Effects of the Community College Attendance Costs on Community College Education and Earnings

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Abstract

The rapidly rising costs of college education received attention and concern from consumers and policy makers. Much attention has focused on whether the returns to college education have kept pace with the increasing college costs. Despite the increasing returns to college education, the growth in the number of college students remains small. This is true especially among community college students who are more sensitive to the changes in the college costs than to the changes in the college premium (Kane and Rouse, 1999). In this paper, I explore the use of the fraction of the cost of attending community college as an exogenous source of variation in community college education. Using rich administrative data from Florida, I find that a higher fraction of the college cost has negative effects on two community college education outcomes: the number of semesters enrolled in the community college and the associates in arts degree completion. Using the fraction of the college cost as an instrumental variable for these college education outcomes, the implied IV estimates of the returns to community college education are large. These instrumental variables estimates provide suggestive evidence of the large returns to community college education among students whose college decisions are affected by the fraction of the cost of attending community college.

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1 Introduction

Many research studies have documented some high returns to college education (see Kane and Rouse 1999). With the rising premium on college education, many high school graduates aspire to acquire college education in the hope of expanding their labor market opportunities. The estimates of the returns to completing associates in arts degree range from 15 to 27 percent of annual earnings, while attending a college could raise the annual earnings by about 10 to 12 percent (Kane and Rouse, 1999). Despite the existing premium to college education, not all high school graduates go to college.

Much effort was devoted to analyze college access and its determinants, most especially for disadvantaged students. A great deal of attention has focused on the rapidly rising cost of college education and its implication on the college-going decisions of most high school students. This high cost of college education prevents a large fraction of high school graduates from attending a college. Between 1999-2000 and 2009-2010, costs for tuition, room, and board rose 37 percent at public institutions and 25 percent for private institutions (see the 2010 Digest of Education Statistics Annual Report, National Center for Education Statistics, 2010). The impact of this rising college costs is more likely felt by community college students who are sensitive to the changes in the college cost than to the changes in the college education premium such as earnings (Kane and Rouse, 1999). Between 1999-2000 and 2009-2010, about 66 percent of the high school graduates enrolled in college in the fall immediately after high school graduation. Among the high school graduates who choose to go to college, only 37 percent matriculated at a community college (see the 2011 Condition of Education Annual Report, National Center for Education Statistics, 2011). As the high labor market premium favoring college education persists and that a college degree becomes a prerequisite to join the ranks of the middle class, this high cost of college education appears to be one of the barriers to student success. To make college education affordable, some argued the need for more aggressive financial support policies to assist students in meeting their goals of acquiring higher education. With the future of every student at stake, providing high quality and affordable college education remains a public policy concern (Perna and Li, 2006).

Despite the availability of financial aid supports as well as the plurality of ways to finance community college education, many community college students remain "priced out" of college education. Much attention was given to understanding the impact of college costs and financial aid policy on the college decisions of students from four year colleges. Perhaps a sound college financing policy that supports equity and efficiency would matter most to the community college students. Community colleges serve students on the margin of college-going who would otherwise choose not to attend college because of the high cost of attending a university. This includes first generation students from the low-income and underrepresented minority families who have high hopes on the power of education to improve their standard of living. These community college students are more likely to seek credentials and most of the time combine work and study (Marcotte et al., 2005; Betts and McFarland, 1995; Grubb, 2002). As a result, college-going decisions at the community college level tend to be more sensitive to the cost of attendance.

In this paper, I consider the effects of the cost of attending community college in Florida. In particular, I use the ratio of the net cost to the total cost of attending the nearest community college, a measure that would reflect the fraction of the cost of attending community college that a family would have to contribute to send a family member to college. The salient features of the community college system in Florida permits the use of the cost of attending community college as an exogenous source of variation in community college education. This source of exogenous variation in community college education allows employing instrumental variables (IV) analysis to generate more credible estimates of the effects of the community college education on earnings.

The analysis is based on two data sources. First, an extensive student-level microdata is obtained from the Florida Education and Training Placement Information Program (FETPIP), a unit within Florida Department of Education. This microdata contain the information on student enrolments in Florida public schools, demographic characteristics (sex, race, year and month of birth), grade 10 FCAT scores (mathematics and reading), postsecondary awards (community college and university awards), and earnings. Second, a community college-level cost data is obtained from the Integrated Post Secondary Education Data System (IPEDS). This data include information on the estimated relevant costs of attending a community college in Florida as well as the records of the average financial support that the students received in a community college.

I find that increasing the fraction of the college cost decreases the number of semesters students were enrolled in the community college (CC Terms) by about a third of a semester and decreases the associates in arts degree (AA degree) completion rate by about two percentage points. These estimates are moderately large when compared to the average semesters enrolled in community college and the average AA degree completion rates. Cutting the sample into different demographic groups, I find that the fraction of the college cost has a larger negative effect on both the number of semesters enrolled in college and the AA degree completion rate in the subsample of females, Hispanics, students who participated in free/reduced lunch program, and the students who reached 10th grade on time. The IV estimates based on the fraction of college costs indicate that a semester of enrolment in community college is associated with about a 20 percent increase in annual earnings. The IV estimate of the returns to competing associates in arts degree are quite large, with a wide range of estimate from about one to 850 percent of the average annual earnings. These IV estimates are concentrated among white students, students who did not participate in the free/reduced lunch program, and students who reached 10th grade on time. The IV estimates provide suggestive evidence of the large returns to community college education.

A caveat should be applied to these findings. Since the IV estimates are local to the community college students whose college education decisions are shifted by the fraction of the college cost, I cannot assess the returns to the community college education for the rest of the students in the sample. As such, the analysis and the interpretation of the findings hold for students in the sample who choose to attend community college when the fraction of the college cost is low and choose not to attend college when the fraction of the college cost is high. Second, I cannot address the advantages and disadvantages of attending community college relative to the traditional four-year colleges. The instrument used in this paper is set up with the community college students in mind. The instrument is expected to affect only the community college-going decisions and not the university attendance decisions.

Despite these caveats, these results suggest that college costs affect college-going decisions and earnings.

2 Background

2.1 Review of Related Literature

2.1.1 Cost of Attendance and Community College Education

Interesting questions surround the cost of attending college. First, how do college costs affect decisions to attend college and other college-going behavior? One strand of research examined the relationship between the tuition costs and the college-going behavior of students. Leslie and Brinkman (1988), Rouse (1994), and Kane (1995) study the relationship between tuition and college enrollment. Manski (1989), St.John (1990), St.John and Starkey (1995), Dynarski (2008) study the effects of tuition costs on college completion and college persistence. The second strand of research asked how the effects of the college tuition costs vary across socio-demographic groups. Kane (1994, 1995, 1999), Ellwood and Kane (2000), and Carneiro and Heckman (2002) examined the sensitivity of various income groups to tuition costs.

The standing unresolved question is whether and how college costs affect the college attendance and the other college-going behavior among high school graduates. Although there has been little empirical work on college costs, a number of research papers have assessed the effects of tuition costs and financial aid on four-year college enrollment. In their comprehensive review of the higher education costs, Leslie and Brinkman (1988) have estimated that a $1,000 increase in tuition costs is associated with three to four percentage point decrease in college enrollments. (St.John, 1990) studied how students respond to college prices. Using the data from the High and Beyond (Class of 1982) survey, St. John analyzed the effects of tuition and aid on student enrollment. St. John concluded that all forms of financial aid – grants, work, and loans – were effective in promoting enrollment. Some skeptics call into question the results of these studies. The estimates from these studies were commonly generated from time series and cross-sectional methods that exploits the variations in the average state public tuition levels to identify the effects of tuition costs on enrollment. Rouse (1994), Kane (1995), Cameron and Heckman (1999), and Long (2004) pointed out that estimates based on state variation in tuition costs are to be treated with caution if tuition costs are correlated with the unobserved factors that are related to college enrollment. Some studies exploited the quasi-experimental nature of the data to examine the effects of tuition costs on enrollment. Dynarski (2003) used the shift in financial policy – the elimination of Social Security Student Benefit Program in 1982 – that affected only some students as the source of the exogenous variation to identify the effects of financial aid on college attendance. Using a difference-in-difference methodology, she finds that the elimination of the Social Security student benefit program reduced the likelihood of college attendance and college completion. Dynarski suggested that a $1,000 increase in aid would increase the probability of college attendance by 3.6 percentage points.

Less is known on how college costs affect college completion and college persistence. The related studies in this area used the information on the tuition costs and financial aid to explain college completion and persistence. Manski (1989) argued that the net effect of reducing tuition cost on college completion and persistence is ambiguous. In the framework of Manski, students who are induced to attend college due to lower tuition costs will soon discover whether or not they are college material. By lowering tuition costs for the less prepared students, both enrollment and the drop out behavior could increase. On the other hand, lowering tuition costs could attract more prepared "credit constrained" students who are more likely to complete college. Manski concluded that the net effect of reducing tuition costs is ambiguous. St.John and Andrieu (1995) assessed the influence of student aid on the within-year persistence by traditional college students. Using the 1987 National Post-secondary Student Aid Study, they concluded that tuition charges had a negative effect on persistence. DesJardins, Ahlburg and McCall (2002), on a similar note, examined the effects of scholarships on retention. They showed that changing loans to scholarship has a large effect on persistence. Dynarski (2008) examined the causal link between the college costs and the degree completion in states with scholarship programs. Using a treatment-comparison group research design, Dynarski concluded that college completion increased in states with scholarship programs.

Little is known on how the effects of the college costs vary across socio-economic groups. Economists have suggested that the differential effects of tuition costs arise due to individual "credit constraints." Compared to the affluent individuals who typically have higher levels of schooling, low income individuals attain lower years of post-secondary schooling due to their inability to borrow against future income. If credit constraints reduce college attendance in these low income individuals, then these individuals are expected to be more sensitive to tuition costs and financial aid. Kane (1994, 1995, 1999) and Ellwood and Kane (2000) find low-income youth to be more sensitive to the tuition costs. Cameron and Heckman (1998, 1999) and Carneiro and Heckman (2002) showed that conditional on ability, the effects of tuition are uniform across family income categories. The evidence in this area of empirical research is mixed.

While there are empirical research papers that examined the link between the college tuition costs, attendance, and completion, these research papers are conducted with the four-year college students in mind. There is a little consensus whether and how the direct and indirect college costs affect attendance and degree completion among two-year college students. Community colleges often serve students on the margin of attending college which include immigrants and the economically disadvantaged. These marginal students are the ones who are sensitive to the changes in college costs. Kane (1995) and Marcotte et al. (2005) argued that community college students are typically more sensitive to the college costs than the traditional four-year college students because the former tend to seek credentials and typically combine school and work. Since community college degree is most of the time the "terminal degree" among these two-year college students, college completion is particularly important because not all students who attend two-year colleges plan to enroll in four-year colleges (Rouse, 1995).

This paper contributes to the literature on the effects of the college costs on community college education outcomes – community college persistence and associates in arts degree completion. This paper makes use of the between community college cost variations among the 28 Florida community colleges in identifying the effects of the college costs on the number of semesters enrolled in college and on the associates in arts degree completion. This paper is the first to use a measure of the fraction of the college costs, the *fraction of cost of attending community college*. Also, I provide several tests and robustness checks to warrant the credibility of the estimates based on the fraction of the college costs, which are not commonly seen in many empirical research papers in this field.

2.1.2 Returns to Community College Education

Finding the extent to which college education improves labor market success of students had been the central research question of many studies in the past. Although there are empirical research papers that documented the effects of college education on the labor market success and earnings, only a few examined the impact of the community college education. Because of the availability of the data, the majority of the empirical research papers had focused on the returns to the four-year education (Card, 2001).

Understanding the economic returns to community college education is important at least for 3 reasons. First, community colleges provide opportunities to disadvantaged students who are typically left behind due to poor academic preparation (Cohen and Brawer, 2003). Second, community colleges play a major role in training to enhance the skills of those individuals who are already in the workforce (Marcotte et al., 2005). Third, since community colleges enroll a large share of college students and are supported by the federal and state governments, these institutions are amenable to policy interventions (Rouse, 1994).

Despite the benefits from the community college education, the value of the community college education in the labor market remained understudied. The early research papers showed that the community college education have no or little effect on earnings. Dougherty (1987) made a comprehensive study of the research papers on the returns to community college education. Based on the synthesized findings, Dougherty concluded that baccalaureate degree seeking students who entered community colleges attain less educationally and economically. The 1990s show some positive strides with more empirical research papers documented the positive returns to the community college education. Using the data from the National Longitudinal Survey Class of 1972 (NLS-72), Grubb (1993) compared the earnings of the students who completed associates in arts degree and the students who finished high school only. Grubb finds that the students who completed associates in arts degree earned more. On a similar note, Grubb (1997, 2002) finds a positive earnings effect of sub-baccalaureate credentials. Using the data from the Survey of Income and Program Participation, Grubb showed that the students who earned college credentials have higher earnings than those students who failed to earn credentials. In their influential paper, Kane and Rouse (1995) used the National Longitudinal Survey Class of 1972 and 79 (NLS-72 and 79) and the National Longitudinal Survey of Labor Market Experience of Youth (NLSY-79) to compare the returns to the two-year and four-year college degrees. One notable conclusion of their paper suggests that the earnings of the community college degree holders are higher by roughly 15 to 25 percent compared to the students who completed high school only.

The importance of understanding the effects of college persistence on earnings cannot be discounted for two reasons. First, the additional years of schooling always have, if not large, some positive effects on earnings. Second, some students who entered community college drop out early and fail to finish a degree, probably due to the costs associated with college education, skills and academic preparation, and to some psychological reasons. Findings that point to positive returns to college persistence call for policies that make students stay in college. Kane and Rouse (1995) and Leigh and Gill (1997) investigated how coursework not leading to a degree affects earnings. These research studies find that a year of coursework increases earnings by about five to eight percent. Similarly, Jacobson, LaLonde and Sullivan (2005) used the administrative data of displaced workers in Washington State and find that an academic year equivalent of credits earned increases earnings by nine percent for men and 13 percent for women. Using the 2000 Follow-Up of the National Education Longitudinal Survey, Marcotte et al. (2005) find positive earnings effects among students who completed and who failed to earn credentials.

There are shortcomings in the early studies that attempt to measure the returns to community college education. First, the datasets used in these early research papers are mostly based on a survey data. Survey data on earnings and other information are commonly mismeasured. As a result, estimates of the returns to community college education based on such dataset are potentially biased. Moreover, the results generated from some outdated datasets provide little value to the current policy makers since the structure of the community colleges and the labor market have changed dramatically since 1980 (Marcotte et al., 2005). The early research papers also have suffered from methodological issues that cast doubts on the credibility of their estimates. The estimates from these papers are potentially biased since the predominant estimation method used is mostly the OLS regression analysis with the family background variables and test scores included which are intended to control at least the ability bias. A convincing estimate of the returns to community college education needs an exogenous variation in the community college education outcomes. To control for the bias from unobserved factors such as ability, the exogenous variation in the education outcomes can be exploited under quasi-experimental research designs. Kane and Rouse (1995) attempted to use the institutional features of the community colleges in their analysis as the source of the exogenous variation in the community college education. They used tuition costs, transcript of records, and the distance to the nearest community college as the instruments for college-going behavior and degree completion. Although Kane and Rouse (1995) were able to produce more credible estimates of the returns to community college education, they were not able to estimate an effect due to the lack of power in their tests.

This paper attempts to use an instrumental variables framework in the analysis of the returns to community college education. I offer several improvements. First, I use rich administrative data on the college costs and financial aid information from Florida. The administrative data include information on earnings, college enrollment, college degree completion, and demographic variables. This administrative data also include important pre-college information such as test scores and information whether a student is on track to finish high school. These pre-college information are valuable since they represent skills, which may control for the unobserved ability. The use of administrative data is also less prone to the measurement error, especially in the earnings information. Second, similar to the approach of Kane and Rouse (1995), I will make use of an institutional feature of the community colleges – the cost of attending the nearest community college – as the source of exogenous variation in the community college education. In particular, I will use the "net to total college cost ratio of attending community college", which measures the fraction of the college costs, as an instrumental variable. Third, I will show how the identification conditions arising from the model under the instrumental variables framework can be tested. In this way, I can establish that my estimates are more credible and that the instrumental variable I use is legitimate.

2.2 The Cost of Attending Florida Community College

A credible estimate of the returns to community college education requires an exogenous variation in community college education. One potential source of this exogenous variation is the differences in the cost of attending community colleges in Florida. A high cost of college attendance is expected to discourage a fraction of students to attend college. In this section I describe the nature and the differences in the cost of attending community colleges in Florida. Prospective students are expected to pay for the educational and living expenses while attending any of the 28 Florida community colleges. Typically, a student's college expenditures include educational and living expenses. Educational expenses consist of tuition and fees and book expenses while living expenses include room and board, transportation, and other personal effects. In the school year 2001-2002, students on average spent most on room and board, which accounts for about 56 percent of the cost of attending community college in Florida. In that same school year, about 18 percent of the cost of attendance is attributed to tuition and fees, 13 percent to the transportation expense, and 12 percent to personal effects (see Report No. 03-33 Office of the Program Policy Analysis and Government Accountability, 2003). Over the years, tuition and fees in the community colleges are set by the Florida legislation. The State Board of Education (SBE) in Florida prescribes a schedule of the tuition and fees that each community college can charge to their current and incoming students. This schedule of the tuition and fees that each community college adopts is based on the prior school year's total cost of operation in each of the community colleges. The legislature also gives each community college some flexibility to charge additional fees. On top of the prescribed tuition and fees, the legislature allows the Board of Trustees of each community college to charge additional fees with the provision that these fees should not exceed five percent of the prescribed tuition and fees and that the sum of these additional fees should be expended only for the local safety and security. The tuition and fees for a given school year may be thought of as an outgrowth of the historical costs of operation and the year to year flexibility of each community college to add some additional fees. Each community college provides estimates of the living costs in every school year. Various cost estimates for several housing arrangements are typically published in each community college web page. The estimated cost of the on-campus housing, off-campus housing not with family, and off-campus housing with family are among the figures published in the colleges' web pages. Transportation costs are typically based on the students' daily commuting distance to and from the campus. Since each college geographic situation is unique, the estimates of transportation costs vary widely across the community colleges. While some community colleges have conservative estimates of the transportation costs, some community colleges choose to include parking fees, gas, automobile insurance, and maintenance in their estimates of the transportation costs. The community colleges in Florida do not follow a specific formula in calculating the living expenses for an average student. Instead, these community colleges follow their own guidelines in estimating this cost item resulting to large differences in the estimates of living cost. Since these estimates count into the computation of financial aid awards, the large differences in the living cost estimates become significantly important to current and prospective students (see Report No. 03-33 Office of the Program Policy Analysis and Government Accountability, 2003). Table 1 presents the estimates of the educational and living costs among Florida community colleges from 2003 to 2006. The cost estimates varied widely. For instance, the largest difference in the cost estimates can be seen in the housing and transportation costs, with the estimates ranging from $3,629 at South Florida Community College to $13,591 at Florida Keys Community College during the school year 2003. In that same school year, there is a small variation in the estimated tuition and fees for registering 30 credit hours, with the smallest and the highest cost estimates of around $1,320 (Tallahassee Community College) and $1,950 (Palm Beach State Community College). The state of Florida achieved big strides in making college students benefit from the state's college education system. The state provides generous financial aid to defray the costs of tuition and fees for in-state students. The resident tuition in Florida is set at around 25 percent of the instructional costs in a given school year. This in effect makes every resident student to receive a tuition waiver of almost 75 percent of the published tuition and fees. To cover the rest of the cost, a variety of need and merit based financial supports in the form of grants, scholarships, and work-study programs were made available to the current and prospective college students. To name a few, popular programs such as Bright Futures Scholarship, federal Pell grants, and other institutional student aids provide financial support to qualified students throughout their college years . For these qualified students, attending college in Florida is relatively inexpensive. Students who do not qualify for these grants and scholarship programs often apply for student loans. A high school student who wishes to get any financial support for college education is advised to get estimates of the eligibility to receive federal grants early in his senior year. On that same year, this senior high school student shops for colleges and applies for college admission. By the spring of the student's senior year, he needs to accomplish the Free Application for Federal Student Aid (FAFSA) if he wishes to receive financial support. The FAFSA assessment will provide the "Student Aid Report" (SAR) which includes the amount of the "Expected Family Contribution" (EFC) based on the student's family resources. The EFC indicates the amount of the student's family resources that are available to help pay for the cost of college education. The final step in the application for the financial support requires the student to complete the "State of Florida Financial Aid Application" prior to high school graduation. By the time the student registers for college classes, he is awarded the financial support. Eligible students who seek admissions to different community colleges do not necessarily get the same amount of financial aid. In the basic formula, the amount of financial support that an eligible student will receive is equal to the difference between the estimated total cost of attendance and the "Expected Family Contribution" (EFC). If the estimated total cost exceeds the EFC, the difference is the amount of financial support that is awarded to the student. The large variations in the financial aid awards among community colleges are primarily due to the wide variation in the estimated cost of attendance in each community college and the variation in the expected family contribution. Table 2 shows the estimated cost of attendance and the amounts of the total financial aid in the 28 Florida community colleges.

3 Data

3.1 Data Construction

To examine the effects of the cost of attending community college on the college-going and labor market returns, I use administrative student-level data obtained from Florida Education and Training Placement Information Program (FETPIP), a unit within Florida Department of Education, and the community college level data on college costs obtained from the Integrated Post Secondary Education Data System (IPEDS). The combined data include information on student enrollments in Florida public schools, demographic characteristics (sex, race, year and month of birth), grade ten FCAT scores (mathematics and reading), post-secondary awards (community college and university awards), and earnings. The earnings data come from the Unemployment Insurance (UI) tax reports submitted by the employers covered by the Florida's Unemployment Insurance law to the Florida Department of Revenue. The enrollment records are based on the academic year in which a student was first enrolled in grade ten in a Florida public school, including charter schools but not private schools. With this, each student in the Florida data has a unique enrollment record which is used to define the cohort affiliation of every student in the data. In this study, I use four student cohorts that include students in grade ten in school years 2000-2001, 2001-2002, 2002-2003, and 2003-2004. Merging all the datasets using the unique student identifier yields a base sample of about 712,142 student observations. Table 3 shows the distribution of observations by cohort.

The data obtained from the IPEDS contain information on the estimated relevant costs of attending community colleges in Florida as well as records of the average financial support that the students received in a particular school year. This cost data include direct instructional costs such as tuition and fees, book expenses, and living costs including the on and off campus housing, transportation, and other personal expenses. Summing up these costs yields the estimated cost of attendance for each of the 28 Florida community colleges. The financial aid records contain average amounts of the federal aid, institutional aid, and student aid. The total yields the average total financial aid that students in each community college receive. For the total cost of attendance and the total financial aid data, the relevant school years included are 2003-2004, 2004-2005, 2005-2006, and 2006-2007. The use of these relevant years is based on the assumption that high school students on average start to shop for colleges two years after they took the grade ten FCAT. For example, grade ten students in cohort one during the school year 2000-2001 are expected to finish grade 12 (high school) in school year 2002-2003 and will shop for colleges to attend for the coming school year 2003-2004. Thus, students in cohort one on average will use the relevant cost of attendance information available in the school year 2003-2004. Also, grade ten students in cohort four, the youngest among the cohort groups, who took the grade ten FCAT during the school year 2003-2004 will on average use the relevant cost of attendance information available in the school year 2006-2007 when they shop for colleges to attend.

Next, I generate the cost of attending the "nearest" community college from the location of the high school attended by each student in the Florida microdata.[1] The idea is that the students will likely attend the nearest and the cheapest college from their high school. Since there is only one community college present in a student's county of residence where the high school is located, a student would highly consider attending this community college and would face the published total cost of attendance in this community college in the event he decides to matriculate in this college. The student enrollment records contain information on the name and the physical location of the high school institution the students attended while in grade ten. The information on the physical location made it possible to collect the data on the coordinates (latitude and longitude) of each high school location from the publicly available school information database found in the Florida Department of Education. The other requirement in finding the nearest community college is the physical location and the coordinates of all the 28 Florida community colleges. Florida Department of Education publishes in its website the physical addresses of all the community college campuses in the state of Florida. Using each high school as the base location, I find the nearest community college by calculating geodetic distances in miles.[2] After finding the nearest community college, I mapped the community college level cost of attendance and financial aid data to

[1]Students who attended private high schools in Florida are excluded in the sample.

[2]Geodetic distance is the length of the shortest curve between two points along the surface of the mathematical model of the earth. The driving distances of each high school location to the nearest community college are approximated by the calculated geodetic distance. This assumes that the earth is flat with no rivers, swamps, mountains and that travelling from point A to point B can be achieved in a linear fashion.

each student in the Florida microdata using the identified nearest community college and cohort ID.[3]

I make a number of sample restrictions. First, I exclude students who did not take the FCAT when it was initially offered and those students who never took the FCAT test. Second, I exclude those students who attended high school programs that have missing physical addresses in the Florida Department of Education School Information database. The final sample includes 584,300 student observations. Summary statistics are reported in Table 3. About 48% of the sample are males. In the sample, 54 percent are whites, 21 percent are blacks, 20 percent are Hispanics. The average age of the students in the sample is 16. About 77 percent of the students in the sample reached grade ten on time. There are only about a quarter of students in the sample who participated in the free/reduced lunch program.

3.2 The Fraction of Cost of Attending the Nearest Community College and Annual Earnings

I use the sample described above to define the following variables.

The Fraction of the Cost of Attending Community College. I consider using a measure of the cost of college attendance based on the total cost rather than using the tuition and fees figures commonly used in many studies. Using a measure of college cost based on the total cost of attendance that includes room and board and other college expenses has one major advantage. The real cost of college attendance is actually the forgone earnings of the students while attending the community college. Since there are no good estimates of the forgone earnings in college, the best proxy for the forgone earnings are the expenditures on the room and board, transportation, books, and other personal effects. Since students need to raise funds to cover these costs, the sum of these costs is the next best estimate of the forgone earnings of the student while attending community college.

The total cost of attending the nearest community College is one of the two components needed to calculate the fraction of the cost of attending the nearest community college. In

[3]The cohort ID is based on the cohort group year affiliation of the student.

calculating the estimated cost of attending community college, I made some computational assumptions on some of the college cost components. First, I used the published "in-state" figures for tuition and fees since most of the students are Florida residents. Second, I used the average of the on-campus and the off-campus room and board costs for a single student (not living with the family) in calculating the housing cost component. Third, the figures I used to calculate other living costs are the average of the on-campus and the off-campus other living expenses for a single student not living with the family. The total of these cost components – tuition and fees, book expenses, room and board, transportation, and other living costs – constitute the total cost of attending Florida community colleges. On the average, students pay $12,985.86 (s.d. $3,596.6) in annual total cost of attending a community college in Florida in the period 2003 to 2006 (see Table 3).

The net cost of attending the nearest college is the second component of the fraction of the college cost variable. The the cost of attendance is calculated by subtracting each college's average total financial aid from the estimated total cost of attendance.[4] The average financial aid is basically the sum of the federal aid, institutional aid, and student aid. The average net cost of attendance is around $7,680.35 (s.d. $3,840.9) in the period 2003 to 2006 (see Table 3).

Finally, I calculate the fraction of the cost of attending community college as the ratio of the estimated net cost (i.e., total cost less financial aid) and the estimated total cost of attending community college. A fraction of college cost close to one means that a student would have to shoulder more of the total cost of attending community college while a fraction of college cost close to zero means that the student will shoulder less of the total cost.

Using the fraction of the college cost has a number of advantages. First, unlike the total cost of attendance, the fraction of the college cost will reflect the fraction of the total cost that students would have to pay for the college education. Second, unlike the net cost of attendance, the fraction of the college cost is a unit free measure. This is especially important when I compare the effects of the costs for students who face similar net costs but different total costs of attendance. Table 3 shows that students on average shoulder around 56 percent

[4] The IPEDS cost data also have information on the average financial aid offered in each of the 28 Florida community colleges.

of the total cost of college attendance. Also, the average fraction of the college cost appears to be stable across cohorts.

Number of Semesters Enrolled in Community College. There are at least two reasons why the fraction of the cost of attending community college would have an impact on a student's college-going decision and persistence in college. First, a higher fraction of the college cost will discourage students most especially those who are financially challenged by the high cost of pursuing a college degree. Second, those who are already in college might consider dropping out early due to the high cost of completing a degree. To measure the effect of the fraction of the college cost on the attendance and college persistence among community college students, I use the number of semesters enrolled in community college. The number of semesters enrolled is derived from the postsecondary enrollment records in the Florida microdata. I define this variable as the number of semesters the students registered for classes in the Florida community colleges. I expect that a higher fraction of the college cost will cause some cost sensitive students to drop out, decreasing the number of semesters that these students were enrolled. Table 4 shows the comparison of the means of this variable across gender, race, and other demographic groups. Table 4 reveals that on the average female students, white students, students who did not participate in the free/reduced lunch program, students without limited English proficiency, non-special students, and students who reached grade ten on time enrolled more semesters while attending a community college in Florida. This pattern is stable across cohorts. Moreover, the older cohorts (i.e., 2000 cohort) registered more semesters in college.

Associates in Arts Degree Completion. To measure the impact of the fraction of the college costs on the community college degree completion, I construct the associates in arts degree variable using the post-secondary awards data in the Florida microdata. The post-secondary awards data have information on the degrees awarded to the student, the award date, and the awarding institution. The student is identified to have ever obtained an AA degree if the student is awarded either an associates in arts or an associates in science degree. I expect that a higher fraction of the college cost will decrease the student's likelihood of receiving an AA degree. Table 5 shows the AA degree completion rates by gender, major racial groups, and other demographic groups. On the average, female students, white students, students who did not participate in the free/reduced lunch program, students without limited English proficiency, non-special students, and the students who reached grade ten on time have higher associates in arts degree completion rates. The pattern is once more stable across cohorts with the oldest cohort (i.e., 2000 cohort) have the highest AA degree completion rates.

Average Annual Total Earnings. Measuring the returns to college education needs a good measure of the labor market outcomes. Most studies have used hourly wages to measure the effect of an extra year of schooling on wages. In this paper, however, I use the average annual total earnings to measure the returns to community college education. This is not a major disadvantage. Firms may be hiring based on education-based signals (e.g., AA degree) where the effects manifest in the total, but not hourly, earnings (Martorell and Clark, 2010). In constructing the average annual total earnings, I first aggregate the quarterly earnings for each year reported for nearly all individuals working for earnings in Florida. The aggregated earnings for each individual is deflated by $2000 (based on the CPI-U series) to get the earnings in constant dollars. To get the average annual total earnings, I averaged 5 years of earnings data, starting in the 2nd year after the student graduated from high school. On average, a student who finishes with an AA degree would have spent at least 2 years in a community college and could have started working at least in the 2nd year after high school graduation. The lack of years used to evaluate the effect of the community college education on earnings would pose some limitations. Although 5 years after receiving a degree would probably be not enough to measure long term effects of the community college education on earnings, the AA degree holders or those who stayed longer in college would have somehow experienced the effects of the community college education. Table 6 shows the comparison of the average annual total earnings among different demographic groups across all cohorts. Males on average earn slightly higher than females. Also, white students, students who did not participate in the free/reduced lunch program, students without limited English proficiency, non-special students, and students who reached grade ten on time are on average have higher average annual total earnings.

4 Empirical Framework

There is a wide consensus that better educated workers earn higher earnings. Hundreds of studies have estimated the gap in earnings between more and less educated individuals. Some of these studies made significant progress in providing credible estimates of the returns to education. A credible estimate of the returns to education requires an exogenous source of variation in the schooling outcomes since it is a well known fact that education levels are not randomly assigned in the population. College choice is no exception where individuals make college-going decisions. In studies involving college choice and its effect on earnings, researchers made significant progress by using the features of the educational institutions as the source of the exogenous variation (Card, 2001). In this study, I propose that the variation in the fraction of the cost of attending community college is a potential source of the exogenous variation in community college education. If indeed the fraction of the college cost is an exogenous determinant of the community college education, then we can can use it to generate more credible estimates of the returns to community college education. In the following section, I discuss the basic model of college choice and earnings as well as the econometric issues in identifying the causal effect of the community college choice on earnings.

4.1 Model of Schooling Choice and Earnings

The following model is inspired by Card (2001). The representative individual maximizes lifetime utility over consumption and schooling under the constraint that his lifetime consumption equals earnings while in school and earnings after school. This representative individual will choose to get more schooling until the marginal benefit of an extra unit of schooling equals the marginal cost of that last unit of schooling. The first order condition expresses this relation as $MB(S) = MC(S)$. Let the marginal benefit and marginal cost of schooling functions take the following linear form:

$$MB(S) = b_i - k_1 S_i \tag{1}$$

$$MC(S) = c_i + k_2 S_i \tag{2}$$

The terms b_i and c_i are individual specific components of the marginal benefit and the marginal cost functions with mean $\bar{b}$ and $\bar{c}$, respectively. The presence of subscript in the parameter b_i allows for heterogeneity in the marginal benefit of schooling across individuals. Setting $MB(S) = MC(S)$ yields the optimal schooling choice:

$$S_i = \left(b_i - c_i\right)/k, \text{where } k = k_1 + k_2. \tag{3}$$

Given the level of schooling, this individual earns a flow of earnings during and after attending a school. Let the structural earnings equation that represents the relation between an individual's choice of schooling and earnings take the form

$$W_i = \alpha_i + b_i S_i + u_i. \tag{4}$$

With the data on earnings and the level of schooling, the ordinary least squares (OLS) procedure may give an inconsistent estimate of the individual specific returns to schooling (b_i) due to the presence of unobserved factors in u_i (e.g., ability) that will potentially affect both the level of earnings and the schooling choice. A consistent estimate of b_i can be obtained if we can find some observable factors that affect schooling choice but not earnings. For example, if schooling were randomly assigned among individuals then we can exploit the randomization process to estimate b_i using the instrumental variables (IV) approach. If pure randomization is absent, we can still consistently estimate b_i only if we can find a causal determinant of schooling that can be excluded in the structural earnings equation in 4 (Card, 1995). Many studies in this area have used the institutional features of schools and colleges to identify the factors that drive schooling decisions. In this paper, I will exploit an institutional feature of the community colleges in Florida as the source of exogenous variation in community college education. In the next section, I discuss the identification conditions to be satisfied at the minimum to obtain more credible estimates of the returns to the community college education.

4.2 Identification Conditions

Let the marginal cost of schooling component c_i in equation (2) takes the form

$$c_i = Z_i \pi + \xi_i, \tag{5}$$

where Z_i represents observable factors that affect the marginal cost of schooling. The vector of the observable factors Z_i contains the instrumental variable. Inserting equation (5) into the optimal schooling choice equation in (3) and adding and subtracting $\overline{b}$, we get the reduced form equation for the schooling choice equation

$$S_i = Z_i \Pi + \varepsilon_i, \tag{6}$$

where $Z_i \Pi = \overline{b} - Z_i \pi$ and $\varepsilon_i = \left(b_i - \overline{b} - \xi_i\right)/k$. The goal is to estimate the average returns to schooling $(\overline{b})$. We can estimate this parameter using the structural earnings equation with some identification conditions. Adding and subtracting $\overline{b}$, we can rewrite the earnings equation in (4) as

$$W_i = a_0 + a_i + \overline{b} S_i + \left(b_i - \overline{b}\right) S_i + u_i, \text{ with } a_i = \alpha_i - a_0 \tag{7}$$

The parameter a_i represents the individual specific level of ability. Replacing the schooling variable S_i in equation (7) by equation (6), we get the reduced form earnings function

$$W_i = a_0 + a_i + \overline{b}\left(Z_i \Pi + \varepsilon_i\right) + \left(b_i - \overline{b}\right)\left(Z_i \Pi + \varepsilon_i\right) + u_i. \tag{8}$$

Taking the expectation of (8) conditional on Z_i yields

$$
\begin{aligned}
E\left(W_i|Z_i\right) &= E\left[a_0 + a_i + \bar{b}\left(Z_i\Pi + \varepsilon_i\right) + \left(b_i - \bar{b}\right)\left(Z_i\Pi + \varepsilon_i\right) + u_i|Z_i\right] \qquad (9)\\
&= E\left(a_0|Z_i\right) + E\left(a_i|Z_i\right) + E\left[\bar{b}\left(Z_i\Pi + \varepsilon_i\right)|Z_i\right] + E\left[\left(b_i - \bar{b}\right)\left(Z_i\Pi + \varepsilon_i\right)|Z_i\right] + E\left(u_i|Z_i\right)\\
&= a_0 + \bar{b}Z_i\Pi + E\left(\bar{b}\varepsilon_i|Z_i\right) + E\left(a_i|Z_i\right) + E\left[\left(b_i - \bar{b}\right)Z_i\Pi|Z_i\right] + E\left[\left(b_i - \bar{b}\right)\varepsilon_i|Z_i\right] + E\left(u_i|Z_i\right)\\
&= a_0 + \bar{b}Z_i\Pi + E\left(a_i|Z_i\right) + E\left[\left(b_i - \bar{b}\right)\varepsilon_i|Z_i\right] + E\left(u_i|Z_i\right)
\end{aligned}
$$

where the terms $E\left(\bar{b}\varepsilon_i|Z_i\right) = 0$ and $E\left[\left(b_i - \bar{b}\right)Z_i\Pi|Z_i\right] = 0$. To obtain consistent estimates of the average return to community college education, we need to satisfy the following identification conditions:

(i) $E\left(a_i|Z_i\right) = 0$

(ii) $E\left(u_i|Z_i\right) = 0$

(iii) $E\left[\left(b_i - \bar{b}\right)\varepsilon_i|Z_i\right] = 0$

Condition (i) implies the absence of the ability bias which requires the independence of ability and the instrumental variable.[5] Condition (ii) requires the independence of the instrumental variable and any unaccounted factor in the earnings equation that affects both earnings and the schooling choice. For example, the factors and policies that improve labor market conditions leading to high employment and earnings potentials may simultaneously affect earnings and the schooling choice, which will induce individuals to work instead of attending a college. Condition (iii) requires the absence of "comparative advantage bias" – individuals who have higher returns to schooling tend to acquire more education. Satisfying these conditions are crucial in obtaining consistent estimates of the average returns to community college education.

The identification conditions above would apply under the assumption of heterogeneous returns to education in (9). If heterogeneity is absent (i.e., $\bar{b} = b_i$), the conditional expectation of earnings collapses to:

[5] It is possible that high ability individuals acquire more education and earn more at the work place regardless of their choice of education.

$$E\left(W_i|Z_i\right) = a_0 + \bar{b}Z_i\Pi + E\left(a_i|Z_i\right) + E\left(u_i|Z_i\right) \tag{10}$$

with the term $E\left[\left(b_i - \bar{b}\right)\varepsilon_i|Z_i\right] = 0$. The identification conditions in this case are

(*i'*) $E\left(a_i|Z_i\right) = 0$

(*ii'*) $E\left(u_i|Z_i\right) = 0$.

Without the heterogeneous returns, the identification conditions in (*i'*) and (*ii'*) only require the independence of the instrumental variable, ability, and the the factors that shift labor market conditions.

The identification conditions are often violated in many studies that try to isolate the causal impact of schooling on earnings due to the potential endogeneity in the schooling choice. I use the fraction of the cost of attending the community college as the instrumental variable to address the endogeneity in the community college education. Provided that the fraction of the college cost is mean independent at least with the unobserved ability, labor market conditions, and the unobserved comparative advantage of individuals with high returns to education, it would be possible to obtain more credible estimates of the effect of the community college education on earnings. It is therefore imperative to establish the validity of the fraction of the cost of attending community college as an instrumental variable.

Since the assumptions above are untestable, I employ the following indirect tests:

1. Balancing tests on the observable covariates which looks at the uncorrelatedness between the instrumental variable and the observed covariates.

2. Test of the uncorrelatedness between the instrumental variable and the test scores, with the test scores used as the proxy for ability. This indirectly tests condition (i).

3. Test of uncorrelatedness between the instrumental variable Z_i and some key indicators of the labor market conditions as well as the community college indicators that are potentially related to the instrumental variable. This is the indirect test for condition (ii).

4. Test for the presence of the systematic correlation between the instrumental variable Z_i and the residual earnings component $\left(b_i - \overline{b}\right) \varepsilon_i$ which will test condition (iii). The feasible way of testing this systematic correlation is by comparing the effects of the test scores on the community college outcomes under different values of the fraction of the college cost. [6]

4.3 Tests on the Validity of the Fraction of College Cost as an Instrumental Variable

The first order test that the instrumental variable must pass is the "balancing test." The idea is that the instrumental variable of interest must be "balanced" in (when the instrument is binary) or uncorrelated with (when the instrument is continuous) the observed and unobserved factors. This is particularly important when the unobserved factors (e.g., ability and comparative advantage over education) are believed to vary systematically across observed characteristics such as gender or racial affiliation. Since the observed factors are already available in the data, the balancing tests can be easily applied by looking at the correlation (and its statistical significance) between the instrumental variable and the observed factors. As for the unobserved factors, it is the creativity of the researcher combined with luck in finding good proxy variables that will potentially make a sensible device to test out the balancedness among the unobserved factors. Because some of the unobserved factors could potentially be related to the observed factors, carrying out the balancing tests on the observed factors is an indirect way of testing whether or not the unobserved factors vary with the instrumental variable. For example, if ability varies with race with whites having the highest ability among the racial groups, then finding that there are more white individuals living near colleges that offer lower cost of attendance would indirectly imply that these individuals with the highest ability live closer to these colleges that offer lower cost of attendance. With this, there is a reason to believe that the estimates from a regression of community college outcome on the instrumental variable is potentially biased even after

[6] For example, we can compare the effects of test scores for students who attended community colleges with below and above median fraction of the college cost.

controlling for an indicator of being a white individual.

Table 7 shows the results from the regression of the observed covariates including age, gender, major racial groups, free/reduced lunch status, indicator of being limited English proficient and being a special child on the instrumental variable. The first column in Table 7 contains coefficient estimates from the simple regression without controlling for the other covariates. I find that some covariates including the fraction of males, fraction of whites, and fraction of blacks are statistically significant. What do we make of these estimates? The negative and statistically significant estimate in the regression with the fraction of males would mean that there are more male students in places where the high school they attended are closer to the community colleges that offer lower cost of attendance. If ability nor comparative advantage over attaining more education does not vary across gender, however, this estimate would not mean anything except that there are basically more males than females on average. The second column in Table 7 presents the coefficient estimates when other covariates are added including cohort dummies, community college dummies, demographic characteristics, and test scores. With the inclusion of these covariates, all the coefficient estimates become statistically not different from zero which renders the covariates to be "balanced" on observables. With this, I can make assumptions using "selection-on-observables", which is a weaker condition relative to the conditions found in (i), (ii), and (iii).

Perhaps a closer but an indirect way of testing whether or not the instrumental variable is correlated with ability is by looking at the correlation between the instrument and the test scores. The Florida data includes information on FCAT scores that are first taken when the students are in grade ten. The FCAT is designed to test the readiness of Florida high school students to engage in higher education and to work. This makes the FCAT scores a good measure of students' ability to get into community colleges and to attain a higher education degree. In testing the correlation, I estimate separate regressions for the mathematics and reading FCAT scores. The regressions include year dummies, community college dummies, and demographic characteristics. The coefficient estimates of the instrument are presented in Table 8. The coefficient estimates are positive but statistically not different from zero. This supports the absence of correlation between the instrumental variable and the FCAT test scores.

To indirectly test condition (ii), I set up a panel data of the key indicators of the labor market conditions and the community colleges. The main idea is to test whether or not these key indicators cause the instrument to change. For example, a finding that the community college's cost of operations affects the published total cost of attendance and educational attainment (which eventually affects earnings potential) will confound the effects of the instrumental variable on the community college education and earnings. Table 9 presents the coefficient estimates of the various labor market and community college key indicators based on the regression with the "current" values of the instrumental variable as the dependent variable. In these regressions, I use the previous year's values for the key indicators because of the timing element in the publication of the cost of the college attendance for a particular school year. Typically, the cost of attendance forecasts are made less than a year ahead of the coming school year and it makes sense to see if the previous year's key college and labor market indicators affect the cost estimates (or the financial aid offers). The coefficient estimates are statistically not different from zero, implying the absence of correlation between the fraction of the college cost and the key indicators. With regards to the cost of operations, the result is not surprising since the cost of operations and the community college attendance costs are independently set, with Florida community colleges calculating the estimates of the cost of operations and with the state government setting the tuition and fees schedule to be adopted by each community college. Since most of the college attendance cost components are set by Florida legislature, it is not surprising to see that the key labor market condition indicators such as average county unemployment rate and average annual county earnings do not affect the fraction of the college cost.

Finally, I test the systematic correlation between the instrumental variable and the residual earnings component $\left(b_i - \overline{b}\right)\varepsilon_i$ by comparing the effects of test scores on college outcomes for students who face low and high fractions of the college cost. Even if ability (as proxied by test scores) is uncorrelated with the fraction of the college cost conditional on the observed covariates, the correlation between education and ability (as measured by test scores) may be different for individuals who attended colleges with low and high fractions of the college cost. These differences in the effects of the test scores could be a result of the changing mapping between the individual ability and education outcomes. This would arise when individuals with higher returns to college education who presumably also have higher ability will always want to get more education and thus, will live closer to community colleges that offer a low fraction of the cost of attendance. Hence, if there is a significant difference on how ability affects college outcomes in individuals who attended colleges that offer low and high fractions of the college cost, that would provide substantial evidence of the correlation between the residual earnings component and ability which would violate condition (iii). I proceed testing this correlation in two ways: first, by comparing the effects between those who face below and above median fractions of the college cost of attendance; and second, by looking at the coefficient estimates of the interaction term between the fraction of the college cost and the test scores. The absence of the correlation amounts to having (statistically) identical coefficient estimates in the first approach and having a statistically insignificant estimate of the interaction term in the second approach. Consistent with the idea that individuals who face a lower fraction of the college cost are more likely to attend college and that the individuals who attended college on average will earn more, I cannot detect a significant difference in the effects of the test scores on the community college outcomes for individuals who attended below and above median fractions of the college cost. Table 10 confirms this. The estimates of the effect of the mathematics test scores (and Reading) for the below and above median fractions of the college cost, if not statistically different from zero, are very similar in magnitude in the regressions with CC Terms or the AA degree as the dependent variable. Turning in to the regression version that includes the interaction term between the ratio variable and test scores, the coefficient estimates of the interaction term are statistically not different from zero in regressions with CC Terms or AA degree as the dependent variable. This implies that there are no variations on how the test scores affect community college outcomes among students who pay small or larger fractions of the college cost. These results somehow ease the doubt that the unobserved correlation between ability and the residual earnings component will bias the estimates of the returns to community college education.

The battery of indirect tests above show that the instrumental variable at the minimum satisfies the identification conditions[7]. There are some qualitative evidence to support the claim that the fraction of the college cost can be treated as exogenous. The Office of Program Policy Analysis and Government Accountability, an arm of Florida legislature, provided several reports on the intriguing issue about the extensive variation in Florida's state university and community college system (see Report No. 03-33 Office of the Program Policy Analysis and Government Accountability, 2003). In this report, tuition and fees and the expenses for room and board received the greatest mention of being the two largest components of the cost of attendance, with the tuition and fees contributing to the largest change over the years. Tuition and fees are set by the Florida legislature through the State Board of Education. The tuition and fees schedule to be adopted in a given school year was based on not less than 15 years of historical cost data. For example, the tuition and fees schedule adopted in the school year 2000-2001 was based on the historical cost analysis that uses the costs in the school year 1999-2000, which was based on the cost analysis of the past years. Because, the tuition and fees component of the total cost of attendance is based on the historical values, it is not hard to see, for example, why the cost of attendance is independent of one to about three years worth of labor market conditions information or any information about the characteristics of Florida community colleges (e.g., enrollment headcounts). The OPPAGA report concluded that the wide variation in the total cost of attendance is primarily due to the differences in the way the cost components are calculated. With this, it is a fact that the total cost of attending a college in Florida is based on Florida legislature and the unique features of the 28 Florida community colleges, an evidence to support that the fraction of college cost can be treated as exogenous.

5 Results

In this section, I present the estimates of the effect of the fraction of the cost of attending community college. I first assess the impact of the fraction of the cost on two community college outcomes: the Number of Semesters Enrolled and the Likelihood of Receiving an As-

[7]To test the merits of other potential instruments, these battery of tests were also carried out for the net cost, total cost, and distance to community college. These 3 alternative instruments failed at least 2 of the tests above.

sociates in Arts degree from a community college in Florida.[8] I also present the instrumental variables estimates of the returns to community college outcomes based on the fraction of the cost of attending community college.

5.1 First Stage Results

The community college outcomes of interests in this paper are the number of semesters enrolled in community college (CC Terms) and the associates in arts degree (AA) completion. Looking at the relationship between the number of semesters enrolled and the fraction of the college cost provides an insight on the extent to which the cost affects the attendance and persistence in community college. On the other hand, the relationship between the likelihood of receiving associates in arts degree and the fraction of the college cost will shed light on how the college cost affect the college degree completion.

Table 11 presents the first stage OLS regression estimates of the effects of the fraction of the cost of attending community college on these college outcomes controlling for the standardized mathematics and reading test scores, indicators of gender, race, free/reduced lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, community college dummies, and interaction terms. In all the regression specifications, I use the robust standard errors that are clustered by year and community college affiliation of individuals in the sample.

The coefficient estimates of the fraction of the college cost in column (1) are negative and precisely estimated in the regression models with the number of semesters enrolled in college and the associates in arts degree completion as the dependent variables. A change in the fraction of college cost from zero to one will decrease the community college enrollment by about 0.4 of a semester (t-stat = -4.86) and will decrease the associates in arts degree completion rate by about two percentage points (t-stat = 3.21).[9] The use of the fraction of the college cost satisfies the requirement of a good instrument. We can draw one conclusion from Table 11. The fraction of the college cost appears to have a negative impact on both

[8] The regression of the associates in arts degree completion or the number of semesters enrolled on the fraction of the cost is basically the first stage regression under the instrumental variables procedure.

[9] Increasing the fraction of the cost from zero to one implies that the college cost shouldered by student increases from zero to the full cost of college attendance.

the number of semesters enrolled in college and the associates in arts degree completion. This implies that a higher contribution in paying for the college education will make these students to enroll less in college and will make college degree completion less likely.

The above estimates may mask differences in the effects across the major racial groups. The estimates might be different across race groups due to the differences in family background, culture, and resources that have direct impact on the college-going behavior and motivation of students to complete a college degree. For example, students with more resources are probably less sensitive to the higher college costs, and as a result, the effects of the college costs would be smaller on them. Table 12 shows the coefficient estimates from the regression of the community college outcomes on the fraction of the college cost for the major racial groups. The regression models in columns (1) and (2) use the same control variables as in the regression specification in Table 11. Standard errors are robust and clustered by year and community college affiliation of the student. The estimates in column (1) indicate that an increase in the fraction of college cost from zero to one will decrease the number of semesters enrolled by 0.33 of a semester for whites (t-stat = -3.4), 0.25 for blacks (t-stat = -2.76), and 0.53 for hispanics (t-stat = -3.73). The fraction of the college cost also has differential negative effects on the associates in arts degree completion. The regression estimates in column (2) show that the associates in arts degree completion rate with decrease by of 1.8 percentage points for whites (t-stat = -2.3), 0.9 percentage points for blacks (t-stat = -2.14), and 2.8 percentage points for hispanics (t-stat = -2.76). These estimates point out that the fraction of the college cost has negative effects on the associates in arts degree completion rates with the largest effect on hispanics.

The above estimates may also mask differences across gender. The differences in the effects may arise due to the gender differences in motivation and persistence towards acquiring college credentials.[10] The estimates in column (1) shows that the estimated decrease in the number of semesters enrolled is 0.27 (t-stat = -3.19) of a semester for males and 0.46 (t-stat = -5.9) of semester for females while the estimated decrease in the associates in arts degree completion rate in column (2) is about 1.5 (t-stat = -2.4) percentage points for males

[10]Leppel (2002) finds that college persistence is higher in females, especially among African-American females.

and 2.5 percentage points (t-stat = -3.46) for females. These estimates indicate that the females' college-going behavior and the desire to complete a college degree are affected more by a higher fraction of the college cost.

The effects of the fraction of the college cost may also be different across students who and who did not participate in the free/reduced lunch program. The differential effects may arise due to differences in family resources, which is an important input to a student's success in college. Also, looking at the differences in the effects across these groups of students is especially important since the program rules for the free/reduced lunch program can be influenced by policies. The coefficient estimates in column (1) show that the estimated decrease in the number of semesters enrolled is 0.44 of a semester (t-stat = -3.11) for students who participated in the free/reduced lunch program and 0.35 of a semester (t-stat = -4.45) for students who did not participate in the free/reduced lunch program. Also, the estimated decrease in the associates in arts degree completion in column (2) is 1.5 percentage points (t-stat = -2.5) for students who participated in the free/reduced lunch program and 2.3 percentage points (t-stat = -3.28) for students who did not participate in the free/reduced lunch program.

The effects of the fraction of the college cost may also be different among students who reached and did not reach grade ten on time. Because these students reached grade ten on time, these students passed the battery of tests administered by the Florida Department of Education starting when the student was in 3rd grade. It is likely that these set of students who are on track have higher ability and possibly have better educational resources compared to those students who failed to reached grade ten on time. This difference in the timing of reaching grade 10 may have implications on persistence and degree completion in college. The estimates in columns (1) and (2) of Table 12 show evidence of this difference. Only the estimates for the students who reach grade 10 on time appear to be statistically not different from zero. In column (1), the estimated decrease in the number of semesters enrolled is 0.44 (t-stat = -5.98) of a semester for students who reached 10th grade on time and about an eight (t-stat = -0.97) of a semester for students who did not reach 10th grade on time. Also, the estimated decrease in the associates in arts degree completion in column

(2) is 2.4 (t-stat = -3.43) percentage points for students who reached 10th grade on time and 0.6 (t-stat = -1.2) percentage points for students who did not reach 10th grade on time.

5.2 Instrumental Variables Estimates

In this section, I present the instrumental variables estimates. I estimate the returns to the community college outcomes – the number of semesters enrolled in community college and the associates in arts degree completion – using the instrumental variables (IV) procedure based on the fraction of the college cost. The standard results in the studies that estimate the effect of schooling on earnings show that the individuals with better schooling outcomes have higher wages/earnings. In this paper, I expect that (1) the community college students who show persistence and enrolled more semesters in the community college are, on the average, have higher average annual total earnings and (2) the community college students who received an associates in arts degree are also, on the average have higher average annual total earnings. I first assess the effects of these community college outcomes using the OLS regression model. Then I compare the IV estimates to the benchmark OLS estimates.

Although the OLS estimates had been proven to be biased in many empirical studies, these estimates are still important since they can serve as comparisons to the other estimates generated by an alternative estimation strategy, with the hope of identifying the potential estimation bias. For example, the standard explanation of having a relatively higher instrumental variables estimates is the presence of a bias attributed to the measurement error or the presence of heterogeneous effects. On the other hand, when the OLS estimates are larger than the IV estimates the standard explanation is the presence of a bias due to the omitted variables. While the IV and OLS estimates cannot be compared directly, the differences in these estimates would indicate the presence, the direction, and the potential source of the bias.

Table 13 shows the estimates of the returns to community college outcomes based on two estimation models. First, the OLS estimates of the returns to community college outcomes in column (1) are generated from the regression of the average annual total earnings on the community college outcomes. Second, the instrumental variables estimates of the returns to community college outcomes in column (2) are generated from the structural models of earnings with the fraction of the college cost as the instrumental variable for the community college outcomes. Both the OLS and IV regressions control for the mathematics and reading test scores, indicators of gender, race, free/reduced lunch status, limited English proficiency, special student, reached grade ten on time, year effects, nearest community college indicators, and interaction terms. In all the regression specifications, I use the robust standard errors that are clustered by year and community college affiliation of individuals in the sample.

Column (1) show the OLS estimates of the returns to the number of semesters enrolled in community college and the returns to completing an associates in arts degree. The OLS estimates indicate that the average annual total earnings will increase by about $323.62 (about 6.7 percent of the mean average annual total earnings) for each semester enrolled in college and are higher by $1,070.80 (about 22 percent of the mean average annual total earnings) for students who completed associates in arts degree. The inclusion of the control variables in the OLS regression, however, does not guarantee the validity of the OLS estimates as casual estimates of the returns to community college outcomes. Despite the potential bias present in the OLS estimates, we can draw a conclusion from these results: the students who persisted and enrolled more semesters in community college and the students who completed an associates in arts degree tend to have higher earnings.

The OLS results should be interpreted with a caveat. As discussed above, these OLS estimates are potentially biased since students can self-select to attend more semesters in college and complete a degree especially with students with higher ability and with higher potential gains from attending college. I use the fraction of the college cost as the source of the exogenous variation in college outcomes to address the problem. Column (2) presents the instrumental variables estimates of the returns to the community college outcomes based on the fraction of the college cost as the instrumental variable for college outcomes. Relative to the OLS estimates, the IV estimates are bigger. The estimated returns to the number of semesters enrolled in college are about 3 times larger while the estimate of the returns to completing an associates in arts degree are about 19 times larger than the OLS. The IV regression estimates are marginally significant. The estimates in column (2) show that the average annual total earnings will increase by $1,097.24 (about 22.8 percent of the mean average annual total earnings) for every semester that a student enroll in community college while the average annual total earnings are higher by $20,419.8 (425 percent of the mean average annual total earnings) for students who completed associates in arts degree. The range of the estimated returns to the number of semesters enrolled in college is quite wide that I cannot rule out the zero effects. Also, the range of the estimated returns to completing an associates in arts degree has a wide confidence interval that includes the OLS estimates at least at the five percent level of significance. Although this range is wide, I can rule out the zero returns to completing an associates in arts degree.[11] This provide a suggestive evidence that the college students who completed an associates in arts degree have higher earnings potential.

The above results point to the following conclusions. First, the IV estimates of the returns to the community college outcomes are uniformly larger than the OLS estimates. Second, because the IV estimate of the returns to the number of semesters enrolled in community college is imprecisely estimated, the range of this IV estimate is large with which zero effects cannot be ruled out. On the other hand, although I estimated an effect in the returns to completing an associates in arts degree are within the 95 percent confidence interval, the range of this IV estimate remain large but I can rule out the zero returns to completing an associates in arts degree.

The IV estimates in Table 13 gave us the picture of the returns to community college outcomes for the full sample. It is possible that these estimates mask differences for the different demographic groups. For example, the returns could be bigger for males than for females maybe because males have stronger attachment to the labor market. Also, the returns for whites could be bigger than any of the racial groups because they typically have more resources and probably have better educational foundation to start with. Further, students who reached 10th grade on time earn more possibly because they have better skills and have higher motivation. Table 14 presents the IV estimates of the returns to community college outcomes by demographic groups – race, gender, free/reduced lunch status, and

[11] Relative to the mean average annual total earnings, the 95 percent confidence interval for the IV estimates of the returns to associates in arts degree completion is [1.2%, 849%]

having reached 10th grade on time. The specifications of the IV regression models are the same with the models in Table 12. Column (1) presents the IV estimates of the returns to the number of semesters enrolled in community college while column (2) presents estimates of the returns to completing an associates in arts degree. I use the same set of control variables as in the regression specifications above. I also use the robust standard errors that are clustered by year and community college affiliations of the students.

In the IV regression models in column (1), only the estimates of the returns to the number of semesters enrolled in college for the sample whites and for the sample of students who did not participate in the free/reduced lunch program are statistically significant at the five percent level. For every semester a student stayed in community college, I find that the average annual total earnings will increase by $1,769.4 in the sample of whites and by $1,194.4 in the sample of students who did not participate in the free/reduced lunch program.[12] The estimates of the returns to completing an associates in arts degree in column (2) are positive and statistically significant only in the sample of whites, in the sample of students who did not participate in free/reduced lunch program, and in the sample of students who reached 10th grade on time. Completing associates in arts degree will increase the average annual total earnings by $33,347.3 (about 680 percent of the mean average annual total earnings) in the sample of whites, by $18,333.0 (about 375 percent of the mean average annual total earnings) in the sample of students who did not participate in free/reduced lunch program, and by $17,704.6 (about 368 percent of the mean average annual total earnings) in the sample of students who reached 10th grade on time.[13] The estimates in columns (1) and (2) point to one conclusion: there are positive returns to the number of semesters enrolled in college and to completing an associates in arts degree at least in the sample of whites, students who did not participate in free/reduced lunch program, and the students who reached 10th grade on time. Although the range of the estimates in Table 14 are wide, I can still rule out zero returns to community college outcomes for these subgroups.

[12]These estimates are larger than the estimates found in column (2) of Table 13.

[13]Compared to the estimates in column (4) in Table 13, the estimates are larger for whites but smaller for students who reached 10th grade on time.

6 Falsification Tests

In this section, I show that the fraction of the cost of attending community college is a legitimate instrumental variable for the community college outcomes. I conducted a number of falsification tests (1) to see if the fraction of the college cost affects only the community college outcomes and not the other outcomes beyond the community college and (2) to see that the the fraction of the college cost has no direct effect on earnings except through the community college outcomes.

In the first falsification test, I show that the instrumental variable does not affect the outcomes beyond community college. In this application, I use four state university system (SUS) outcomes:

1. SUS only attendance – this includes the high school students who attended an SUS after completing high school and have never attended a community college;
2. the number of semesters enrolled while attending an SUS;
3. the bachelor's degree completion in SUS – whether a degree is completed while attending an SUS;
4. ever attended an SUS – this includes the students who only attended an SUS and the students who transferred to an SUS from a community college.

If the fraction of the college cost is a legitimate instrument, then it should only affect the community college outcomes and not these SUS outcomes. In carrying out the falsification tests, I run regressions of the SUS outcomes on the fraction of the college cost controlling for standardized mathematics and reading test scores, indicators of gender, race, free/reduced lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, community college dummies, and interaction terms. In all the regression specifications, I use the robust standard errors that are clustered by year and community college affiliation of individuals in the sample. The coefficient estimate of the fraction of the college cost should be statistically not different from zero to establish no correlation. Table 15 presents the estimates from the OLS regression models with control variables. Except for the marginally significant coefficient estimate in column (2) for the SUS Terms, all of the coefficient estimates are statistically not different from zero, with t ratios below the conventional levels, implying no correlation between the fraction of the college cost and the SUS outcomes. Coupled with the first stage results in Table 11 that show correlations between the fraction of the college cost and the community college outcomes, the results from these falsification tests indicate that the fraction of the college cost affects only the community college outcomes and not the SUS outcomes which are beyond the student's community college-going behavior and the desire to complete an associates in arts degree.

The second falsification test aims to show that the fraction of the college cost does not directly affect earnings but affects earnings indirectly through the community college outcome. In other words, this falsification test is a test whether or not the fraction of the college cost can be excluded in the structural model of earnings. Since the students from the low income households would be affected more compared to the students from the high income households facing the same high fraction of the college cost, this suggests that a fraction of the college cost must have larger effects on the college education outcomes of the students coming from the low income households. The model for the schooling choice becomes:

$$S = X\beta_1 + \alpha_1 Fraction + \alpha_2 Ratio \times P + u \qquad (11)$$

where X includes all control variables other than $Fraction$, P denotes an indicator for low family income, β_1, α_1, and α_2 are positive coefficients. If $Fraction$ is included in the earnings equation,

$$E = \gamma_1 X + \theta_1 Fraction + \mu_1 S + v, \qquad (12)$$

the interaction term $Fraction \times P$ in equation (11) can be used as an instrumental variable for community college education S. The identification condition is that the direct earnings effect associated with the $Fraction$ variable does not vary with the unobserved factors.[14]

[14] For example, $Fraction$ should not in any way vary with unobserved ability or the unobserved geographic wage differentials

Since there is no direct information or indicator for low family income in the data, I used several observed factors that are directly related to being a low income household:

1. if the student's race is black; and
2. if the student participated in the free/reduced lunch program.

Table 16 shows the coefficient estimates from the instrumental variables estimation based on the interaction term of the fraction of the college cost and an indicator of low family income as the instrument. The fraction of the college cost is included both in the schooling equation (first stage) and in the earnings equation (2nd stage). The coefficient estimates of the fraction of the college cost variable should appear statistically not different from zero to claim that the fraction of the college cost can be excluded in the earnings equation. If this is the case then we can support the claim that the fraction of the college cost does not directly affect the earnings equation. Also, the IV estimate based on the interaction term should be smaller than the IV estimate based on the fraction of the college cost. This is consistent with the idea that a higher fraction of the college cost has a greater negative impact on the community college outcomes of students from the low income family and thus, will yield lower earnings estimates. The results in Table 16 confirm this. All of the coefficient estimates of the *Fraction of College Cost* in column (2) are statistically not different from zero in the structural model of earnings equation with t ratios below the conventional levels. Moreover, the IV estimates of the returns to the number of semesters enrolled in college and to completing an associates in arts degree based on the interaction term of the fraction of the college cost, black, and the lunch status are also smaller than the IV estimates based on the fraction of college cost in Table 13 implying that students from low income families are affected more by a higher fraction of the college cost.

7 Discussion

In this paper, I consider using the fraction of the cost of attending community college as the source of exogenous variation in the community college outcomes to estimate the returns to the number of semesters enrolled in community college and the returns to completing an associates in arts degree. The analysis suggests that the fraction of the college cost has a negative impact both on the number of semesters enrolled in college and on the associates in arts degree completion. These are associated with positive returns both to the number of semesters students were enrolled in community college (i.e., the schooling effect) and to completing an associates in arts degree (i.e., the sheepskin effect). In this section I discuss what might explain these results.

The findings in this paper suggest that community colleges generates positive returns to the community college education. The results above also suggest that that these estimates are quite large relative to the size of the estimates from the OLS regression, with the IV estimates of the sheepskin effect (i.e., AA degree completion) of about 19 times larger and the schooling effect (i.e., the number of semesters enrolled in community college) of about 3 times larger than the OLS estimates. To put these estimates into perspective, we need to know at least two things about these IV estimates. First, we cannot directly compare the IV and OLS estimates since they measure different things. In general, the IV estimates apply only to the group of students in the sample whose college-going decisions are shifted by the fraction of the college cost (see Imbens and Angrist, 1994). For example, by assuming that the students who are presented with a low fraction of the college cost completed AA degrees and the students who are presented with a high fraction of college cost did not complete the AA degree, then the "sheepskin effect" applies only to the students who completed their AA degrees because they are presented with a low fraction of the college cost. Thus, the effect applies only to some groups in the sample who are shifted by the instrument. In the sample, however, this group is very small. Recall that the instrument has a negative effect on the AA degree completion rate of only two percentage points. In entire sample, the AA completion rate is only about four percent or about 23,457 students. A decrease in the fraction of the college cost from one to zero will only push the AA degree completion rate by at most 50 percent or about 11,700 students, which is a big effect relative to the four percent average AA degree completion rate in the sample. Second, we need to understand why these estimates are particularly big for this small group of students in the sample. Because the IV estimates can be interpreted as the weighted average of the causal effect of the AA degree completion, there might be groups in the sample whose returns to completing an AA degree are uniquely large. For instance, the results above confirmed that the IV estimates of the sheepskin and the schooling effects are particularly large in the sample of whites, students who did not participate in the free/reduced lunch program, and students who reached grade ten on time. In the sample, the students who completed an AA degree are mostly whites (72 percent), students who did not participate in the free/reduced lunch program (83 percent), and the students who reached 10th grade on time (86 percent). Most of the variations in the effect of the AA degree completion and the number of semesters enrolled in college are due to the heterogeneous effects associated with these groups. In the reduced form model of the AA degree completion and semesters students enrolled in college, the estimated effects of the instrument for these groups are also smaller relative to the estimated effects in the version that uses the full sample. There is at least one reason why these group of students choose to complete an AA degree regardless of the high cost of attending a community college. Conditional on ability, students that belong to these groups might have more access to credit or have more family resources available to them to defray the high cost of attending community college.

The estimates from the reduced form model of earnings indicate that the instrument has the largest effect on the earnings among these groups of students. There are reasons why these students who were presented a low fraction of college costs earned more later in life. It is possible that these students differ from their counterparts that they have more family resources, stronger attachment to the labor market, higher levels of motivation, and have more social capital. These factors provide them the edge in the labor market. It is possible that the earnings opportunities of these students are better even without obtaining college education. Because we can interpret the IV estimates as the ratio of the estimates from the reduced form models of earnings and AA degree completion (or the number of semesters students were enrolled in college), we can see that the large IV estimate of the returns to completing an AA degree (and also the number of semesters enrolled in college) can be attributed to these small fraction of students who have better earnings prospects and whose decisions to complete an AA degree or to attend more semesters in college are less sensitive to the college cost. It is also interesting to know whether these IV estimates of the returns to community college education are consistent with the estimates found in the literature. There are a few research studies that investigate the effects of community college education, sub-baccalaureate, or two-year degree on the economic outcomes of the students such as earnings. Estimates of the returns to education from these research studies are often generated from survey datasets that are fitted in OLS regression models, with test scores and family background variables included to control for the ability bias. Also, the use of the log earnings in these studies makes the estimates from these studies conditional on the labor force participation. The study of Kane and Rouse (1995) is the most influential one. Conditional on test scores and family background characteristics, they estimated the annual earnings differential associated with the credits completed and the earnings differential associated with the degrees received in two-year and four year colleges. Their estimates suggest that the returns to the credits completed ranged from four to ten percent of the annual earnings while the returns to associates in arts degree ranged from 24 to 31 percent of the annual earnings. Kane and Rouse (1995) attempted to use the distance of student's high school from the nearest two-year and four-year institution as well as tuition levels in the state as instruments for the college attendance. Marcotte et al. (2005) estimated the models that yield returns associated with the number of years of full time equivalent (FTE) post-secondary education among students who did not receive credentials and the returns to completing an associates in arts degree among students who completed post-secondary education. The estimated returns to attending a two-year college without earning a degree or a credential is about six to eleven percent of the annual earnings. Moreover, their estimates indicate that the returns to completing an associates in arts degree is about 14 to 39 percent of the annual earnings. The recent study by Jepsen, Troske and Coomes (2009) used the administrative data from Kentucky Community and Technical College System (KCTCS) to estimate the change in the earnings associated with attendance and the degrees received from the KCTCS. By including the person fixed effects to control for the time invariant measures of innate ability, their estimates indicate that the returns to associates in arts degree is about 20 to 39 percent of the quarterly earnings. The findings in these studies are consistent with the results in this paper. To make the results of this paper comparable with the results of the studies mentioned above, I estimated the returns associated with the number of semesters enrolled in college and the returns associated with completing associates in arts degrees using the OLS regression models of the log average annual total earnings that include test scores, demographic characteristics, cohort, and indicators of nearest community college as the control variables. The estimates indicate that the returns associated with the number of semesters enrolled is about 6.3 percent of the average annual total earnings and about 22 percent for completing an associates in arts degree. Apparently, these estimates are comparable in magnitude with the estimates in the studies mentioned above. In the IV regression version of the log earnings, the estimates suggest that returns to the semesters enrolled is about 26 percent while the returns to associates in arts degree completion is about 400 percent.[15]

8 Conclusion

In this paper I explore the use of the fraction of the cost of attending community college as the exogenous source of variation of two community college outcomes – the number of semesters enrolled in college and the associates in arts degree completion. Using rich administrative data in Florida and the community college cost data from the Integrated Postsecondary Education Data System (IPEDS), the analysis of average annual total earnings and the community college education outcomes suggests that a higher fraction of the college cost will decrease both the number of semesters enrolled and the associates in arts degree completion rates, and the average annual total earnings are higher among students who enrolled more semesters in college and among students who completed an associates in arts degree.

While the IV estimates show suggestive evidence of large positive returns, these estimates are local to the community college students whose decisions to acquire community college education are affected by the fraction of the college cost. In particular, the estimated returns to community college outcomes are concentrated among white students, students who did not participate in the free/reduced lunch program, and the students who reached 10th grade on time. Critics might argue that these group of students may not be on the margin of dropping out of college. These community college students, however, are still more sensitive to the cost of college education compared to the students in the four year colleges. Because community college students are sensitive to the changing cost of the college education,a higher cost of college education would likely hinder their desires to attend and finish a college degree. While I have not compared students from the community colleges and the four year colleges in terms of their sensitivity to the cost of higher education, the evidence in this paper suggests that there are some groups of students who are affected by the high cost of community college education.

Promoting a better access to community college education is one way to narrow the existing gap in income inequality. A sound policy to increase college attendance and degree completion is needed to help students especially those from the low income and disadvantaged families who are less likely to experience a good quality of life. Since getting a college education is increasingly becoming a prerequisite to join at least the ranks of the middle class, access to college education must be given a great deal of attention and must be in the list of the policy makers' agenda.

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Table 1: Estimates of the Cost of Attending Community Colleges in Florida

Community College	Tuition and Fees				Books				Housing and Transportation				Other Personal Effects			
	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
Brevard	1,356	1,428	1,542	1,626	700	800	800	800	6,000	8,000	8,000	8,000	2,024	2,424	2,424	2,424
Broward	1,536	1,755	1,513	1,675	990	1,296	864	1,000	8,765	9,928	9,569	9,147	4,690	5,008	4,532	3,995
Central Florida	1,381	1,450	1,569	1,631	984	984	1,230	1,230	5,112	5,112	5,562	4,896	3,212	3,212	3,386	5,012
Chipola	1,755	1,870	2,020	2,137	800	800	800	800	4,974	4,974	4,974	4,974	2,896	2,896	2,896	3,642
Daytona State	1,739	1,825	2,003	2,103	463	800	800	800	7,676	13,400	13,400	13,400	2,226	2,624	2,624	2,624
Edison State	1,747	1,833	1,983	2,091	673	696	696	696	3,645	3,645	3,645	4,680	3,029	2,487	2,487	2,701
Florida Keys	1,900	1,980	2,079	2,250	2,105	2,300	2,392	2,488	13,591	14,157	14,723	15,312	944	983	1,903	1,980
Florida SC	1,510	1,615	1,638	1,714	800	800	800	800	7,950	7,950	7,950	8,260	3,110	3,100	3,100	3,590
Gulf Coast	1,672	1,750	1,916	2,006	900	900	900	1,035	6,100	6,150	7,200	7,850	2,300	2,350	2,400	2,450
Hillsborough	1,747	1,833	1,983	2,380	1,950	2,048	1,950	1,950	5,964	6,262	5,964	5,964	4,860	5,103	4,860	5,475
Indian River SC	1,650	1,740	1,662	1,756	900	900	1,100	1,000	5,400	5,400	5,700	5,400	850	850	1,020	1,020
Lake City	1,706	1,790	1,887	2,979	860	877	877	900	5,510	5,518	5,576	5,799	445	445	450	465
Lake-Sumter	1,731	1,785	1,932	2,008	800	800	850	850	6,192	6,192	6,192	6,192	2,975	2,975	2,995	2,995
Miami Dade	1,583	1,875	2,022	1,655	1,368	1,500	1,500	1,200	6,992	8,100	8,100	14,510	4,410	2,970	2,970	6,610
North Florida	1,671	1,740	1,860	1,860	700	700	800	800	5,400	5,400	5,400	5,400	2,556	2,300	2,300	2,300
Northwest Florida SC	1,550	1,629	1,664	1,763	1,400	1,475	1,500	1,650	9,000	9,000	9,126	10,426	4,500	4,500	2,670	3,294
Palm Beach SC	1,950	2,088	2,100	2,300	750	810	900	1,000	5,650	6,275	7,500	8,000	1,750	2,000	2,250	2,500
Pasco-Hernando	1,561	1,644	1,722	1,967	1,200	1,200	1,200	1,200	4,950	4,950	4,950	4,950	2,971	2,971	2,971	2,971
Pensacola JC	1,337	1,404	1,496	1,581	775	775	775	1,100	5,085	5,085	5,085	5,085	2,086	2,086	2,375	2,375
Polk SC	1,693	1,755	1,841	1,890	1,349	1,484	1,710	1,700	6,800	7,600	6,800	6,400	3,000	3,000	3,000	3,000
St. Johns River	1,585	1,732	1,732	1,974	1,036	1,036	1,036	1,062	6,577	6,577	6,577	6,741	2,675	2,675	2,675	2,745
Santa Fe	1,338	1,404	1,521	1,604	700	700	700	700	5,384	5,392	5,560	6,080	3,144	2,928	3,048	2,880
Seminole SC	1,747	1,931	2,081	2,180	775	1,200	1,200	1,200	5,400	6,030	6,030	6,032	2,610	2,610	2,610	2,610
South Florida	1,695	1,820	1,892	2,048	812	824	840	875	3,629	3,684	3,757	3,757	1,523	1,546	1,577	1,577
St. Petersburg	1,747	1,833	1,983	2,091	800	1,000	1,000	1,100	5,260	5,260	5,260	5,460	2,780	2,780	2,780	3,080
Manatee	1,741	1,833	1,983	2,091	1,099	1,127	1,164	1,202	10,081	10,081	10,414	10,758	3,671	3,763	3,887	4,015
Tallahassee	1,320	1,424	1,476	1,645	800	800	800	800	5,000	5,000	6,000	6,000	1,800	1,800	1,800	1,800
Valencia	1,729	1,800	1,983	2,100	1,000	1,000	1,000	1,000	8,800	8,800	8,800	8,800	2,300	2,800	2,800	2,800

Note: Data is taken from the Integrated Post-secondary Education Survey.

Table 2: Estimated Total Cost, Average Financial Aid, and the Fraction of Cost

	Total Cost of Attendance				Total Financial Aid				Fraction of Cost			
Community College	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
Brevard	10,080	12,652	12,766	12,850	5,209	4,039	5,429	4,715	0.48	0.68	0.57	0.63
Broward	15,981	17,987	16,478	15,817	4,981	5,148	4,995	5,705	0.69	0.71	0.70	0.64
Central Florida	10,689	10,758	11,747	12,769	2,124	4,078	5,280	2,898	0.80	0.62	0.55	0.77
Chipola	10,425	10,540	10,690	11,553	6,768	7,134	7,564	7,907	0.35	0.32	0.29	0.32
Daytona State	12,104	18,649	18,827	18,927	5,214	5,762	5,718	6,091	0.57	0.69	0.70	0.68
Edison State	9,094	8,661	8,811	10,168	5,819	5,776	5,791	6,710	0.36	0.33	0.34	0.34
Florida Keys	18,540	19,420	21,097	22,030	3,921	2,850	4,663	4,696	0.79	0.85	0.78	0.79
Florida SC	13,370	13,465	13,488	14,364	4,520	4,852	4,768	5,392	0.66	0.64	0.65	0.62
Gulf Coast	10,972	11,150	12,416	13,341	5,609	6,027	5,826	6,316	0.49	0.46	0.53	0.53
Hillsborough	14,521	15,246	14,757	15,769	5,134	5,042	5,241	5,398	0.65	0.67	0.64	0.66
Indian River SC	8,800	8,890	9,482	9,176	6,162	8,338	5,316	2,697	0.30	0.06	0.44	0.71
Lake City	8,521	8,630	8,790	10,143	5,876	5,923	5,581	6,805	0.31	0.31	0.37	0.33
Lake-Sumter	11,698	11,752	11,969	12,045	5,401	5,755	4,877	4,640	0.54	0.51	0.59	0.61
Miami Dade	14,353	14,445	14,592	23,975	5,654	5,731	5,745	5,311	0.61	0.60	0.61	0.78
North Florida	10,327	10,140	10,360	10,360	6,200	4,787	4,768	2,429	0.40	0.53	0.54	0.77
Northwest Florida SC	16,450	16,604	14,960	17,133	1,415	1,461	1,629	1,947	0.91	0.91	0.89	0.89
Palm Beach SC	10,100	11,173	12,750	13,800	2,885	2,500	3,651	5,086	0.71	0.78	0.71	0.63
Pasco-Hernando	10,682	10,765	10,843	11,088	4,188	4,365	4,865	6,651	0.61	0.59	0.55	0.40
Pensacola JC	9,283	9,350	9,731	10,141	5,538	5,856	6,194	6,639	0.40	0.37	0.36	0.35
Polk SC	12,842	13,839	13,351	12,990	5,055	5,486	5,978	6,336	0.61	0.60	0.55	0.51
St. Johns River	11,873	12,020	12,020	12,522	6,308	6,376	6,966	5,844	0.47	0.47	0.42	0.53
Santa Fe	10,566	10,424	10,829	11,264	5,921	5,876	5,972	6,276	0.44	0.44	0.45	0.44
Seminole SC	10,532	11,771	11,921	12,022	5,311	2,286	5,003	5,527	0.50	0.81	0.58	0.54
South Florida	7,659	7,874	8,066	8,257	5,209	5,543	5,784	6,264	0.32	0.30	0.28	0.24
St. Petersburg	10,587	10,873	11,023	11,731	2,906	2,976	3,087	3,346	0.73	0.73	0.72	0.71
Manatee	16,592	16,804	17,448	18,066	5,529	6,114	6,419	5,941	0.67	0.64	0.63	0.67
Tallahassee	8,920	9,024	10,076	10,245	2,094	5,165	5,165	5,588	0.77	0.43	0.49	0.45
Valencia	13,829	14,400	14,583	14,700	5,519	5,714	5,865	5,894	0.60	0.60	0.60	0.60

Note: Data is taken from the Integrated Post-secondary Education Survey.

Table 3: Summary Statistics

		Cohort Year			
	Full Sample	2000	2001	2002	2003
Percent of Total Observations		21.87	23.96	26.52	27.65
Gender (%)					
Male	48.5	47.7	48.3	48.8	48.8
Female	51.5	52.3	51.7	51.2	51.2
Race (%)					
White	54.1	56.6	54.9	53.1	52.6
Black	20.7	20.3	20.4	21.2	20.1
Hispanics	20.2	18.5	19.8	20.7	21.2
Others	5.0	4.6	4.9	5.0	6.1
Free/Reduced Lunch Status	27.7	26.8	24.9	27.4	31.2
Limited English Proficient	18.6	17.6	18.5	18.9	18.9
Special	8.7	7.6	8.3	8.9	9.5
Grade 10 on Time	76.7	77.5	76.7	75.6	77.1
Age	16.04	16.02	16.04	16.05	16.04
Total Cost of Attendance	12,985.9	12,214.8	12,936.8	12,984.0	13,639.7
Net Cost of Attendance	7,680.4	7,118.8	7,707.4	7,595.3	8,182.5
Fraction of Cost (Net/Total Cost)	0.560	0.556	0.556	0.555	0.570
Observations	584,300	127,745	139,996	154,980	161,579

Table 4: Number of Semesters Enrolled in Community College

		Cohort Year			
	Full Sample	2000	2001	2002	2003
Mean	1.75	2.57	2.14	1.57	0.94
Gender					
Male	1.50	2.21	1.85	1.34	0.80
Female	1.98	2.90	2.41	1.79	1.07
Race					
White	1.90	2.70	2.28	1.72	1.06
Black	1.37	2.10	1.71	1.21	0.71
Hispanics	1.64	2.58	2.08	1.46	0.81
Free/Reduced Lunch Status					
Yes	1.41	2.23	1.72	1.25	0.77
No	1.88	2.70	2.28	1.69	1.02
Limited English Proficient					
Yes	1.56	2.45	1.97	1.37	0.76
No	1.79	2.60	2.18	1.62	0.98
Special					
Yes	1.11	1.75	1.41	1.01	0.59
No	1.8	2.64	2.21	1.62	0.98
Grade 10 on Time					
Yes	1.87	2.72	2.29	1.70	1.01
No	1.33	2.06	1.63	1.15	0.70
Observations	584,300	127,745	139,996	154,980	161,579

Table 5: Associates in Arts Degree Completion Rates (%)

		Cohort Year			
	Full Sample	2000	2001	2002	2003
Mean	4.01	8.75	5.93	2.04	0.49
Gender					
Male	3.10	7.12	4.64	1.44	0.39
Female	4.84	10.24	7.14	2.62	0.61
Race					
White	5.04	10.41	7.33	2.72	0.67
Black	1.65	3.82	2.53	0.70	0.18
Hispanics	3.35	8.23	5.10	1.49	0.31
Free/Reduced Lunch Status					
Yes	2.45	6.23	3.61	1.02	0.29
No	4.61	9.68	6.70	2.43	0.60
Limited English Proficient					
Yes	2.91	7.07	4.31	1.24	0.24
No	4.26	9.11	6.30	2.23	0.56
Special					
Yes	1.31	3.64	1.84	0.58	0.09
No	4.27	9.17	6.30	2.19	0.54
Grade 10 on Time					
Yes	4.52	9.69	6.66	2.37	0.57
No	2.35	5.50	3.52	1.02	0.25
Observations	584,300	127,745	139,996	154,980	161,579

Table 6: Average Annual Total Earnings (in Year 2000 $)

	Full Sample	Cohort Year 2000	2001	2002	2003
Mean	4,795	8,120	5,802	3,835	2,213
Gender					
Male	4,873	7,931	5,696	3,762	2,195
Female	4,721	8,326	5,917	3,912	2,233
Race					
White	5,058	8,491	6,046	3,960	2,306
Black	4,276	7,183	5,215	3,508	1,994
Hispanics	4,870	8,367	6,004	4,034	2,319
Free/Reduced Lunch Status					
Yes	4,639	7,912	5,730	3,915	2,267
No	4,855	8,196	5,826	3,805	2,189
Limited English Proficient					
Yes	4,532	7,693	5,554	3,712	2,128
No	4,855	8,211	5,859	3,864	2,233
Special					
Yes	4,488	7,708	5,773	3,773	2,132
No	4,824	8,153	5,805	3,841	2,222
Grade 10 on Time					
Yes	4,892	8,283	5,911	3,897	2,250
No	4,476	7,556	5,445	3,643	2,092
Observations	584,300	127,745	139,996	154,980	161,579

Note: The average annual total earnings is calculated as the mean of the 2nd to 6th year earnings after high school graduation.

Table 7: Balancing Test

Covariate	Fraction of College Cost Coefficients No Controls	Controls
Male [mean = 0.48]	-0.017	0.000
std. error	(0.007)*	(0.000)
t-stat	-2.264	-0.055
White [mean = 0.54]	-0.437	0.000
std. error	(0.146)**	(0.000)
t-stat	-2.977	-1.469
Black [mean = 0.21]	0.245	0.000
std. error	(0.064)**	(0.000)
t-stat	3.826	-0.942
Hispanic [mean = 0.2]	0.178	0.000
std. error	(0.121)	(0.000)
t-stat	1.470	-1.311
Lunch Status [mean = 0.28]	0.045	-0.001
std. error	(0.060)	(0.002)
t-stat	0.757	-0.434
LEP [mean = 0.19]	0.176	0.003
std. error	(0.104)	(0.002)
t-stat	1.693	1.628
Special [mean = 0.09]	-0.007	0.000
std. error	(0.013)	(0.001)
t-stat	-0.504	-0.366
Grade 10 on Time [mean = 0.77]	-0.017	-0.001
std. error	(0.019)	(0.001)
t-stat	-0.913	-1.591
Age [mean = 16.04]	-0.005	0.000
std. error	(0.021)	(0.000)
t-stat	-0.253	-1.016
Age Squared [mean = 257.9]	-0.137	0.002
std. error	(0.678)	(0.002)
t-stat	-0.203	1.014
Observations	584,249	584,249

Note: ** - significant at 0.01 level, * - significant at 0.05 level. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 8: Estimates of the Regression of FCAT Scores on Fraction of Cost

	Dependent Variable	
	Mathematics	Reading
	1	2
Fraction of College Cost	0.207	0.188
std. error	(0.134)	(0.150)
t-stat	1.55	1.25
Mean	14.86	13.71
Observations	584,249	584,249

Note: ** - significant at 0.01 level, * - significant at 0.05 level. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 9: Estimates of the Regression of "Current Year" Fraction of Cost on "Prior Year" County and Community College Characteristics

Independent Variable	Estimate
Enrollment (headcount)	0.034
std. error	0.046
t-stat	0.728
CC Annual Expenditures	0.034
std. error	0.046
t-stat	0.728
CC Annual Instructional Costs	0.034
std. error	0.046
t-stat	0.728
County Mean Annual Earnings	5.180
std. error	6.265
t-stat	0.827
County Mean Annual Unemployment Rate	6.626
std. error	46.201
t-stat	0.143
Observations	268

Note: ** - significant at 0.01 level, * - significant at 0.05 level. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 10: Estimates of the Regression of College Outcomes on Math and Reading Scores

	Effect of Math on		Effect of Reading on	
	CC Terms 1	AA Degree 2	CC Terms 3	AA Degree 4
Sub-group				
Below Median Fraction of Cost	0.032	0.001	0.032	0.001
std. error	(0.011)**	(0.000)*	(0.008)**	(0.000)
t-stat	3.00	2.64	3.97	1.60
Above Median Fraction of Cost	0.023	0.001	0.021	0.000
std. error	(0.008)**	(0.000)*	(0.006)**	(0.000)
t-stat	2.91	2.25	3.79	1.23
Interaction Term				
Fraction of Cost x Mathematics	-0.020	-0.001		
std. error	(0.038)	(0.002)		
t-stat	-0.54	-0.68		
Fraction of Cost x Reading			-0.028	-0.001
std. error			(0.031)	(0.002)
t-stat			-0.91	-0.80

Note: ** - significant at 0.01 level, * - significant at 0.05 level. Math and reading scores are standardized with mean 100 and standard deviation 15. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 11: First Stage Regression Models (Reduced Form Estimates)

Reduced Form Model	OLS Estimate
Effect of Fraction of Cost on Semesters Enrolled	-0.369
std. error	(0.076)**
t-stat	-4.86
R-Square	0.15
Mean	1.75
Standard Deviation	2.49
Effect of Fraction of Cost on AA Degree Completion	-0.020
std. Error	(0.006)**
t-stat	-3.21
R-square	0.1
Mean	0.04
Standard Deviation	0.20
Effect of Fraction of Cost on Average Annual Total Earnings	-405.08
std. Error	(165.95)*
t-stat	-2.44
R-square	0.131
Mean	4,794.8
Standard Deviation	6,249.4
Observations	584,249

Note: ** - significant at 0.01 level, * - significant at 0.05 level. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 12: First Stage Regression Models with Heterogeneous Effects

Sub Group	CC Terms	AA Degree	Observations
	1	2	3
White	-0.335	-0.018	316,418
	(0.098)**	(0.008)*	
Black	-0.253	-0.009	121,117
	(0.092)**	(0.004)*	
Hispanic	-0.530	-0.028	117,977
	(0.142)**	(0.010)**	
Male	-0.271	-0.015	283,010
	(0.085)**	(0.006)*	
Female	-0.463	-0.025	301,290
	(0.078)**	(0.007)**	
Lunch	-0.439	-0.015	162,220
	(0.141)**	(0.006)**	
No Lunch	-0.352	-0.023	422,080
	(0.079)**	(0.007)**	
Grade 10 on Time	-0.437	-0.024	448,166
	(0.073)**	(0.007)**	
Grade 10 not on time	-0.127	-0.006	136,083
	(0.137)	(0.005)	

Note: ** - significant at 0.01 level, * - significant at 0.05 level. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 13: Instrumental Variables Estimates of the Returns to Community College Education based on the Fraction of Cost of Attending a Nearby Community College

Community College Outcome	OLS	Structural Estimates (IV)
	1	2
Number of Semesters Enrolled in College	323.62	1097.24
std. error	(8.37)**	(573)
t-stat	38.65	1.91
Associates in Arts Degree	1,070.8	20,419.8
std. error	(75.98)**	(10,183.5)*
t-stat	14.09	2.01
Observations	584,249	584,249

Note: ** - significant at 0.01 level, * - significant at 0.05 level. Estimates in Year 2000 $. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 14: Instrumental Variables Estimates with Heterogeneous Effects

Sub Group	CC Terms	AA Degree	Observations
	1	2	3
White	1,769.4	33,347.3	316,418
	(839.5)*	(16,694.7)*	
Black	155.1	4,254.9	121,117
	(717.1)	(19,756.1)	
Hispanic	148.6	2,853.0	117,977
	(447.1)	(8,411.0)	
Male	1,843.5	34,248.2	283,010
	(1,186.6)	(19,907.9)	
Female	675.6	12,661.0	301,290
	(341.4)	(6,593.5)	
Lunch	642.6	18,223.7	162,220
	(601.4)	(16,608.7)	
No Lunch	1,194.4	18,333.0	422,080
	(581.1)*	(8,571.8)*	
Grade 10 on Time	(975.1)	17,704.6	448,166
	(494.6)	(8,910.1)*	
Grade 10 not on time	2,047.2	43,541.7	136,083
	(2,494.4)	(49,060.4)	

Note: ** - significant at 0.01 level, * - significant at 0.05 level. Estimates in Year 2000 $. Excluding the demographic groups used in the estimation sample, the control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 15: Estimates of the Regression of State University System Outcomes on the Fraction of Cost

	Dependent Variable			
	Attended SUS Only 1	SUS Terms 2	BA Degree 3	Ever Attended SUS 4
Fraction of College Cost	0.024	0.235	0.006	0.023
std. error	(0.014)	0.1134*	(0.004)	(0.013)
t-stat	1.76	2.08	1.49	1.75
Mean	0.091	1.027	0.014	0.196
Observations	584,249	584,249	584,249	584,249

Note: ** - significant at 0.01 level, * - significant at 0.05 level. Estimates in Year 2000 $. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.

Table 16: Instrumental Variables Estimates of the Returns to Community College Education based on the Interaction of the Fraction of Cost,Lunch Status, and Black

	Model	
	First Stage	Structural (IV)
	1	2
Fraction of College Cost × Black × Lunch Status	0.15	
std. error	0.07	
t-stat	2.14	
Fraction of College Cost	-0.38	-270.43
std. error	(0.0281)**	(802.51)
t-stat	-13.59	-0.34
Number of Semesters Enrolled in Community College		364.73
std. error		(2,117.6)
t-stat		0.17
Control Variables	Yes	Yes
Observations	584,249	584,249
Fraction of College Cost × Black × Lunch Status	0.02	
std. error	(0.0055)**	
t-stat	3.61	
Fraction of College Cost	-0.02	-352.28
std. error	(0.0022)**	-332.10
t-stat	-9.48	-1.06
Associates in Arts Degree Completion		2,661.70
std. error		(14,534.2)
t-stat		0.18
Control Variables	Yes	Yes
Observations	584,249	584,249

Note: ** - significant at 0.01 level, * - significant at 0.05 level. The IV Estimates are in Year 2000 $. The control variables include test scores, indicators of gender, race, lunch status, limited English proficiency, special student, reached grade 10 on time, year effects, nearest community college, and interaction terms. Standard errors in parenthesis. Standard errors are robust and clustered by year and nearest community college.