially for both KCTCS samples. For example, the average for non-award students grew from around $6,000 per quarter in 2002 to close to $8,000 in the last quarter of 2007. Although the graph suggests that the KCTCS non-award sample is not an unreasonable comparison group for panel data analysis (which looks at changes over time rather than solely at levels), it does not show that the comparison group is a perfect one, either.

Next, we compare our KCTCS sample to the 2000 Census sample for Kentucky. Because the set of students who first attended KCTCS in between 2002 and 2004 is not a representative sample of all Kentuckians, a comparison of descriptive statistics between the two data sets would merely illustrate these differences between them. What is more relevant is whether the returns to schooling differ between the two data sets. Specifically, we compare cross-sectional regression results from the KCTCS sample with regression results from the 2000 Census, using models as shown in equation (1).

The results from these regressions are shown in Table 2.[9] In both data sets, the sample is limited to individuals ages 22 to 66 (at the time of data collection) who have positive earnings. This age range is chosen to be consistent with the general sample restriction in the KCTCS of students being ages 17 to 60 at the beginning of their first school year. The results show similar returns for an Associate's degree between the two data sets. For men, the return is 21.7 percent for the KCTCS data and 25.3 percent for the Census data. For women, the return is 47.7 percent for the KCTCS data and 43.4 percent for the Census data. The cross-sectional earnings differential between an Associate's degree recipient and a high school graduate in the 2000 Census data is similar to the cross-sectional earnings differential between an Associate's degree recipient and a KCTCS attendee with no award recipients in the KCTCS administrative data. Thus, the use of KCTCS students as a comparison group, although unusual, does not appear to be unreasonable based on comparisons with larger, representative samples of Kentucky workers.

[9] All results in the table are unweighted. Weighted Census results produce similar results and are available from the authors upon request.

*5.2 Earnings Patterns*

We begin our analysis of the longitudinal (or panel) aspect of the KCTCS data by looking at earnings patterns over time by highest award. Figure 2 shows the average quarterly earnings for men (top panel) and women (bottom panel), where each quarter is measured relative to initial attendance at KCTCS. The quarter when the student first attended KCTCS is measured as 0 on the horizontal axis of the graph. The first quarter before the student attended KCTCS is measured as –1, and the first quarter after the student attended KCTCS is measured as 1. For example, consider a student who first attended KCTCS in fall 2002. For this student, quarter 0 is July-September 2002; quarter –1 is June-August 2002; and quarter 1 is October-December 2002. We measure time relative to entrance at KCTCS, rather than calendar quarter, for two reasons. First, students enter KCTCS at different time periods between summer 2002 and spring 2004. Quarterly earnings at a particular calendar quarter, such as the first quarter of 2006, will measure students with different levels of KCTCS schooling. Second, this arrangement of quarters allows us to illustrate clearly pre-KCTCS differences in earnings. This technique is common in evaluations of job-training programs, where researchers are concerned about the similarity of recipients and non-recipients prior to participation in job-training programs. We are able to conduct analogous comparisons for participation in KCTCS.

The top panel of Figure 2 has several interesting patterns. Men who attend KCTCS without receiving an award have the highest pre-KCTCS earnings, with average quarterly earnings in excess of $5,000 in most quarters.[10] Individuals who eventually receive an award have relatively similar pre-KCTCS earnings around $4,000 a quarter,

[10] As mentioned previously, all dollar figures are reported in 2008 dollars.

although the average pre-KCTCS earnings are slightly lower for individuals who eventually receive a diploma. However, these award earners – especially those who receive diplomas – experience a substantial decrease in earnings the quarter before entering KCTCS. Average quarterly earnings for award recipients begin to increase dramatically approximately four quarters after entering KCTCS. By 18 quarters after entering KCTCS, the earnings for the four groups of individuals are relatively equal.

The bottom panel of Figure 2 illustrates average quarterly earnings for women. There are noticeable differences between men and women. Women have lower average earnings than men. In the quarters prior to KCTCS attendance, average quarterly earnings are relatively similar across the four education levels, except for the same decline in average earnings for award recipients starting in the quarter before KCTCS attendance. As with men, average quarterly earnings for women with awards start to increase around four quarters after KCTCS attendance. For women with diplomas and associate's degrees, average earnings increase dramatically around eight or so quarters after KCTCS attendance. By 18 months after initial KCTCS enrollment, the average quarterly earnings of diploma and associate's degree recipients substantially exceed average earnings of women who did not receive an award. Women with certificates have the lowest average earnings 18 months after initial KCTCS attendance.

Although these graphs provide a useful starting point for our discussion of labor-market returns, they look only at differences in average earnings between the four groups indicated in the graphs. Figure 2 does not control for differences in age or length of KCTCS enrollment. Therefore, we now turn to our regression analysis.

*5.3 Overall Earnings Returns*

Table 3 contains the effects of the highest award received on quarterly earnings. The first four columns are for men and the second four columns are for women. The first and fifth columns contain no controls other than highest award. The second and sixth columns contain controls for the timing of enrollment (*ENROLL* in equation (2)). The third and seventh columns also contain demographic controls (*DEMOG* in equation (2)). The fourth and eighth columns also contain controls for student intentions (*INTENT* in equation (2)). The last specification is our preferred one because it has the most control variables.

The table shows that the returns for all awards are largest in the specification with no other control variables (columns 1 and 5). The returns fall slightly when we add controls for enrollment timing (columns 2 and 6), and returns fall substantially when demographics are added (columns 3 and 7). In contrast, the returns increase noticeably when we include controls for student intentions (columns 4 and 8). In other words, the gap in earnings between students with and without awards is higher when we compare students with similar intentions (columns 4 and 8) than when we compare students with no regard toward their intentions (columns 3 and 7). This pattern suggests that students without awards who have similar intentions to students with awards but fail to achieve these awards have worse earnings experiences than the entire set of students without awards. In some ways, this increase in returns is consistent with the general pattern in the returns to schooling literature where the returns from more detailed models such as instrumental variables or family fixed effects result in larger estimated returns compared to simple OLS estimates (Card, 1999).

The table shows that associate's degrees are associated with large increases in earnings, particularly for women. In our preferred specification (columns 4 and 8), associate's degrees are associated with 38.7 percent returns for women and 20.0 percent returns for men.

Women also have higher returns from diplomas than men: 41.0 percent (column 8) versus 22.3 percent (column 4). The similarity in returns between associate's degrees and diplomas is somewhat unexpected because (as mentioned earlier) associate's degrees typically require an additional 6 to 12 months of coursework. Note that the gender difference in returns cannot be explained by differences in the number of credits earned. For both men and women, the average number of credits earned varies little between individuals earning diplomas and individuals earning associate's degrees.

Certificates have small positive returns for women and men, although the returns for women are only significant once we include controls for intentions as well as demographics and enrollment timing (column 8). In the preferred specification, certificates are associated with returns of 3.3 percent for women and 9.2 percent for men. Certificates require the least amount of coursework (usually one year or less of full-time course work), so their lower returns are not surprising.

*5.4 Field of Study*

As illustrated in Table 1, men and women have different fields of study at KCTCS. Therefore, one explanation for the gender differences in returns (Table 3) is that returns vary by fields of study. Table 4 contains the results where the highest education level is divided into six fields: humanities, other academic subjects (i.e. social science and science), business, health, services, and vocational. No students received diplomas

or certificates in academic subjects (humanities or otherwise). Except for the highest award received variables, the models used to estimate the results in Table 4 are identical to the preferred specification in Table 3 (columns 4 and 8).

The table shows that, for both men and women, the highest returns are from associate's degrees in health: 75.0 percent for women and 57.8 percent for men. The returns for associate's degrees in academic subjects other than the humanities are also positive: 32.6 percent for women 25.8 percent for men. Vocational associate's degrees are associated with higher earnings of 19.7 percent for women and 23.3 percent for men. Women receive positive returns of 15.7 percent for associate's degrees in business and 3.5 percent for associate's degrees in humanities; for men, the results are not statistically different from zero (at five percent) for either field of study. The coefficients for associate's degrees in services fields are not statistically different from zero at the ten percent level.

Diplomas have mixed effects on earnings. Fewer than 20 men receive diplomas in business; we do not discuss this coefficient because it is likely driven by small sample sizes. Health-related diplomas are associated with large increases in earnings: 50.8 percent for women and 35.5 percent for men. Vocational diplomas also have large, positive effects of 21.4 percent for women and 22.9 percent for men. As with associate's degrees, services diplomas are not associated with higher earnings levels. Business diplomas for women have insignificant returns, perhaps because most business diplomas are related to office administration, a low-paying field.

Certificates also have mixed effects on earnings. Vocational certificates are associated with higher earnings of 12.4 percent for men, but the results for women are not

statistically significant from zero (at ten percent). Health certificates and services certificates are associated with higher earnings of approximately four percent for women. For men, certificates in these fields have little or no association with earnings.[11] The coefficients for business certificates are always statistically insignificant (at ten percent) for both men and women. Thus, the disparity in overall returns to certificates in Table 3 may be a result of field study, as most men receive certificates in the relatively high-return vocational fields, whereas women are more likely to receive certificates in two fields with more moderate returns, health and services.

*5.5 Earnings Returns for Credits*

Another way to measure the returns to KCTCS is to look at the returns to credits (see Jacobson, LaLonde, and Sullivan (2005a, 2005b) and citations within). However, in our KCTCS sample, the number of credits earned is closely related to the highest award. Because almost all of the students who receive 50 or more credits also receive a diploma or associate's degree, we cannot disentangle the separate effects of credits earned and awards received for these individuals. Therefore, in our analysis of the returns to credits, we exclude individuals who have an award and focus on the subset of students who do not have an award. That way, we can study whether KCTCS attendance is associated with higher earnings for students who receive credits but not an award.

We estimate two sets of specifications to measure the relationship between the number of credits earned and earnings. In the first set, credits are constrained to have a polynomial effect on earnings. We estimate models where the effect of each credit is

[11] The disparity for health certificates is not related to areas of study, as most of the health-related certificates are nursing-related for both men and women. Most women receive service certificates in "family and consumer sciences" whereas men are more likely to receive service certificates in "personal and culinary services."

linear, quadratic, cubic, and quartic. In the second set, the number of credits is divided into several categories, allowing for non-linear effects. The number of credits is divided into six categories: 1 to 5 credits, 6 to 10 credits, 11 to 20 credits, 21 to 35 credits, 36 to 50 credits, and 51 or more credits. For all specifications, the sample is limited to people who have not earned an associate's degree, a diploma, or a certificate.

Figure 3 illustrates the returns using credits as the measure of KCTCS attendance. The top panel contains the results for men, and the bottom panel contains the results for women. The results are from our preferred specification with controls for enrollment timing, demographics, and student intentions. Coefficients that are statistically significant at the five-percent level (two-sided test) are shaded in, and those that are not significant are not shaded in.[12] Appendix Table 1 contains the regression results.

For men, the results are dependent on the specification. The results from the categorical model, where the effect of credits is constant within each category (such as one to five credits), have the lowest returns. The linear specification has the next lowest returns (for 50 credits or fewer). For both these specifications, the predicted return to a term of full-time coursework, approximately 15 credits, is less than five percent. We choose 15 credits as our reference point because more than 80 percent of the students in the sample received 20 or fewer credits. For the nonlinear specifications (quadratic, cubic, and quartic), the estimated returns from 15 credits is much higher, around ten percent. Because the returns from a certificate, which typically requires between 12 and 36 credits, are around nine or ten percent (Table 3), we suspect that the non-linear specifications likely overstate the estimated returns for men in this credit range.

[12] The regressions are analogous to the regressions in columns 4 (for men) and 8 (for women) in Table 3.

For women, the bottom panel shows that the returns are roughly similar across all specifications. The results for 15 credits are around five percent, similar to the results from the linear and categorical specifications for men. Thus, the results in Figure 3 suggest that men and women who attend KCTCS but receive no degree, diploma, or certificate generally receive an increase in earnings from the credits earned. Furthermore, the size of the return – around ten percent for a year of full-time study – is in line with previous studies of the returns to community college credits (Card, 1999).

*5.6 Differences by Age*

Our sample contains a wide range of ages from 17 to 60. We explore the variation in earnings returns across the age distribution by estimating separate regressions for each age group and sex, where age is measured at the start of students' first school year. Figure 4 displays the coefficients for highest award received; Appendix Table 2 contains the coefficients and t-statistics. As in Figure 3, the results are from the specification that includes the most complete set of control variables. Coefficients that are statistically significant at the five-percent level (two-sided test) are shaded in, and those that are not significant are not shaded in.

Returns vary greatly by age, award and sex. For men, the largest returns for all three awards are generally for teenagers, although there are sizable returns to associate's degrees and diplomas for some older age ranges. The fixed effects models rely on the comparison between pre-KCTCS earnings and post-KCTCS earnings, and this comparison may exaggerate the returns for teenagers, who often have little or no pre-KCTCS earnings. Thus, the results for teenagers should be interpreted with caution. For all age groups, the returns to associate's degrees are often above 20 percent, and they are

always positive and significant. Returns to a diploma are often over 25 percent, and they are positive for all categories below age 40. Returns to a certificate are usually around 10 percent, although they are often statistically insignificant. Even though the return to certificates for men ages 50 to 59 is negative, few men in this age range receive certificates. Likely, these men are returning to school for reasons other than increasing their earnings (such as to find employment after being laid off or simply for enjoyment).

Women receive sizable returns to degrees and diplomas throughout their teens, 20s, and 30s. The returns for associate's degrees and diplomas are positive, significant, and in excess of 20 percent for all but one age category (diplomas for ages 50-59, a category with only 17 diploma recipients). In many cases, the returns are in excess of 40 percent. The largest returns are in excess of 50 percent. For certificates, the returns are only positive and significant for only four of the ten categories: ages 18, 25-29, 30-34, and 50-59.

*5.7 Employment Returns*

In addition to studying the effect of community college awards on earnings, we also study their impact on employment. Higher earnings are a potential benefit of community colleges. Another potential benefit is increased employment, especially for individuals who, prior to entering KCTCS, face the possibility of losing their jobs. Therefore, we estimate models similar to those in equation (2), except that the dependent variable is now a dichotomous variable for having positive quarterly earnings. We refer to this variable as employment, although the category of people with no reported earnings includes individuals who are employed in jobs that are not covered by the Kentucky Unemployment Insurance system.

Table 5 contains the regression results for employment. The table has the same layout as Table 3; the only difference is the dependent variable is now employment rather than log earnings. The first four columns contain results for men, and the second four contain results for women. The rows at the bottom of the table explain the set of additional control variables in each regression.

All three awards are associated with higher probabilities of employment for both men and women. Associate's degrees are associated with a 10.8 to 12.5 percent increase for men and a 16.7 to 18.2 percent increase for women. Diplomas are associated with larger increases of 13.7 to 15.4 percent for men and 16.6 to 20.1 percent for women. This pattern is similar to the earnings results, where earnings returns are as high if not higher for diplomas as they are for degrees. Certificates are associated with increased employment probabilities of 3.9 to 5.2 for men and 5.9 to 7.2 percent for women. Thus, community college awards are associated with higher employment and earnings.

*5.8 Sensitivity Analysis*

A primary concern in the returns to schooling literature is establishing the causal effect of educational attainment on earnings. The previous literature uses a variety of sophisticated methods to control for the fact the educational attainment is determined by factors that are correlated with labor-market outcomes such as earnings and employment. We use a relatively new technique, student fixed effects, to estimate the labor-market returns to community college degrees, and we include detailed control variables including student intentions. Our results for associate's degrees are similar to previous estimates, and little if any previous work has been done on diplomas and certificates. Still, we acknowledge that concerns about the causality may remain, so we conduct several

sensitivity analyses to test the robustness of our earnings returns, as shown in Table 6. The top panel contains the results for men, and the bottom panel contains the results for women. The first column of the table contains the results from Table 3, columns 4 and 8, our preferred specification.

Students who fail to receive any community college credits may not be an ideal comparison group because they may have fundamental differences in earnings growth. They may have lower ability, ambition, or they may have had a random shock that caused them to drop out of KCTCS before completing a for-credit class. All of these factors may lead to lower earnings growth compared to students with awards, producing an upward bias in our estimated returns. Therefore, our first sample limitation is to exclude students who received zero credits from KCTCS, and the returns from this alternate sample are in the second column of the table. Compared to the returns for the full sample, the returns to associate's degrees are slightly lower for men and slightly higher for women; the returns to certificates are higher for both men and women. Overall, the results do no support the notion that the overall returns are overstated because the comparison group includes students who attend KCTCS but do not receive any credits.

Students who state that they do not intend to pursue an award (degree, diploma, or certificate), called "non-degree students," may not be an ideal comparison group because they differ in their educational aspirations.[13] Approximately five percent of non-degree students receive an award, compared with 27 percent of other students. Thus, our second sample restriction is to exclude these non-degree students, as shown in the third column of the table. For men, the returns from this sample are one to four percentage points lower than the full sample, but the returns are nearly identical, if not higher than, the full

[13] Aspirations are measured at the time of initial enrollment in the KCTCS system.

sample returns for women. Thus, if we believe that the regressions for the full sample do not completely account for differences in educational aspirations (which are included as interactions with age and age squared), then the full sample may somewhat overstate the returns for men. However, less than half the men state that they plan to pursue an award, so limiting the sample to men who are pursuing awards may lead to other sample selection issues.

As stated earlier, the earnings data cover through the third quarter of 2008. Students who are still enrolled in community college less than two years before will have limited information on their post-KCTCS earnings potential. Therefore, in the fourth column of Table 6 we exclude students who were still enrolled in KCTCS (i.e. signed up for at least one class) as of the fourth quarter 2006. The returns to diplomas are slightly lower for the restricted sample compared to the full sample. The returns to certificates are actually higher in the restricted sample, particularly for women. Many women with certificates as their highest award received certificates in 2007 or 2008, suggesting that the full sample return to certificates for women may be driven by the low, short-run returns to certificates rather than the larger, longer-run returns.

Rather than following students for a specific number of quarters after they leave KCTCS, the data contain earnings from the first quarter of 2000 through the third quarter of 2008 for every person in the sample. Because students who leave KCTCS early will have more post-KCTCS observations in the regressions than students who leave KCTCS later, there is the possibility that the returns may be driven by the individuals who finished KCTCS the soonest and have the most post-KCTCS quarters (and therefore observations). Those who finish early with awards may possess positive unobservable

traits that are positively correlated with earnings, whereas those who finish early without an award may possess negative unobservable traits that are negatively correlated with earnings. Thus, there is a concern that these individuals may create an upward bias in the earnings estimates in full sample. To address this potential concern, in the fifth column of Table 6 we exclude all observations (i.e. quarters, not people) that are more than 12 quarters after leaving KCTCS. In other words, for each person, the sample is limited to the first 12 post-KCTCS quarters, as well as all quarters prior to KCTCS attendance and all quarters during which the person is attending KCTCS. The results from the fifth column in Table 6 provide little support for this concern aside from the slightly lower returns for certificates compared to the full sample.

As shown in Figure 2, KCTCS students have a sizable drop in average earnings the two quarters before their enter KCTCS. To investigate whether this earnings drop affects our estimated returns, the results in column six of Table 6 excludes the two quarters prior to KCTCS attendance. The results from this sample are nearly identical to the full sample, suggesting that the pre-KCTCS earnings drop is not driving the estimated labor-market returns.

Finally, the fixed-effects model provides a comparison of pre-KCTCS and post-KCTCS earnings for each individual. For individuals who are under 20 when they enroll at KCTCS, many of their pre-KCTCS observations are during their teenage years when their earnings might be limited by high school attendance, labor laws, and other factors. Therefore, it is possible that the fixed-effects results for these individuals will be less meaningful than for older students. To address this concern, the seventh and final column of Table 6 contains the results from a sample that excludes students who were

ages 17 to 19 at the beginning of their first KCTCS school year. The results show that the returns to diplomas for men are slightly larger than in the full sample, and the returns to certificates are smaller for both men and women than in the full sample. Thus, the inclusion of teenagers in the model may slightly overstate the returns for certificates and – for men – diplomas.

In summary, the sensitivity analysis in Table 6 shows that the overall pattern of findings in Table 3 is robust to several alternate sample definitions, although the magnitude of the effect varies slightly across samples. The findings are robust to the inclusion of students with no credits or with no plans to receive an award, to students who have few post-schooling observations or many post-schooling observations, and to students who were teenagers in the pre-schooling periods.

**6. Discussion**

This paper provides new estimates on the labor-market returns to certificates and diplomas offered by community colleges. More people receive these awards than receive associate's degrees, which are more commonly studied. We study the earnings returns for the cohort of students aged 17 to 60 who entered Kentucky's community college system during the 2002-2003 and 2003-2004 school years. For these students, associate's degrees and diplomas have returns of nearly 40 percent for women, compared with returns of 18 to 20 percent for men. Certificates have small positive returns for men and in some cases for women. The highest returns for associate's degrees and – for women – diplomas are for health-related awards. The highest returns for diplomas and certificates for men are in vocational fields. Like Jacobson, LaLonde, and Sullivan's (2005a) work on displaced workers in Washington, we find that earning credits at a community college

without receiving an award has a positive effect on earnings. All three awards are associated with higher likelihoods of employment, although – like earnings – the largest increases are for degrees and diplomas.

Although our estimated returns are large, they are comparable to previous work on associate's degrees. If we translate these returns into dollar amounts using average earnings from Table 1 and our preferred results in Table 2 (columns 4 and 8), the labor-market returns for degrees and diplomas is around $8,000 per year for women and $7,000 per year for men. For certificates, the annual return is around $650 for women and $800 for men. Thus, these returns are not unreasonably large for a human capital investment of two years or less of full-time coursework. In addition, the cost of 30 credits, one year of full-time coursework, was $3,450 for the 2007-2008 school year (Kentucky Council on Postsecondary Education, 2009).

These findings add to an extremely limited literature on the returns to community college certificates and diplomas. Nearly all the previous literature focuses on associate's degrees or the amount of schooling received (measured by credits or years of full-time attendance). Although our study focuses on the experience in one state, the richness of the data and the similarities of community college systems around the U.S. suggest some tentative national policy conclusions. Human capital investments in community and technical college programs produce large labor-market returns, particularly for women, but the returns vary substantially among fields and awards.

## 7. References


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Table 1: Descriptive Statistics, KCTCS Data

| | Men | | Women | |
|---|---|---|---|---|
| Variable | Mean | Std. Dev | Mean | Std. Dev |
| Quarterly Earnings | 8,286 | 7,837 | 4,951 | 8,124 |
| Age | 28.8 | 11.1 | 28.8 | 10.5 |
| Percentage Nonwhite | 0.209 | 0.406 | 0.200 | 0.400 |
| Associate's Degree | 0.086 | 0.280 | 0.177 | 0.382 |
| Diploma | 0.044 | 0.205 | 0.057 | 0.233 |
| Certificate | 0.058 | 0.234 | 0.065 | 0.246 |
| Associate's Degree Fields | | | | |
| Business | 0.004 | 0.059 | 0.022 | 0.144 |
| Health | 0.012 | 0.108 | 0.072 | 0.254 |
| Humanities | 0.018 | 0.132 | 0.036 | 0.181 |
| Other Academics | 0.024 | 0.153 | 0.025 | 0.156 |
| Services | 0.007 | 0.083 | 0.018 | 0.133 |
| Vocational | 0.020 | 0.138 | 0.003 | 0.054 |
| Diploma Fields | | | | |
| Business | 0.002 | 0.048 | 0.010 | 0.101 |
| Health | 0.004 | 0.065 | 0.042 | 0.201 |
| Services | 0.001 | 0.036 | 0.004 | 0.059 |
| Vocational | 0.036 | 0.186 | 0.001 | 0.037 |
| Certificate Fields | | | | |
| Business | 0.001 | 0.038 | 0.009 | 0.094 |
| Health | 0.005 | 0.069 | 0.034 | 0.180 |
| Services | 0.002 | 0.043 | 0.017 | 0.130 |
| Vocational | 0.050 | 0.218 | 0.004 | 0.065 |
| Uunemployment Rate | 6.137 | 1.210 | 6.141 | 1.133 |
| Number of Students | 21,747 | | 24,861 | |

Note: Earnings are conditional on employment (i.e. observations with zero earnings are excluded).

Table 2: Cross-Sectional OLS Model of 2000 Census and KCTCS Data
Dependent Variable is Log Yearly Earnings (2008 $)

| | Men | | Women | |
|---|---|---|---|---|
| | KCTCS | Census | KCTCS | Census |
| Associate's Degree | 0.217 | 0.253 | 0.477 | 0.434 |
| | (6.60) | (13.01) | (20.07) | (23.33) |
| Diploma | 0.197 | | 0.441 | |
| | (4.01) | | (10.91) | |
| Certificate | 0.067 | | -0.033 | |
| | (1.78) | | (0.94) | |
| 1+ Years College, No Degree | | 0.179 | | 0.221 |
| | | (13.99) | | (15.00) |
| <1 Year College, No Degree | | 0.182 | | 0.181 |
| | | (10.92) | | (9.91) |
| In School | 0.198 | -0.432 | -0.079 | -0.276 |
| | (7.44) | (23.15) | (2.82) | (14.17) |
| Age | 0.135 | -0.238 | 0.069 | 0.006 |
| | (24.18) | (16.58) | (11.49) | (0.37) |
| Age Squared | -0.001 | 0.129 | -0.001 | 0.100 |
| | (18.77) | (49.03) | (7.13) | (31.42) |
| Nonwhite | -0.115 | -0.001 | -0.033 | -0.001 |
| | (5.79) | (44.99) | (1.62) | (28.29) |
| Intercept | 6.997 | 7.578 | 7.698 | 7.507 |
| | (68.59) | (142.42) | (71.28) | (116.89) |
| Observations | 20,527 | 42,996 | 22,580 | 39,672 |

Notes: Absolute values of t-statistics are in parentheses. All models include workers ages 22 to 66 with positive yearly earnings. Regressions using Census data also include controls for the following educational levels: less than high school, bachelor's degree, master's degree, and professional (or doctoral) degree.

Table 3: Earnings Returns for Highest Award Received, KCTCS Data

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Associate's Degree | 0.257 | 0.236 | 0.164 | 0.200 | 0.419 | 0.392 | 0.357 | 0.387 |
| | (28.65) | (26.15) | (18.76) | (22.37) | (62.56) | (58.09) | (53.40) | (56.98) |
| Diploma | 0.301 | 0.279 | 0.189 | 0.223 | 0.389 | 0.363 | 0.361 | 0.410 |
| | (23.50) | (21.74) | (15.13) | (17.45) | (35.43) | (33.11) | (33.27) | (37.17) |
| Certificate | 0.166 | 0.154 | 0.073 | 0.092 | 0.024 | 0.015 | 0.002 | 0.033 |
| | (16.86) | (15.58) | (7.61) | (9.41) | (2.53) | (1.55) | (0.23) | (3.49) |
| Enrollment Timing | no | yes | yes | yes | no | yes | yes | yes |
| Demographics | no | no | yes | yes | no | no | yes | yes |
| First Term Plans | no | no | no | yes | no | no | no | yes |
| Observations | 623,562 | 623,562 | 623,562 | 623,562 | 669,239 | 669,239 | 669,239 | 669,239 |

Notes: Absolute values of t-statistics are in parentheses. All models also include person fixed effects and time fixed effects.

Table 4: Earnings Returns for Highest Award by Field of Study, KCTCS Data

| | Men | | Women | |
|---|---|---|---|---|
| | Coefficient | T-statistic | Coefficient | T-statistic |
| *Associate's Degree* | | | | |
| Humanities | -0.032 | 1.63 | 0.035 | 2.30 |
| Other Academic | 0.258 | 15.84 | 0.326 | 18.98 |
| Business | 0.017 | 0.40 | 0.157 | 8.71 |
| Health | 0.578 | 24.48 | 0.750 | 72.84 |
| Services | -0.042 | 1.38 | 0.015 | 0.74 |
| Vocational | 0.233 | 13.28 | 0.197 | 4.41 |
| *Diploma* | | | | |
| Business | -0.290 | 2.02 | 0.046 | 1.53 |
| Health | 0.355 | 9.64 | 0.508 | 41.53 |
| Services | -0.003 | 0.04 | 0.021 | 0.42 |
| Vocational | 0.229 | 16.38 | 0.214 | 2.73 |
| *Certificate* | | | | |
| Business | -0.040 | 0.75 | -0.001 | 0.04 |
| Health | -0.046 | 1.38 | 0.040 | 3.34 |
| Services | -0.094 | 1.96 | 0.045 | 2.37 |
| Vocational | 0.124 | 11.60 | 0.061 | 1.46 |
| Observations | 623,562 | | 669,239 | |

Notes: Absolute values of t-statistics are in parentheses. All models also include controls for enrollment timing, demographics, student intentions, person fixed effects, and time fixed effects.

Table 5: Employment Returns for Highest Award Received, KCTCS Data

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Associate's Degree | 0.110 | 0.117 | 0.108 | 0.125 | 0.167 | 0.169 | 0.169 | 0.182 |
| | (30.64) | (32.39) | (30.26) | (34.60) | (65.14) | (65.96) | (66.32) | (70.17) |
| Diploma | 0.139 | 0.146 | 0.137 | 0.154 | 0.166 | 0.169 | 0.182 | 0.201 |
| | (28.43) | (29.88) | (28.36) | (31.14) | (40.55) | (41.16) | (44.78) | (48.76) |
| Certificate | 0.053 | 0.057 | 0.039 | 0.052 | 0.059 | 0.061 | 0.062 | 0.074 |
| | (14.03) | (15.15) | (10.58) | (13.73) | (17.22) | (17.88) | (18.17) | (21.57) |
| Enrollment Timing | no | yes | yes | yes | no | yes | yes | yes |
| Demographics | no | no | yes | yes | no | no | yes | yes |
| First Term Plans | no | no | no | yes | no | no | no | yes |
| Observations | 936,985 | 936,985 | 936,985 | 936,985 | 1,053,990 | 1,053,990 | 1,053,990 | 1,053,990 |

Notes: Absolute values of t-statistics are in parentheses. All models also include person fixed effects and time fixed effects.

Table 6: Sensitivity Analysis to Alternate Samples, KCTCS Earnings Returns

| Sample Exclusion | None - Full sample (Table 3) | Earned zero credits | Non-degree students | Enrolled in fourth quarter 2006 | More than 12 post-KCTCS quarters | 2 quarters before KCTCS enrollment | Ages 17 to 19 |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| | | | | Men | | | |
| Associate's | 0.200 | 0.186 | 0.177 | 0.192 | 0.201 | 0.210 | 0.192 |
| Degree | (22.37) | (20.01) | (16.59) | (16.67) | (21.81) | (23.10) | (19.81) |
| Diploma | 0.223 | 0.224 | 0.189 | 0.181 | 0.222 | 0.223 | 0.170 |
| | (17.45) | (17.10) | (12.34) | (12.29) | (16.83) | (17.00) | (12.07) |
| Certificate | 0.092 | 0.103 | 0.080 | 0.100 | 0.086 | 0.092 | 0.075 |
| | (9.41) | (10.02) | (6.49) | (8.42) | (8.46) | (9.15) | (7.14) |
| Observations | 623,562 | 507,958 | 310,567 | 449,593 | 548,758 | 587,077 | 531,032 |
| | | | | Women | | | |
| Associate's | 0.387 | 0.398 | 0.385 | 0.396 | 0.388 | 0.392 | 0.389 |
| Degree | (56.98) | (56.08) | (51.72) | (45.00) | (54.27) | (56.63) | (52.48) |
| Diploma | 0.410 | 0.408 | 0.407 | 0.398 | 0.417 | 0.422 | 0.413 |
| | (37.17) | (35.34) | (34.21) | (31.29) | (36.40) | (37.19) | (35.29) |
| Certificate | 0.033 | 0.055 | 0.039 | 0.082 | 0.026 | 0.029 | 0.026 |
| | (3.49) | (5.36) | (3.78) | (7.04) | (2.64) | (2.98) | (2.64) |
| Observations | 669,239 | 553,482 | 503,400 | 495,818 | 590,582 | 629,432 | 571,531 |

Notes: Absolute values of t-statistics are in parentheses. The table contains results from 14 regression models (seven specifications and two sexes). All models also include controls for enrollment timing, demographics, student intentions, person fixed effects, and time fixed effects.

Figure 1: Average Quarterly Earnings for KCTCS Award, KCTCS Non-award, and Non-KCTCS Workers, 2002 to 2008

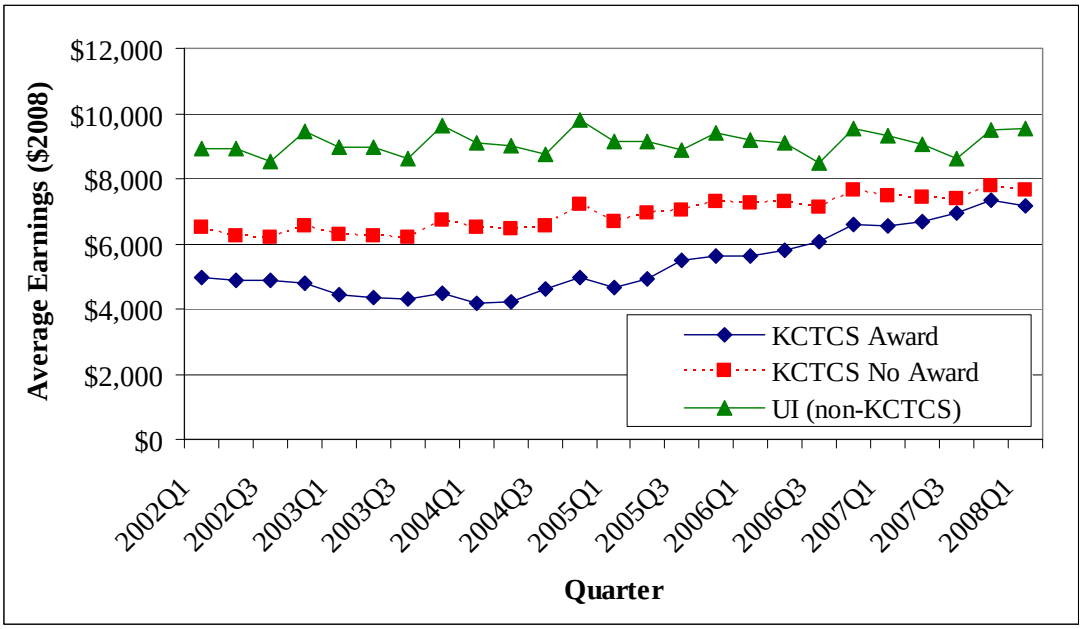
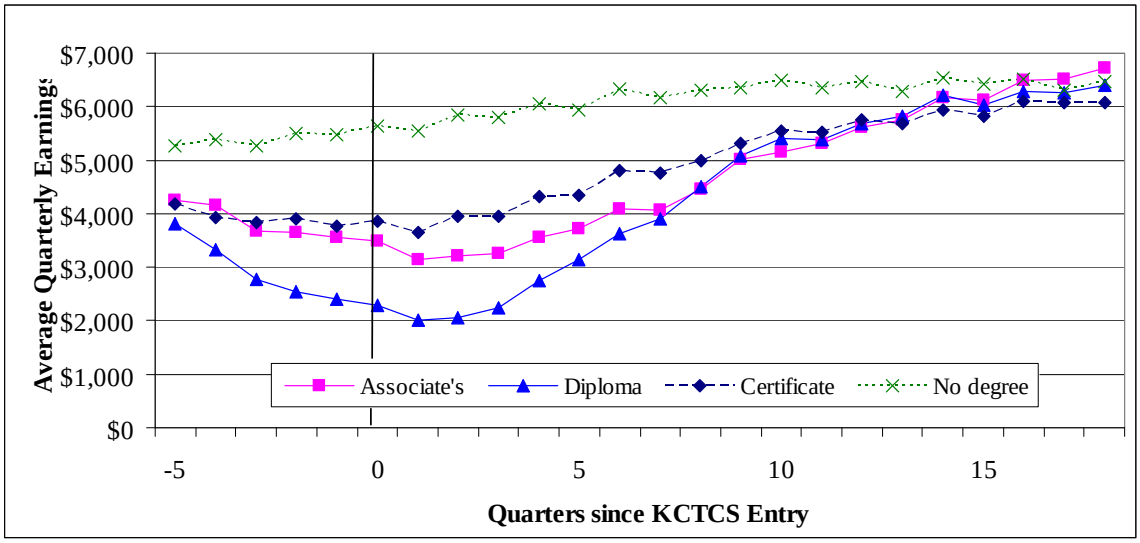


Figure 2: Quarterly Earnings by Quarters since KCTCS Entry

Men




Women

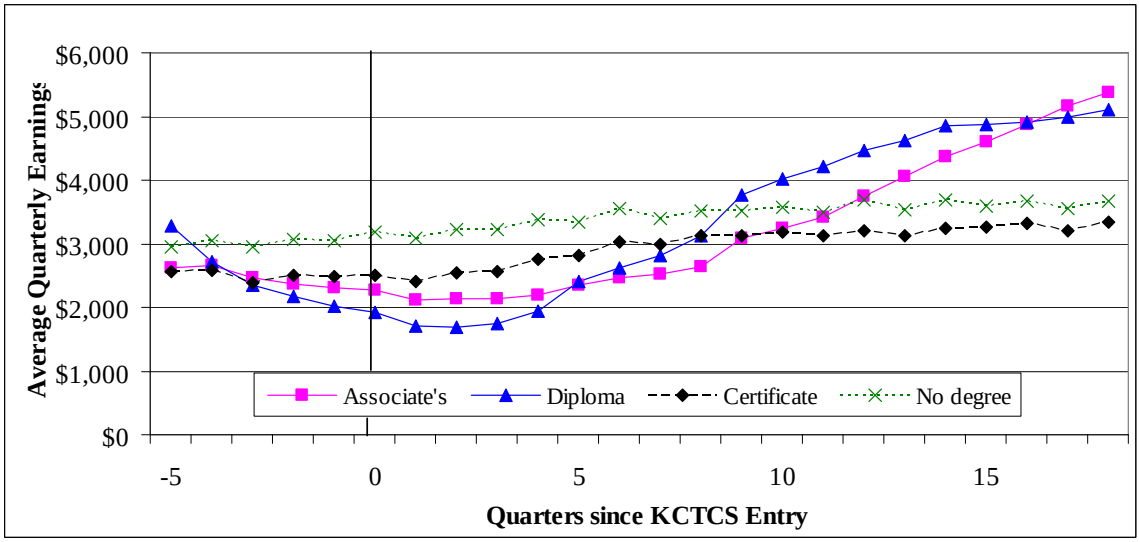
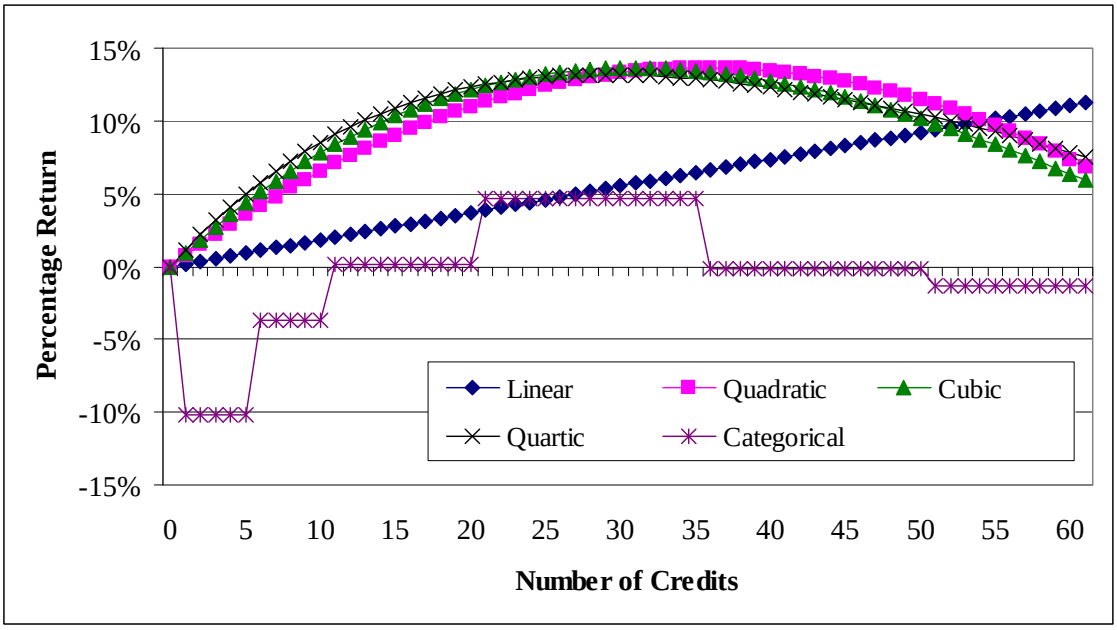


Figure 3: Earnings Returns for Credits Earned, KCTCS Data
Excluding Students with Degrees, Diplomas, or Certificates

Men




Women

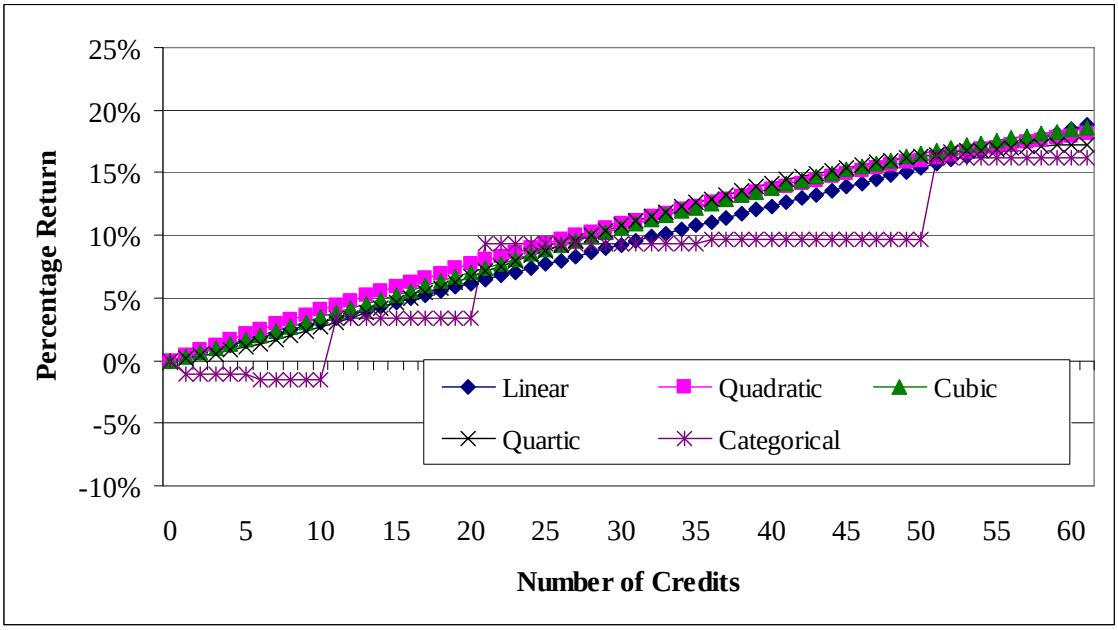
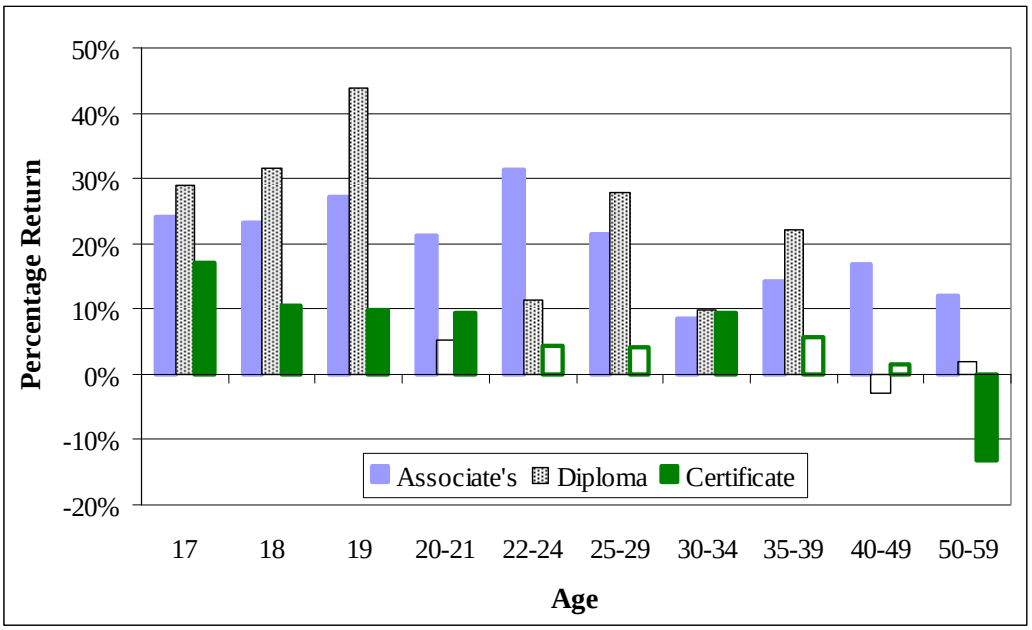
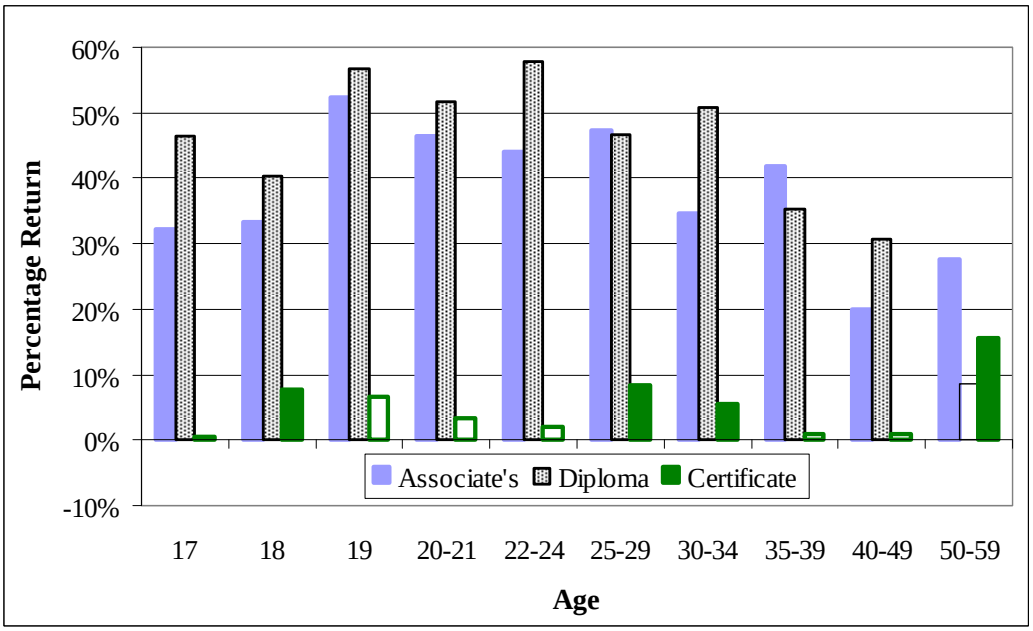


Figure 4: Earnings Returns for Highest Award Received by Age, KCTCS Data

Men




Women




Notes: Coefficients that are not statistically significant from zero at the five-percent level (two-sided tests) are not shaded. The coefficient for certificates for men ages 35-39 and the coefficient for diplomas for women ages 50-59 are significant at the ten-percent level (but not the five percent level). The coefficients for certificates for women ages 17, 35-39, and 40-49 are not shaded (and are not significant at the ten-percent level either).

Appendix Table 1: Earnings Returns for Credits Earned, KCTCS Data Excluding Students with Degrees, Diplomas, or Certificates

| | Men | | Women | |
|---|---|---|---|---|
| | Coefficient | T-statistic | Coefficient | T-statistic |
| *Linear specification* | | | | |
| Credits | 0.002 | 9.42 | 0.003 | 15.64 |
| *Quadratic specification* | | | | |
| Credits | 0.008 | 15.97 | 0.004 | 8.98 |
| Credits squared | -0.011 | 13.28 | -0.002 | 2.73 |
| *Cubic specification* | | | | |
| Credits | 0.010 | 11.68 | 0.003 | 3.94 |
| Credits squared | -0.020 | 6.32 | 0.002 | 0.64 |
| Credits cubed | 0.0009 | 3.06 | -0.0004 | 1.4 |
| *Quartic specification* | | | | |
| Credits | 0.012 | 8.92 | 0.002 | 1.17 |
| Credits squared | -0.035 | 4.13 | 0.014 | 1.87 |
| Credits cubed | 0.004 | 2.39 | -0.003 | 1.99 |
| Credits quartic | -0.0002 | 1.89 | 0.0002 | 1.77 |
| *Categorical specification* | | | | |
| 1 to 5 credits | -0.102 | 12.34 | -0.010 | 1.15 |
| 6 to 10 credits | -0.037 | 3.91 | -0.015 | 1.54 |
| 11 to 20 credits | 0.002 | 0.16 | 0.033 | 3.26 |
| 21 to 35 credits | 0.047 | 4.09 | 0.093 | 8.25 |
| 36 to 50 credits | -0.002 | 0.12 | 0.097 | 6.49 |
| 51+ credits | -0.013 | 0.79 | 0.162 | 9.68 |

Notes: Absolute values of t-statistics are presented. All models also include controls for enrollment timing, demographics, student intentions, the average number of credits earned per quarter (in-school periods only), person fixed effects, and time fixed effects. The table reports results from 10 regressions (5 specifications and 2 sexes). For men, the number of observations in each regression is 538,170; for women, the number of observations in each regression is 509,810.

Appendix Table 2: Earnings Returns for Highest Award Received by Age, KCTCS Data

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Associate's Degree | Diploma | Certificate | Associate's Degree | Diploma | Certificate |
| Age 17 | 0.240 | 0.288 | 0.170 | 0.323 | 0.465 | 0.004 |
| | (5.90) | (5.22) | (4.80) | (12.45) | (8.11) | (0.12) |
| Age 18 | 0.233 | 0.316 | 0.106 | 0.332 | 0.402 | 0.078 |
| | (8.30) | (8.33) | (3.30) | (15.65) | (9.60) | (2.39) |
| Age 19 | 0.271 | 0.438 | 0.099 | 0.523 | 0.567 | 0.067 |
| | (5.52) | (7.45) | (2.17) | (13.47) | (9.76) | (1.49) |
| Age 20 - 21 | 0.212 | 0.053 | 0.094 | 0.464 | 0.518 | 0.033 |
| | (5.00) | (0.87) | (1.97) | (13.28) | (11.00) | (0.95) |
| Age 22 - 24 | 0.313 | 0.114 | 0.044 | 0.441 | 0.579 | 0.021 |
| | (8.04) | (2.21) | (1.23) | (16.09) | (13.92) | (0.61) |
| Age 25 - 29 | 0.215 | 0.277 | 0.042 | 0.473 | 0.466 | 0.083 |
| | (8.21) | (6.93) | (1.31) | (23.13) | (14.96) | (2.65) |
| Age 30 - 34 | 0.084 | 0.099 | 0.093 | 0.345 | 0.509 | 0.055 |
| | (2.99) | (2.55) | (3.39) | (15.76) | (15.28) | (1.99) |
| Age 35 - 39 | 0.142 | 0.221 | 0.056 | 0.419 | 0.353 | 0.010 |
| | (4.12) | (4.84) | (1.77) | (17.57) | (9.48) | (0.32) |
| Age 40 - 49 | 0.169 | -0.028 | 0.016 | 0.201 | 0.307 | 0.009 |
| | (7.45) | (0.79) | (0.66) | (10.42) | (11.44) | (0.42) |
| Age 50 - 59 | 0.120 | 0.020 | -0.132 | 0.277 | 0.087 | 0.156 |
| | (2.43) | (0.31) | (2.79) | (6.72) | (1.65) | (3.83) |

Notes: Absolute values of t-statistics are in parentheses. All models also include demographics, controls in-school and post-school periods, controls for each of the two quarters prior to KCTCS entry, person fixed effects, and time fixed effects. Each age and sex combination (such as age 18 males) is from a separate regression. The table reports results from 20 regressions (10 age groups and 2 sexes).