THE EFFECT OF STAFFING TYPE ON STUDENT COMPLETION RATES AT THE CALIFORNIA COMMUNITY COLLEGE

A Thesis

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by

Brian Martin-Rojas

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Department of Public Policy and Administration

Abstract

of

THE EFFECT OF STAFFING TYPE ON STUDENT COMPLETION RATES AT THE CALIFORNIA COMMUNITY COLLEGE

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States now place a heavier burden on institutions of higher education to play a role in the evolution of the workforce into a new knowledge economy demanding higher levels of training and different skills than was required in the twentieth century workforce. However, state higher education funding has declined as a share of the budget over the last four decades, and in California's most recent recession, in real dollars, there was a two billion dollar decrease in funding that has yet to be fully recovered. Keeping in mind the system's desire to run efficiently recovering from the recession, and the legislative rules in place governing how community colleges may allocate their budget, I employ a quantitative approach to answer the question: To what extent does the composition of staffing levels of full-time, adjunct faculty, and administrators affect student completion rates at the community college level?

The data used to conduct the regression analysis in this thesis comes from the California Community College system's DataMart. In order to better understand the problem, the regression uses six years of cohort data.

Panel data regression analysis showed, controlling for student and institutional characteristics, a one unit increase in full-time faculty per thousand students predicts a 0.280% increase in that school's student completion rate with 95% confidence and a one unit increase in part-time faculty per thousand students predicts a -0.067% decrease in that school's student completion rate with 90% confidence. This finding is consistent with the literature surrounding both full and part-time faculty. Further, when looking at my interaction terms describing the interaction between Pell grant recipients and both types of staff, a one unit increase in PellPartTime predicts a 0.086% increase in student completion rates with 95% confidence and a one unit increase in PellFullTime predicts a 0.179% in student completion rates with 90% confidence. Of note, part-time faculty, when interacted with Pell grant recipients, change from a negative to positive effect on student completion rates. Finally, I recommend state policy granting high Pell grant recipient schools the ability to hire part-time faculty without facing repercussions to allow colleges with poorer student populations to quickly respond to hiring issues that are specific to their district, such as impaction or large enrollment increases that may not be felt system wide. However, as I note, more research is necessary to determine where the most effective Pell cut-off is for campus exemptions.

_____, Committee Chair
Robert Wassmer, Ph.D.

_____
Date

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Chapter 1

INTRODUCTION

Knowledge-intensive jobs and technologies increasingly dominate the evolution of global economic competition. This leads to the idea that to strengthen competitive positions, states must increase the development of resident's human capital through higher education (Carnevale, Smith, Strohl, 2013). This realization fundamentally alters the relationship between states and higher education in the United States. States now place a heavier burden on institutions of higher education to play a role in the evolution of the workforce into a new "knowledge economy" demanding higher levels of training and different skills than was required in the twentieth century workforce (Carnevale, Smith, Strohl, 2013). Institutions that were historically "cultural training grounds" for the privileged have become significant agents of change and a tool for government investment in human capital and economic development. Specifically, California has experienced dramatic changes in recent years due to changes in education policy focused on student completion and large disruptions in California's higher education funding.

Raising student completion rates at the community college level has significant economic impact for the state of California. According to the Public Policy Institute of California, by 2025, California is likely to face a shortage of workers as high as 1.5 million with some postsecondary education but less than a bachelor's degree (Bohn, 2014). Community college completion rates directly affect California's changing economy by supplying this skilled cohort to the job market. Lower educational attainment levels among California's future workforce is problematic in that economic

forecasting points to an increasing demand for skilled workers. Training beyond high school has become increasingly valuable in the evolving labor market, and forecasts of the composition of industries and jobs indicate that this trend is likely to continue over the next decade (Bohn, 2014). However, the benefits of simply attending college and completing college are vastly different for both individuals and society. For example, data on unemployment rates continue to indicate that college graduates are much less likely to be unemployed and, if so, to have shorter episodes of unemployment, especially during the most recent recession (Bohn, 2014). Furthermore, college dropouts are expensive. Currently, the California Community College has a student completion rate of 48 percent, and the 52 percent that do not finish represent lost income tax revenue as well as spent subsidies for the state.

Legislative Budget Spending Restrictions

In California, state higher education funding has declined as a share of the budget over the last four decades. While higher education funding accounted for 18% of the state budget in 1976-77, by 2016-17 higher education funding fell to by a third to 12% of the budget (Cook, 2017). In real dollars, this amounted to a two billion dollar decrease in community college funding, when adjusted for inflation. Since this significant drop in funding, in the time since California's most recent recession, community college funding has begun to recover however remains $600 million less than pre-recession real dollars. A partial attribution of this is Proposition 98's shifting of state higher education funding toward the community college system. Prior to Proposition 98, the three branches of

higher education received a roughly even split of state funding, but by 2015-16, the UC and CSU system, who do not receive Proposition 98 funding, shared about 40% of state funding, while 60% was allocated to the community colleges (Cook, 2017). While it is key to view this increase as a benefit to the system, it is important to consider the rules surrounding community college budget allocation. Since the early 1960s, California's legislature has placed multiple restrictions on how much money is spent on faculty, and more recently, structurally changed how the system receives its funding per student, leading to the question:

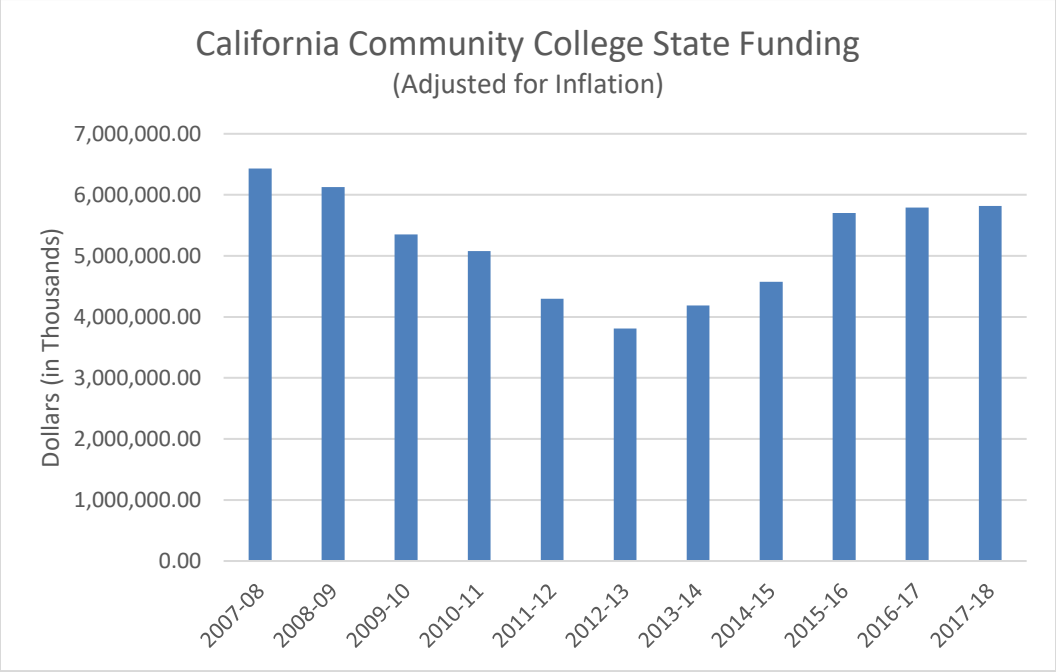
To what extent does the composition of staffing levels per student of full-time, adjunct faculty, and administrators affect student completion rates at the community college level?

Considering these rules on budgetary spending at the legislative level and restrictions governing how much of the budget is spent on faculty, this thesis will examine the effect of staffing type levels on student completion rates. Student completion, as defined by the California Community College, is achieving transfer, a certificate or degree, or completion of a student's academic goal. Through a careful examination of the relationship between these variables, controlling for other factors, this thesis will attempt to demonstrate the individual effect of administrative staff, part-time faculty, and full-time faculty on student completion rates.

In the next section, I discuss legislative budget allocation restrictions related to staffing at community colleges. Following this, I discuss the shift in statewide policy

from increasing student access to ensuring student completion. Since my goal is to relate staffing type and student completion rates and use my findings to inform policy recommendations on budgetary staffing restrictions at the community college, I provide an overview of why student completion at community college is especially relevant to public policy today. The chapter concludes with my thesis outline which will detail how I plan to use panel data regression to create a longitudinal analysis and assess how staffing composition on campuses affect student completion rates.

Figure 1.



50% Law (1961)

Beginning in 1961, California state law requires each community college district to allocate no less than 50% of its general fund expenditures to salaries of classroom

instructors, under a formula based upon the current expense of education. This was established with the objective of addressing the imbalance developing between spending on administrative and instructional duties. Originally, this law only applied to K-12 school districts, and because of this, the statues that applied to community colleges reflected a definition of teaching largely revolving around the instructional model found in K-12 schools: instruction that is almost entirely based within the classroom (Bruno, Carrol, Ann-Dowd, Duncan, Hansen, Mahler, Morse, Nyaggah, & Serrano, 2016). This definition of classroom instructor does not fully cover activities in the context of community college instruction, as a sizable portion of the duties of community college professors is accomplished outside the classroom on other activities, whereas K-12 instructors are in the classroom virtually all day, five days per week.

AB 1725 (1988)

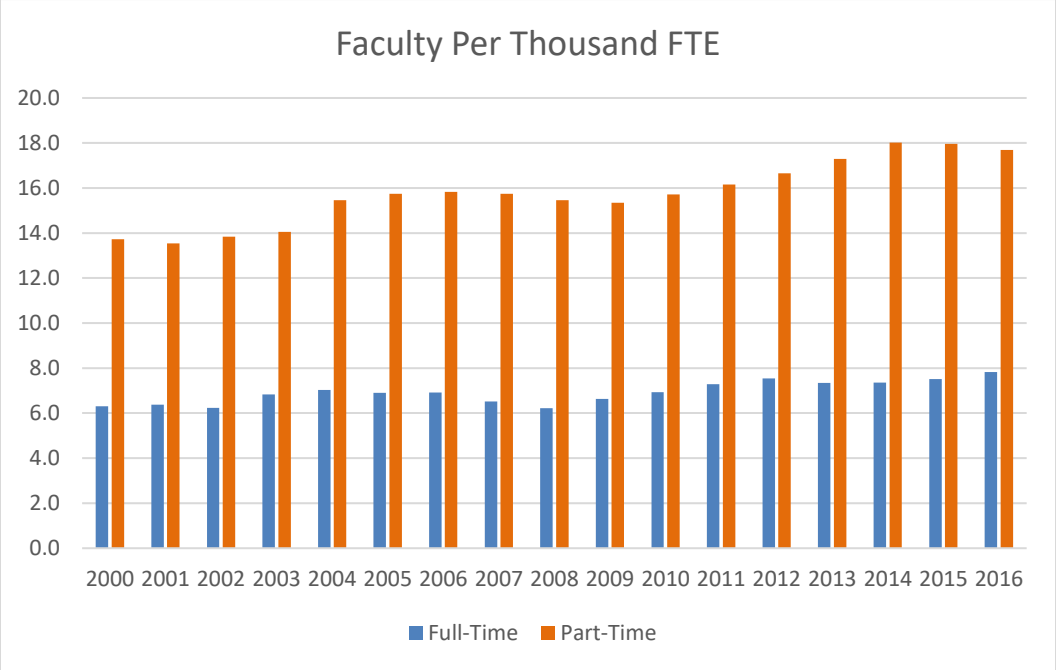
Keeping in mind these restrictions on the working definition of "classroom instruction," AB 1725 (1988) was enacted by the CA Legislature with the specific intent to authorize a larger scope of activities for faculty members that are incidental to their primary professional duties. This also served to expand the definition of the appropriate role of community college faculty outside of the classroom. As a result, funding for instructors now can connect to time spent on additional select activities such as: office hours, curriculum development, participatory college governance, and leadership activities such as Academic Senate or Department Chair (Mize, 2000). While this change allowed for greater flexibility in budgetary spending, the updated statutory

definition continues to exclude many activities that are currently considered instructions, such as online course design and distance education support.

75/25% Ratio Rule (1988)

Additionally, AB 1725 (1988) created the 75/25 rule, a staffing requirement that reserved 75% of teaching faculty at the community college for full-time faculty members. Below, Figure 2 displays full-time and part-time staffing levels for the community college system per thousand FTEs.

Figure 2.



The legislature declared that:

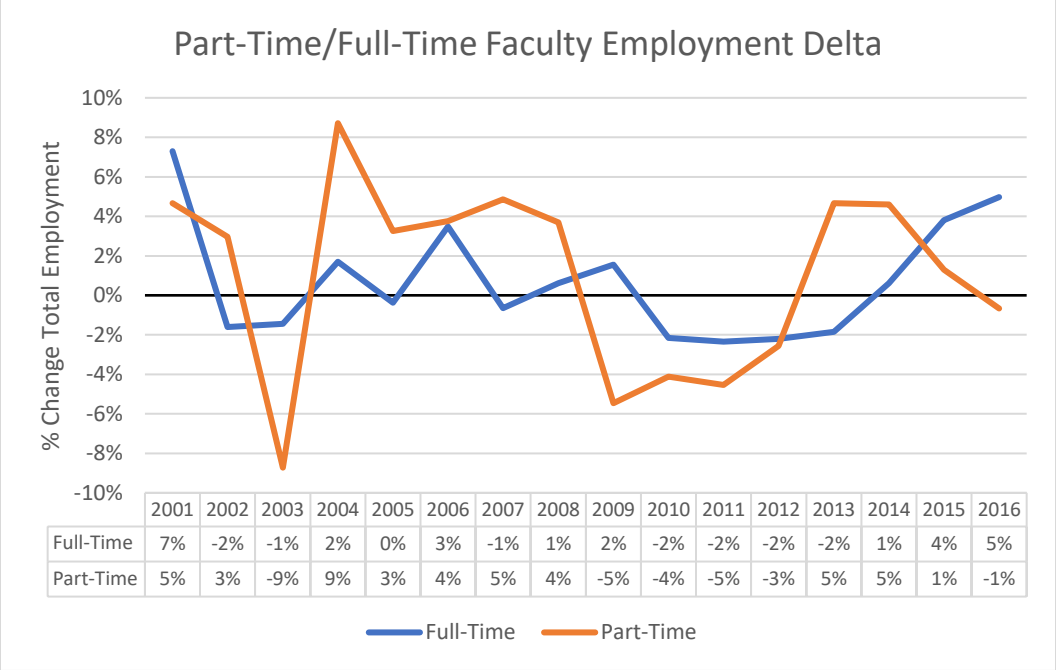
> "Because the quality, quantity, and composition of full-time faculty have the most immediate and direct impact on the quality of instruction, overall reform cannot

succeed without sufficient members of full-time faculty…" (CA Assembly Bill 1725, 1988)

In practice, the 75/25 rule was met with multiple structural problems. Program improvement funding related to AB 1725 (1988) was discontinued after only two years, leaving no dedicated funding mechanism to support progress towards the 75/25 goal. During the late 1990s, some community college districts used Partnership for Excellence funds to make progress toward the goal, but the 2002-2004 state budget crisis created reductions in ongoing support for the program (Chancellor's Office, 2005).

In addition to funding reductions, rapid enrollment growth and the implementation of the Faculty Obligation Number (FON), a rule developed in 1989 that required districts to increase the number of full-time faculty over the prior year in proportion to the amount of growth in funded credit FTES, stymied progress toward the goal (Bruno et al., 2016). Since the annual FON is determined by the previous year's funded growth, substantial growth in the previous year results in a larger number of required new full-time faculty hires. However, districts experiencing continuous growth generally hire large numbers of part-time faculty members to cover additional course sections for the current year. Over several years, "chasing prior year's growth," as shown below in Figure 3, resulted in little improvement in the 75/25 ratio despite increased hiring of full-time faculty members (Chancellor's Office, 2005).

Figure 3.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Full-Time	7%	-2%	-1%	2%	0%	3%	-1%	1%	2%	-2%	-2%	-2%	-2%	1%	4%	5%
Part-Time	5%	3%	-9%	9%	3%	4%	5%	4%	-5%	-4%	-5%	-3%	5%	5%	1%	-1%

Student Access to Student Completion

SB 1456 (2012)

In 2012, the California Senate passed SB 1456, commonly known as the Student Success Act, as part of an effort to increase the share of community college students who earn an associate degree, a certificate, or transfer to a four-year college within six years (Senate Bill 1456, 2012). It attempts to accomplish this by providing support to students on the front-end of their educational experience by ensuring that all students receive orientation, create an educational plan, and declare a program of study. Additionally, the bill targets student success and support funds for matriculation services geared toward helping students progress towards their college goals and requires campuses to participate

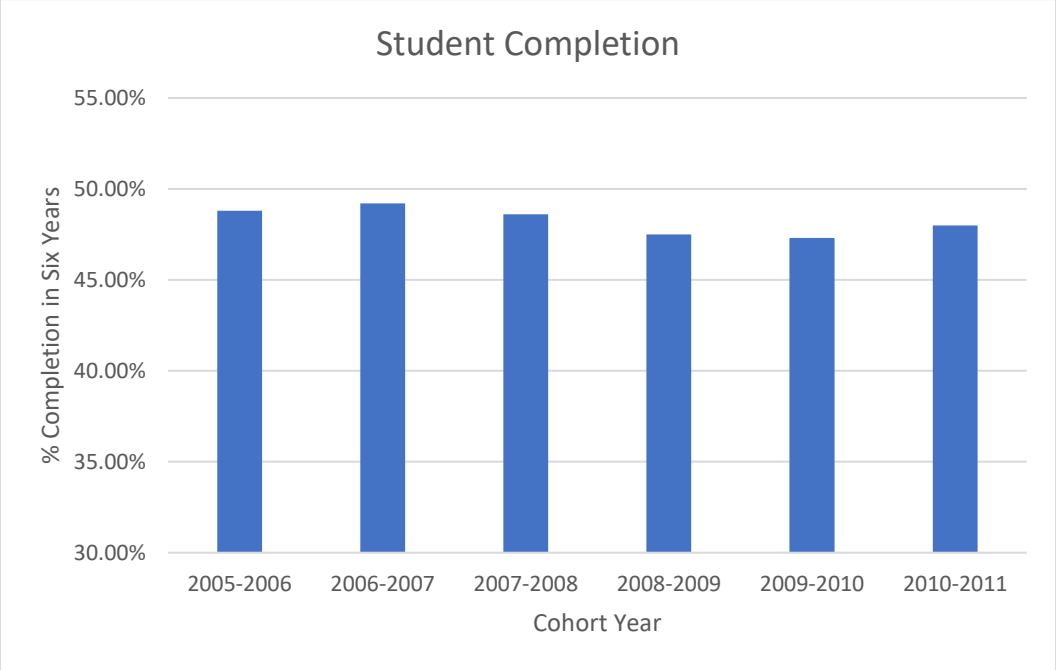
in a common assessment system and post a student success campus scorecard as a condition for receiving student success categorical funding (Senate Bill 1456, 2012). This new student completion scorecard metric is how the 2.1 million student California Community College system changed the definition of student success to include transfer, completion of a certificate or associate degree, or completion of an educational goal.

The passage of this bill denoted a shift in the operational goals of the community college system. Prior to this change, policies were designed to center around increasing student access to college. Programs such as subsidized federal loans and Pell grants served to create a larger and more diverse student body. However, low transfer and graduation rates of these student populations prompted lawmakers to shift the policy focus from student access to student success, and to develop and embrace measures of institutional performance that incorporate fiscal incentives into campus student performance.

When student success reforms were first debated, the most recent completion figure available was 48.8 percent from the 2010-11 school year for students who enrolled six years earlier (Data Mart, 2017). In the time since, the overall rate of student completion at the California Community College has remained largely unchanged, hovering at roughly 48 percent (Student Success Scorecard, 2017). While school officials state that implementation of the Student Success Act has made considerable progress, implementation remains slow and uneven and according to those officials, and

significant changes in completion rates should not be expected for another two to three years (Gordon, 2017).

Figure 4.



While the overall rate has remained largely flat, issues of equity arise when other factors are considered in completion rate. Different ethnic groups have experienced more drastic changes in completion rates, with Filipino student completion rates increasing by 6.2 percent over the last five years and African American student completion rates dropping by 3 percent (Student Success Scorecard, 2017). Additionally, there is a significant completion difference of roughly 30 percent between students considered college prepared and college unprepared, or those students made to take remedial coursework (Student Success Scorecard, 2017). This great variation in completion rates,

ranging from 28.9% overall completion rates at Los Angeles Southwest College to 64.4% at De Anza College. This study will rely upon these student completion variations at the campus level to conduct analysis.

Thesis Agenda

The purpose of this thesis is to quantitatively examine the discrete effects of administrative and faculty staffing compositions on student completion rates at the community college, keeping in mind budgetary restrictions from the 50% Law and Faculty Obligation Numbers. This leaves the questions: *To what extent does the composition of staffing levels of full-time, adjunct faculty, and administrators affect student completion rates at the community college level?*

Chapter Two will provide an overview of the limited existing empirical literature related to student college completion rates and the relationship to administrative support structures and classroom faculty interactions. This chapter will identify common themes by examining previous studies that have attempted to determine the effects of faculty type on factors related to student completion, such as graduation rate and persistence. In Chapter Three, I discuss my dataset from the California Community College system's public database, DataMart, and describe the quantitative methods used in my panel data regression analysis. Using six years of cohort data for student completion rates as my dependent variable and the number of staff (full-time faculty, part-time faculty, and administrators) per thousand students as my independent variables, I show that an increase in the use of both part-time and administrative staff show a small, but positive

effect on student completion rates. In Chapter Four, I provide deeper context for my regression by comparing my results to the legislative budgeting restrictions in place during the study to look at the effectiveness of said policies in increasing student success. Finally, in Chapter Five, I will provide an overall summary of my findings from the regression model. I will then provide recommendations, identify the limitations of my study, and discuss opportunities for further research on the topic.

Chapter 2

LITERATURE REVIEW

The following section is a review of existing literature surrounding variables found to effect student completion rates. After reviewing the empirical literature related to completion rates, I have organized this review into three broad topics: student characteristics, institutional characteristics, and student outcomes. Researchers studying the impact of these three factors on student completion rates and related metrics utilize multiple forms of statistical regression. A table included in Appendix A illustrates the diversity of these statistical methods within existing research.

Student Characteristics

Socioeconomic Status

A student's socioeconomic status or background impacts both student persistence and graduation rates. Chen and St. John (2011) looked at differences in student persistence depending on student socioeconomic background utilizing a hierarchical generalized linear model of 12,000 students from the Beginning Postsecondary Survey (BPS). The findings from the study showed that even after controlling for all other factors at individual, institutional, and state levels, substantial gaps exist in persistence rates with students who are attending their first higher education institution by socioeconomic status. Specifically, students from families with high socioeconomic status have a 55 percent higher chance of enrolling the following year than their low socioeconomic status peers. Given the financial resources required to attend college, it

logically follows that income level of students and their families affect graduation rates. While Chen and St. John (2011) found that low-income students are more responsive to financial aid in the form of grants or work-study, high-income students are less likely to need various form of financial assistance to pursue their studies and are 7 percent more likely to persist, holding other factors constant (Paulsen and St. John, 2002).

Students from a higher socioeconomic background tend to have parents with higher level of educational attainment. Research demonstrates that parent level of education impacts both a student's probability of enrolling in college and graduating (Choy, 2002). Analyzing data from the BPS, Choy (2002) ran a linear modeling study on 8,000 students and determined that students from a low socioeconomic background are twice as likely to persist to the second year (37%) if their parents held bachelor's degrees. Similarly, researchers claim that students perform better and are more likely to succeed when their families affirm their choices and encourage them to stay the course; this is especially important for low socioeconomic populations, which make up a larger portion of community college students than students at four-year institutions (Perna & Titus, 2005; Bound & Turner, 2010). Perna and Titus (2005) analyzed the role of parental involvement as a form of social capital on college enrollment and found the odds of enrolling in either a two-year or four-year college increase with the frequency with which the parent discusses with the student education-related topics, with an odds-ratio of 1.130 and 1.164 for two and four-year colleges respectively. The positive affect of socioeconomic status, parental attainment, and parental involvement in educational development for college-bound and college students is consistent across studies.

Academic Preparedness

Student level of preparedness and innate academic ability leaving high school is a strong predictor of student likelihood to succeed in college courses. Adelman (1999) utilized OLS and Logistic regressions to study a sample of the High School & Beyond/Sophomore cohort file and found that roughly 87 percent of students who complete a high school course load comprising four years of math, science, and English stay on track to graduate in college compared with a 62 percent persistence rate among those who did not complete comparable coursework. Finding similar results, Warburton, Bugarin, and Nunez (2001) studied a sample of 12,000 students from the Beginning Postsecondary Students Longitudinal Study and found that as the rigor of high school coursework increases for a student, so does the likelihood that they will persist to degree completion.

While it is important for all students to complete these types of classes prior to enrollment in college, opportunities to do so vary by factors such as race and class. For example, Hispanic, Black, and low-income students are more likely to attend public high schools with a high percentage of students from disadvantaged backgrounds (Adelman, 1999). These same groups of students are also less likely to attend a school that offers high-level math courses. As a result, course-taking patterns for these students are more likely to be in lower level math and English courses and less likely to participate in Advanced Placement exams (Adelman, 1999). Graduating high school without these

courses leaves students less prepared for higher education in comparison to their White and higher income peers who have taken these courses.

Institutional Characteristics

Student Faculty Interaction

Student-faculty interaction is an influential factor in college life for students because faculty can serve as both mentors and valuable resources for class material. Researchers Eagan and Jaeger (2008a) utilized logistic regressions to track the effect of "gatekeeper courses," or first-level courses in a series of courses, taught by adjunct faculty on a sample of roughly 30,000 students at four-year colleges and found that although students were 20 percent less likely to persist when taught be part-time faculty in a gatekeeper course, when controlling for students' prior and current academic achievement, academic major, and number of gatekeeper credits completed, the negative affects had less to do with the adjunct faculty's quality of instruction and more to do with their level of availability and accessibility on campus (Eagan & Jaeger, 2008a). The type of interaction that students report as being most important is contact with faculty outside the classroom (Wirt, 2010). Furthermore, students' perceptions of faculty members' availability and concern for them have positive and significant effects on persistence (Wirt, 2010). Wirt (2010) studied the relationship between faculty interaction and persistence through multiple regression employing the Community College Survey of Student Engagement to sample 1,990,347 students and found that "significant interaction" with faculty, as defined by the study, lead to a student retention rate of 81.3

percent. However, debate exists of whether the relationship is causal. Some say that students who have higher levels of persistence and a higher probability of graduating are more likely than others to seek out faculty interaction, instead of faculty interaction being the factor that leads to higher levels of persistence and graduation rates. Kuh and Hu (1999) claim that the effects of student faculty interaction on student outcomes vary between distinct groups of students. According to their study, students who are better academically prepared for college and those who devote more effort to their studies are 12 percent more likely to interact often with faculty. They offer two possible explanations; either the better prepared students are more assertive in seeking out faculty interaction, or, faculty offered cues to the better prepared students, such as comments on papers, that induced them to seek interaction (Kuh & Hu, 1999)

Current research on student engagement highlights the role of the student as a participant in their own learning experience. Literature on the subject defines student engagement as the amount of time and effort students invest in meaningful academic and extra-curricular opportunities and activities during college (Jones, 2011; Wirt, 2010). Students are more likely to persist and achieve at higher levels if they are more actively engaged with faculty and the academic material.

Additionally, most community college students are unlike their four-year counterparts. Research considers these students non-traditional, meaning that they are more likely to be older, financially independent, not to live at school, and only attend school part-time (Jones, 2011; Wirt, 2010). Studies by Jones (2011) and Wirt (2010)

suggest that these students particularly benefit from greater levels of engagement, and specifically, student-faculty interaction. Jones (2011) found full-time faculty to be more available through a survey of students throughout her sample of 112 institutions.

Support Programs for Incoming Students

Some institutions offer support programs for first year students to aid in the transition to college. Support programs vary by type, including: orientation, mentoring, peer tutoring, transition courses, and first-year seminars. Research finds that simply offering these programs does not guarantee an increase in either student persistence or graduation rates. According to research, support programs must be carefully designed based on the needs of an institutions at-risk populations to maximize the program's chance of success (Kuh, Cruce, Shoup, Kinzie & Gonyea, 2008; Dunphy, Miller, Woodruff & Nelson, 1987). However, colleges typically provide little guidance to help new students choose a program of study and develop a plan for completing it, leading to many students self-advising. This self-advising leads to nonlinear course-taking patterns that extend times to transfer or graduation (Karp, 2013). When asked, students indicate that being in a program with a well-defined pathway would improve their chances of persisting, completing, and transferring (Public Agenda, 2012).

Kuh *et al*. (2008) examined the impact of support programs that promote student engagement on graduation rates, controlling for student factors such as academic ability, race, and income. Their research model found that students are 72 percent more likely to persist to the second year if they participate actively in educationally effective activities,

defined in their study as: time spent studying, time spent in co-curricular activities, and a global measurement of institutional engagement. While quantitative research studies on the topic of support programs on graduation rates are not prevalent in the literature, existing qualitative literature corroborates these results through interviews of faculty and surveys of campus administrators (Dunphy *et al*., 1987).

Increase in Use of Part-Time Faculty

As community colleges have expanded their diverse educational offerings, they have continued to increase their reliance on part-time faculty (Rassen, Caplot, Jenkins & Johnstone, 2014). Part-time faculty provide institutions with the ability to be more economically efficient in managing financial resources, as part-time faculty are generally cheaper to employ than their full-time counterparts and offer greater flexibility to the institution (Rassen *et al*., 2014). While providing an avenue for greater economic efficiency, the increased employment of part-time faculty throughout the United States has drawn significant criticism from scholars, as part-time faculty are seen as threats to the level of quality in academic programs (Rassen, et al., 2014; Rogers, 2015; Eagan & Jaeger, 2008a).

As the hiring of part-time faculty has increased across community colleges in the last few decades, researchers have examined more closely the characteristics associated with part-time faculty at two-year colleges. In an analysis of faculty characteristics at community colleges throughout the United States, Wirt (2010) found that less than 8 percent of part-time faculty possessed a doctorate degree compared to more than 18

percent of full-time faculty in 2004. Additionally, Bryant (2014) found that adjunct faculty were more likely to work across multiple campuses, be teaching a course for the first time, and spend less time overall on campus outside of teaching hours. Eagan and Jaeger (2008b) concluded that adjunct faculty at community colleges felt a high level of dissatisfaction due to job security and lower employment benefits compared to fellow faculty potentially affecting the quality of their instruction and how long they stay in their positions. Contrary to this point, Ellingson, Gruys, and Sackett (1998) argue that although part-time employees often have more negative job attitudes than their full-time counterparts, there is no direct link between part-time workers' volition and their performance.

Some researchers assert that reliance on part-time faculty negatively impacts undergraduate education (Benjamin, 2002; Jacoby, 2006). Jacoby (2006) suggests that overreliance on part-time faculty undermines successful student integration and therefore, student persistence, because they may often be unavailable to students outside of class and often use less challenging instructional methods. Jacoby (2006) looked at a sample of 1,209 public two-year colleges across the United States in 2001 to study the relationship between graduation rates and the part-time faculty ratio to full to staff. The results of this study show that for every one percent increase in part-time faculty, there is a six percent decrease in completion rates.

While Jacoby's (2006) results show that higher rates of employing part-time faculty have a negative effect on graduation rates, empirical evidence does not fully

support these findings. On the other hand, several surveys of staff and administrators have suggested that contingent faculty members are at least as effective in delivering instruction when compared to their full-time counterparts (Gappa & Leslie, 1993; Baldwin & Chronister, 2001). This argument stems from two main points. First, contingent faculty tend to offer universities flexible scheduling options to meet the needs of students who may need to take classes late in the evenings or on weekends. These students are often the least likely to complete their degrees due to family obligations or employment, thus by offering more flexible course options, allows more opportunities for success for this population. Second, contingent faculty may be less burdened by research expectations and are thus able to spend more time concentrating on teaching and engaging with students. Unfortunately, there is little empirical evidence to support these claims and multiple counter arguments exist.

Student Outcomes

Persistence

In addition to providing insight into the characteristics of adjunct faculty, there are also findings that illustrate how exposure to adjunct faculty affects student outcomes. Much of this research, however, has focused almost entirely on students at four-year institutions. Using students as their unit of analysis, Eagan and Jaeger (2008a) found that students who had greater amounts of exposure to part-time faculty had a twenty percent reduced likelihood of persisting to the second semester. In 2011, Eagan and Jaeger replicated this study again controlling for institution types and found that the effects of

part-time faculty remained statistically significant, but only amounted to a two percent reduction in student retention. Particularly of note in this study, by controlling for type of institution, the study only included a single baccalaureate institution. Along the same lines, Ronco and Cahill's (2004) single-institution study concluded that students with the highest level of exposure to part-time faculty were thirteen percent less likely to persist into their second year of enrollment. Although part-time faculty exposure represented a significant negative predictor of student retention, they found that student background characteristics had the greatest explanatory power, such as a high score in high school GPA making students 65% more likely to persist.

Eagan and Jaeger (2008a) went a step further and broke out the category of "contingent faculty" used in the previous studies into three sub-categories. They compared graduate student instructors with full-time non-tenure track faculty, and part-time non-tenure-track instructors utilizing a logistic regression. Specifically, their study related to students' likelihood of persisting following a first-year course load of gatekeeper courses. While they also found a significant negative relationship, Eagan and Jaeger (2008a) concluded that of the three employment sub-categories, only part-time, non-tenure-track faculty had a significantly negative effect on student persistence to the second year, showing a one percent increase in part-time faculty exposure leading to a twenty percent reduction in persistence.

Degree Completion Rates

Ehrenberg and Zhang (2005) were the first to examine the correlation between increased hiring of part-time faculty and graduation rates. Their study utilized panel data from the College Board 1986-87 and 2000-01 and used OLS regression analysis to show that at American four-year and two-year institutions, other factors held constant, their results associate a ten percent increase in the percentage of part-time faculty with a 2.65 percent reduction in the institutions graduation rate (Ehrenberg & Zhang, 2005). Looking closely at their study reveals that their methodology may not address the full relationship between the variables. First, the dependent variable used in this study was four, five, and six-year graduation rates over a four-year period. This separation of rates is due to changes in how the College Board stored their data. They kept four-year graduation rates from 1986 to 1988, five-year rates from 1988 to 1998, and six year rates from 1999 to present. This is problematic when using a two-panel regression analysis because the time to completion for the first panel year is fifty percent less than the six-year rate used in the second panel.

Additionally, numerous studies have demonstrated the effect of other variables that have a significant effect on graduation rates, such as race/ethnicity, socioeconomic status, and academic preparedness prior to enrollment. Following Ehrenberg and Zhang's research, Jacoby (2006) also analyzed how the employment of adjunct faculty affects degree completion rates at public community colleges. Jacoby utilized data from the 2001 Integrated Postsecondary Education Data System (IPEDS) and expanded and improved on their regression model by including more detailed institutional control data such as, faculty to student ratio, part-time student ratio, and a subset of racial and ethnic

percentages as opposed to only having on “minority” category, as seen in Ehrenberg and Zhang’s research. Jacoby also included in his model state dummy variables, state community college enrollment, and state ratio of two to four-year students to account for geographic variation. When examining the three-year graduation rate at 1,209 community colleges throughout the United States and Puerto Rico, Jacoby (2006) found that a one-percent increase in the percentage of part-time faculty at a community college reduced graduation rates by six percent. However, he admits in his study he is not able to identify the specific reason that reliance on part-time faculty reduces graduation rates (Jacoby, 2006). This may be due to possible omitted variable bias within the study. Additionally, his use of single-level statistical techniques for multi-level data may have inappropriately biased his results (Eagan & Jaeger, 2008b). Bryant (2014) replicated this study using multivariable regression analysis and came to the similar conclusion that the percentage of total adjunct faculty employed hindered the academic performance of students and had a negative effect on graduation rates. These results negatively correlate ratio of part-time faculty and graduation rates at community colleges, but do not specifically note what about those part-time faculty contributes to the lower graduation rate or specify any subset of the student population that may be more affected.

Closing Thoughts

After examining the empirical studies described in this chapter there appears to be compelling evidence supporting a significant negative relationship between the increased use of contingent faculty and both persistence and degree completion rates, however, the magnitudes of statistically significant findings vary wildly, ranging from a one percent

increase in faculty lowering graduation rates by six percent (Jacoby, 2006) to a ten percent increase in part-time faculty lowering graduation rates by only 2.65 percent (Ehrenberg & Zhang, 2005). The literature demonstrates this negative relationship similarly across other factors such as first-year student persistence related to increases in part-time faculty levels.

Looking forward, improving data and policy changes within higher education necessitates further study of the subject. There are no California-specific studies administered on the correlation of staffing levels to student completion rates at the community college level. This is especially important due to the large shift in California education policy from focusing solely on college admittance, to student success and completion rates. Additionally, the California Community College, in-line with the 2011 Student Success Act, created a variable grouping multiple factors of student success, namely transfer rates, graduation rates, and academic goal achieved enabling research to study variables that affect student success instead of only a facet of that figure. Although it is increasingly clear that contingent faculty have a negative effect on student graduation rates at the community college level (Jacoby, 2006; Eagan & Jaeger, 2008), each of the studies had an identified statistical issue either related to a lack of control variables or utilizing single-level statistical techniques for multi-level data.

I plan to employ panel data regressions with data spanning six full cohorts of students, ranging from the 2004 cohort to the 2010 cohort, to negate some of the sampling bias seen in earlier single-institution studies. This data originates from

DataMart, the California Community Colleges' data warehouse, and will allow me to control for a multitude of factors at the institution level. I hope that by including six cohorts worth of data, I will be able to isolate the discrete effect part-time, full-time, and administrative staff have on student completion rates at the California Community Colleges. In chapter three, I will explain the statistical model and data set I use to evaluate the impact of staffing levels on student completion rates in depth.

Chapter 3

METHODOLOGY

As the previous chapter's review demonstrates, research on the topic of student completion gravitates around individual-level data, allowing researchers to isolate and identify factors that aide both student persistence and degree completion rates. My study focuses on institution-level data and will study how institutions' student populations progress towards completion through a review of the type and number of staff on campus. My sample includes the full population of institutions within the California Community College system (CCC) that possess cohort data for the years spanning 2005 to 2010. This generates 654 campus observations that then split into 6 student cohort years of data for 109 campuses. By examining the characteristics of institutions at the institutional level, I hope to shed light on actionable state policy that can structurally bring about changes in staffing to assist in increasing student completion rates.

This chapter will first explain my regression method I have chosen to analyze my data to answer the question: *To what extent does the composition of staffing levels per student of full-time faculty, part-time faculty, and administrators affect student completion rates at the community college?* Secondly, I will discuss the theoretical model my regression follows to examine my data set. Lastly, I will describe my dependent variable, explanatory variables, and the control variables together with their expected effects on student completion rates.

Regression Method

The regression I chose to run my study is a panel data regression. Because I have observations that span both time and locations in a cross-section, a panel data regression gives more efficient estimates due to increased sample sizes over time. Additionally, panel data allows this study to control for unobserved or unmeasurable sources of individual heterogeneity that may vary between campus locations, but do not vary over time. This type of control for omitted variable bias is especially important considering the nature of my dataset. For example, because all the data are located at the institution-level, it becomes difficult to include variables that are derivatives of geography. Community college campuses offer services for many students, both local and commuters. This changing geography by student varies between individuals but does not change over time. Utilizing a panel data regression then structurally controls for variables like this that influence the dependent variables at college sites and remain constant over all the years observed in the study.

Within my panel data regression, I employ a fixed-effects (FE) model. Specifically, a FE model explores the relationship between predictor and outcome variables within a location. Like the structural controls implemented through a panel data regression, using a FE model assumes there are variables outside of the theoretical model that do not change. The FE model is then able to control for these variables by removing the effect of those time-invariant characteristics, so the model can assess the net effect of the key explanatory variables on the dependent variable. This culminates in a FE table,

enabling the results to demonstrate how an increase of one in one of the three key explanatory variables affects the dependent variable.

Theoretical Model

As established in the literature review, most factors that predict student success fall within two main categories: student and institutional characteristics. Following these models from the literature, I include variables to account for both sets of characteristics. Additionally, this regression model accounts for the fixed effects of both college and cohort year within the community college system. Accounting for these factors, the following theoretical model defines the regression:

$$\text{Student Completion Rate} = \boldsymbol{\beta 0} + \boldsymbol{\beta 1}\,(\text{School Characteristics}) + \boldsymbol{\beta 2}\,(\text{Student Characteristics}) + \boldsymbol{\beta 3}\,(\text{Cohort Year}) + \boldsymbol{\beta 4}\,(\text{College Fixed Effect})$$

where

School Characteristics = f(Students, Part-Time Faculty Per Thousand Students, Tenured Faculty Per Thousand Students, Educational Administrator Per Thousand Students)

Student Characteristics = f(Percentage Pell Recipients, Percentage EOP, Percentage Female, Percentage Age 20 to 24, Percentage Age 25 to 29, Percentage Age 30 to 34, Percentage Age 35 to 39, Percentage of Age 40 49, Percentage Age 50 Plus, Percentage African American, Percentage Native American, Percentage Asian, Percentage Filipino, Percentage Hispanic, Percentage Pacific Islander, Percentage of Unknown Race)

Cohort Year = f(Cohort Year 05 Dummy, Cohort Year 06 Dummy, Cohort Year 07 Dummy, Cohort Year 08 Dummy, Cohort Year 09 Dummy)

College Fixed Effect = f(College Campus Index)

Variables

I accessed data from the California Community College system's DataMart (http://datamart.cccco.edu/) databases. This database tracks information on students, courses, student services, outcomes, and faculty/staff information. Data in this study originate from the 2005 to 2010 cohorts of students. Despite being the system's official record for tracking statistics of both the student body and the administration, the data may be subject to some inaccuracies stemming from survey error due to students potentially reporting inaccurate information to the system's database. The remainder of this section explains each variable grouping in more detail and offers justification for the inclusion variables within the model. As shown in Table 1, the section also discusses the expected effect each independent variable will have on the dependent variable.

Table 1: Independent Variables and Expected Effects on Student Completion Rates

Variable	Description	Expected Effect
Student Characteristics		
Pell	Percentage of Pell grant recipients	-
Female	Percentage of Females	+
(Male)	Percentage of Males	Reference
EOP	Percentage of EOP recipients	-
(Age 19 or Less)	Percentage of Age 19 or less students	Reference
Age 20 to 24	Percentage of Age 20 to 24 students	+

Variable	Description	Expected Effect
Age 25 to 29	Percentage of Age 25 to 29 students	+
Age 30 to 34	Percentage of Age 30 to 35 students	-
Age 35 to 39	Percentage of Age 35 to 39 students	-
Age 40 to 49	Percentage of Age 40 to 49 students	-
Age 50 Plus	Percentage of Age 50 Plus students	-
African American	Percentage of African Americans	+
Native American	Percentage of Native Americans	+
Asian	Percentage of Asians	+
Filipino	Percentage of Filipinos	-
Hispanic	Percentage of Hispanics	-
Pacific Islander	Percentage of Pacific Islanders	-
Unknown Race	Percentage of Unknown Race	+
(White)	Percentage of Whites	Reference
School Characteristics		
Students	Number of students	-
Part-Time Faculty	Part-time faculty per thousand students	-
Tenured Faculty	Tenured faculty per thousand students	+
Educational Administrator	Educational administrator per thousand students	+
(Classified Employees)	Classified employees per thousand students	Reference
Cohort Year		
(Cohort 05)	Dummy Variable for Cohort Year = 2005	Reference
Cohort 06	Dummy Variable for Cohort Year = 2006	?
Cohort 07	Dummy Variable for Cohort Year = 2007	?
Cohort 08	Dummy Variable for Cohort Year = 2008	?
Cohort 09	Dummy Variable for Cohort Year = 2009	?
Cohort 10	Dummy Variable for Cohort Year = 2010	?
College Fixed Effect		
College Campus Index	Index variable for college campus	Reference

**Data for all variables gathered from Community College Database DataMart*

Dependent Variable

The dependent variable indicates the rate at which degree and/or transfer seeking, first-time students succeed in completing a degree, certificate, transfer related outcome,

or educational goal within six years. This variable combines the success outcomes of studies found throughout the literature to capture the spectrum of educational outcomes that the CCC defines as success.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Student Characteristics					
Pell	654	13.72%	8.32%	0.36%	68.70%
Female	654	54.84%	6.86%	17.77%	71.24%
(Male)					
EOP	654	4.34%	2.63%	0.86%	15.29%
(Age 19 or Less)					
Age 20 to 24	654	26.61%	5.34%	8.89%	39.36%
Age 25 to 29	654	12.73%	2.23%	8.03%	24.02%
Age 30 to 34	654	7.90%	1.85%	3.51%	14.19%
Age 35 to 39	654	6.36%	1.82%	2.79%	15.59%
Age 40 to 49	654	10.04%	3.01%	4.18%	24.58%
Age 50 Plus	654	10.41%	6.06%	2.92%	29.67%
African American	654	8.26%	9.39%	0.57%	66.63%
Native American	654	1.03%	0.93%	0.04%	7.38%
Asian	654	10.08%	8.90%	0.47%	37.87%
Filipino	654	3.29%	2.78%	0.17%	18.08%
Hispanic	654	28.07%	14.97%	5.64%	86.24%
Pacific Islander	654	0.83%	0.61%	0.00%	4.78%
Unknown Race	654	11.03%	6.24%	0.44%	64.63%
(White)					
School Characteristics					
Students	654	23038	13115	2865	69624
Part-Time Faculty	654	32.70%	17.27%	0.43%	76.38%
Tenured Faculty	654	13.96%	7.46%	0.12%	33.51%
Administrative Employees	654	1.59%	1.28%	0.00%	9.47%
(Classified Employees)					

Cohort Year					
(Cohort Year 05)					
Cohort Year 06 Dummy	654	-	-	-	-
Cohort Year 07 Dummy	654	-	-	-	-
Cohort Year 08 Dummy	654	-	-	-	-
Cohort Year 09 Dummy	654	-	-	-	-
Cohort Year 10 Dummy	654	-	-	-	-

School Characteristics/Key Explanatory Variables

The three key explanatory variables of the regression located within school characteristics are: tenured faculty per thousand students, part-time faculty per thousand students, and educational administrators per thousand students. These variables, following the results of the regression, explain the relationship between campus staffing levels and student completion rates. Following my review of the literature, I expect both tenured faculty and educational administrators to demonstrate a positive effect on student completion rates, and for part-time faculty to have an overall negative effect. Additionally, I include number of students both as a variable to inform the size of each campus and as a tool to provide a frame of reference for the staffing levels of each campus.

Student Characteristics

As discussed in the literature review, differing student characteristics can have a profound effect on student success. I attempt to control for socioeconomic characteristics within the student body by included both the Pell grant recipients and EOP variables.

Pell grants are eligible to families with total incomes under $50,000, however most Pell grant money awards to students with a total family income below $20,000. Similarly, Educational Opportunity Program (EOP) grants prioritize students from both low-income backgrounds and their status as first-generation students. The purpose of the EOP grant is to find students who have the potential to perform well but have not been able to realize their potential due to economic factors. I anticipate that while Pell will have a negative relationship, EOP will have a positive relationship with student completion rates because while both indicate low socioeconomic status, the EOP variable identifies potentially high-performing students.

Additionally, I have included variables to control for ethnicity and age group. Ethnic groups achieve "student completion" with varying degrees of success. In the most recent year, within the 2010 cohort of students in the dataset, Asian students achieved completion 65.1 percent of the time while Hispanic students completed only complete 41.1 percent of the time, with the other races falling in between. Similarly, within the same cohort, students under 20 years old graduated 51.4 percent of the time, while students over the age of 40 graduated 32.2 percent of the time, with the remainder of age groups falling in between. Including these descriptive student characteristics allows the regression to control for these differences between students. Table 1 describes the anticipated effect each of these variables will have on student completion rates. These effects will be relative to the base category excluded in each variables classification's case. For the purposes of this study, I utilize the following reference variables: Male, Age 19 or Less, White, Classified Employees, and Cohort Year 5 Dummy. The

regression coefficients derived from the analysis are relative to these base categories and determine which variables receive p-values in the analysis.

Fixed-Effect Variables

I created two FE variables within my dataset. First, the cohort year dummy variables provide a longitudinal view of data as well as expanding the sample of available data to run statistics. Second, the college campus index denotes fixed locations for reach institution. Both variables are necessary to panel the dataset and create the hierarchy within my data to expand my sample. By paneling the dataset using these variables, I increase the available data by six times to increase the specificity of my regression.

Chapter 4

REGRESSION RESULTS

In this chapter, I will report the results of my regression analysis studying the relationship between staffing type and overall completion rates at the California Community College. In addition, I will discuss the three different equations I used to analyze the data. I have included a functional forms table showcasing regression results for each variable under each equation. I will then describe the error tests I conducted to determine the presence and severity of heteroskedasticity and multicollinearity. Lastly, I will present an analysis of significant variables and potential implications of those results.

Functional Forms

All three functional forms presented utilize a panel data form with fixed effects. This type of regression allows the study to best account for, and isolates, cohort years and campus locations for each variable. The regression utilizes fixed effects estimations, instead of random effects. Fixed effects assume that individual specific influences remain fixed for each variable. By using the College Index variable, I have assigned fixed locations to test this against. To determine if this is the correct method to run the data, I ran a Hausman test to verify that fixed effects are preferable to random effects for this model. The results of the test indicated it appropriate to reject the null hypothesis that differences in coefficients were not systematic with 99.9% confidence, indicating that fixed effects better suit this dataset.

To determine which regression form best fits my study, I tested Linear-Linear (Lin-Lin) regression, Logged-Linear (Log-Lin) variable regression, and Logged-Logged (Log-Log) regression. Each of these three types of regressions represent generalized linear model (GLM) procedures and depending on the dataset, each may fit better than the others. Statistically, linear regressions assume that errors or skewing in the data are normally distributed. When a dataset is not normally distributed and skewed, using logs of variables can help mitigate that skewing. In a Log-Lin regression, the model uses a log of the dependent variable while the other variables remain linear, or without change. In the Log-Log regression, both the dependent and independent variables run using their logs.

Table 3: Functional Forms Table

Functional Forms Table						
	Model 1: Lin-Lin		**Model 2: Log-Lin**		**Model 3: Log-Log**	
	Coef.	**Std. Error**	**Coef.**	**Std. Error**	**Coef.**	**Std. Error**
Constant	53.896	6.614	3.898	0.154	5.959	0.723
Part-Time Faculty	-0.067*	0.054	-0.001	0.001	0.001	0.022
Tenured Faculty	0.280**	0.131	0.006**	0.003	0.010	0.021
Administrative Employees	-0.245	0.386	-0.004	0.009	-0.009	0.010
Female	0.070	0.071	0.002*	0.001	-0.106	0.105
Students	-0.000	0.000	0.000	0.000	-0.073*	0.038
Pell	-0.081**	0.033	-0.001**	0.000	0.023	0.014
EOP	0.022	0.064	0.001	0.001	-0.006**	0.002
Age 20 to 24	0.043	0.113	0.001	0.002	-0.185	0.067
Age 25 to 29	-0.479**	0.235	-0.011**	0.005	0.049	0.079
Age 30 to 34	-0.510*	0.296	-0.011	0.006	-0.092	0.061
Age 35 to 39	0.250	0.333	0.006	0.007	-0.017	0.056
Age 40 to 49	-0.021	0.186	0.000	0.004	-0.090	0.055

	Model 1: Lin-Lin		Model 2: Log-Lin		Model 3: Log-Log	
	Coef.	**Std. Error**	**Coef.**	**Coef.**	**Std. Error**	**Coef.**
Age 50 Plus	-0.014	0.083	0.000	0.001	0.064**	0.025
African American	0.047	0.103	0.000	0.002	0.000	0.015
Native American	0.697	0.6	0.021	0.014	-0.010	0.017
Asian	-0.011	0.118	0.000	0.002	-0.009	0.026
Filipino	-0.140	0.315	-0.002	0.007	0.031	0.023
Hispanic	-0.053	0.062	0.000	0.001	-0.089**	0.037
Pacific Islander	0.150	0.46	0.000	0.010	-0.010	0.008
Unknown Race	-0.033	0.035	0.000	0.000	-0.033	0.032
Observations	654		654		654	
Stat. Significant Variables	5		4		4	
Within R-Squared	0.2114		0.2100		0.2410	
Between R-Squared	0.0749		0.0264		0.0209	
Overall R-Squared	0.0861		0.0405		0.0337	

The Log-Lin and Log-Log regression both resulted in four significant variables. The Lin-Lin regression model resulted in five significant variables. Each of the former regression models also resulted in significantly lower regression coefficients across all variables. Conversely, the Linear form maintained relatively higher levels of coefficient effects. Of the main independent variables, the Lin-Lin regression model resulted in most significant variables, with both Tenured Faculty and Part-Time Faculty reaching levels of statistical significance. While the Log-Log regression model resulted in the highest R-Squared of 0.2410, it found fewer statistically significant variables than the Lin-Lin model, which resulted in a R-Squared of 0.2114. Therefore, due to the Lin-Lin

model resulting in the greatest number of statistically significant variables, this thesis employs the Lin-Lin model to run the panel regression.

Heteroskedasticity and Multicollinearity

Heteroskedasticity occurs when a regression inconsistently predicts an outcome across the independent variables, resulting in overconfidence in the statistical significance of the results. To test for heteroskedasticity, I ran a Breusch-Pagan specification test, which uses the squared residuals of the explanatory variables to identify differing variance. The results generated a chi-squared value of 1.08 and a p-value of 0.3225 suggesting that heteroskedasticity is not a significant problem within the model.

Table 4: VIF Values for Independent Variables

Variable	VIF
AGE_3539_PER	27.73
AGE_3034_PER	22.72
AGE_4049_PER	16.61
AGE_2024_PER	9.44
AGE_2529_PER	8.56
AGE_50PLUS~R	4.01
PELL_PER	3.29
COHORT06	3.29
COHORT07	3.18
HISPANIC_PER	2.93
STUDENTS	2.91
NATAMER_PER	2.84
COHORT05	2.57
EOP_PER	2.55
COHORT08	2.53
ASIAN_PER	2.34

Variable	VIF
FEMALE_PER	2.17
COHORT09	1.98
FILIPIN_PER	1.89
ACAD_TENUR~R	1.87
AFAM_PER	1.86
ACAD_TEMP_~R	1.79
PACISLAN_PER	1.69
UNKNOWN_RA~R	1.39
ED_ADMIN_PER	1.31
Mean VIF	5.44

Multicollinearity likely exists between independent variables that are highly correlated with one another. This relationship biases results of a study by affecting the statistical significance amongst explanatory variables. I ran two tests to detect multicollinearity. First, I generated a pairwise coefficients table for all independent variables. If the coefficient shown in the diagram exceeds 0.8 this indicates the existence of multicollinearity. As shown in Appendix B, two values are multicollinear. These are a value of 0.8611 between Age 30 to 34 and Age 25 to 29 students, and 0.9116 between Age 35 to 39 and Age 40 to 49 students. However, both instances are between age grouping variables only used as controls and thus will not significantly distort findings between the key explanatory variables and dependent variables. In addition to the first test, I run a Variance Inflation Factors (VIF) table. Table 4 provides the output of this test. A VIF of five or higher indicates the potential existence of multicollinearity and a value of ten or above represents high multicollinearity. Although three variables exhibit a score above ten, they all are control variables within the age group and will not require changes to the model. This test corresponds with the previous pairwise coefficients table,

adding one additional value demonstrating multicollinearity. The way the data groups together within the age category make sense that some multicollinearity could be present. The three key explanatory variables describing staffing types, ACAD_TENUR~R, ACAD_TEMP~R, and ED_ADMIN_PER all exhibit low VIF scores. Therefore, multicollinearity is not a problem within the model.

Analysis of Significant Variables

Key Explanatory Variables

Consistent with the literature, the sign of the coefficient for the Tenured Faculty variable is positive, though the effect is small. An increase of one tenured faculty member per thousand students predicts a 0.28% increase in the student completion rate with 95% confidence. Also, consistent with the literature, the regression model found the coefficient for Part-Time Faculty is negative, showing an increase of one faculty member per thousand students predicting a -0.067% decrease in student completion rate with 90% confidence. To put these results into perspective the mean of the dependent variable, Student Completion Rate, is 46.94% and the standard deviation is 8.07%. While these findings affirm recent research on the effects of both faculty types, the effects are small (Ehrenberg & Zhang, 2004; Jacoby, 2006; Rogers, 2015; Wirt, 2010). However, there are several key differences between the findings reported in these studies and my results. For example, Ehrenberg & Zhang (2004) used a combination of four, five, and six-year graduation rates in their two-panel regression analysis, and Wirt (2010), using student level data, did not run a panel data regression to isolate campus variables. By controlling

for geographic factors using institution, my result controls for significant outliers in the dataset. The implication of this result follows that, controlling for other factors, full-time tenured faculty have the largest positive effect on student completion rate across all staffing types at the community college, while increases in part-time faculty has a minor negative effect on student completion rate. This result is consistent with current state policy promoting the hire of full-time staff over part-time professors.

The model did not find Administrative Staff to be statistically significant.

Table 5: Significant Variables

Significant Variables: Lin-Lin Model		
Variable	*Coefficient*	*Standard Error*
Tenured Faculty	0.280**	0.131
Part-Time Faculty	-0.067*	0.054
Pell	-0.081**	0.033
Age 25 to 29	-0.479**	0.235
Age 30 to 34	-0.510*	0.296
Interaction Terms		
Pell & Tenured Faculty	0.311*	0.680
Pell & Part-Time Faculty	0.086**	0.195

Institution Characteristics

Among the other control variables in the model, the Pell variable is the only institutional characteristic that remained statistically significant. With 95% confidence, a one percent increase in students at a specific campus receiving Pell grant funding results in a -0.081% increase in student completion rates. While the variable has a high degree

of significance, the actual positive effect on student completion rates is small. Low income students generally struggle to navigate and access student services, so Pell grant recipients likely catches a percentage of that group of students who have received some form of guidance towards campus resources raising their likelihood of completion.

Student Characteristics

Interestingly, only two of my student characteristic variables are statistically significant. Age 25 to 29 and Age 30 to 34. Age 25 to 29 is significant at 95% confidence and demonstrates a coefficient stating that a one percent increase in the variable leads to a -0.479% decrease in student completion rates. Similarly, the Age 30 to 34 variable is significant at 90% confidence with an increase of one percent decreasing student completion rates by -0.510%. These results demonstrate that students who fall between ages 25 and 34 are statistically less successful at reaching completion than the youngest age group that I left out as a base. Many potential factors could influence this, such as students in that age group having a less defined educational goal, being less likely to take advantage of campus programs, or more likely to be working than their younger counterparts.

Interaction Terms

To determine whether the effect on student completion rates of my three key explanatory variables, Tenured Faculty, Part-Time Faculty, and Administrative Staff, varies by percentage of Pell grant recipients on campus I added interaction terms to the

model for each type of staff (per thousand students) and percentage of Pell grant recipients.

Table 6: Regression with Interaction Terms

Regression with Interaction Terms		
Variable	*Coefficient*	*Standard Error*
Constant	54.074	6.711
Part-Time Faculty	-0.063*	.081
Tenured Faculty	0.266*	.174
Administrative Employees	-0.295	.528
Female	0.070	.072
Students	-0.000	.000
Pell	-0.088*	.090
EOP	0.022	.064
Age 20 to 24	0.041	.115
Age 25 to 29	-0.478**	.236
Age 30 to 34	-0.513*	.299
Age 35 to 39	0.258	.337
Age 40 to 49	-0.023	.188
Age 50 Plus	-0.014	.084
African American	0.046	.103
Native American	0.696	.608
Asian	-0.010	.119
Filipino	-0.144	.318
Hispanic	-0.053	.063
Pacific Islander	0.155	.466
Unknown Race	-0.033	.035
PellPartTime	0.086**	0.195
PellFullTime	0.179*	0.680
PellAdminStaff	0.275	1.938
Observations	654	
Stat. Significant Variables	7	
Within R-Squared	0.2115	
Between R-Squared	0.0732	
Overall R-Squared	0.0845	

Two of these three interaction terms were statistically significant within the model, PellFullTime and PellPartTime. These interaction terms describe the effect over and above the discrete effect of each individual variable, meaning that each term describes the effect of a specific staffing type when the campus contains more Pell grant recipients.

The level of significance for Tenured Staff when combined with Pell is significant at the 90% confidence level and its coefficient transformed to show that a one percent increase in the interaction term leads to a 0.311% increase in completion rates. This is a stronger effect than the Tenured Faculty variable alone. Additionally, interacting the Pell variable with Part-Time Faculty shows significance at the 95% confidence level and suggests that a one percent increase in the interaction term amounts to a 0.086% increase in completion rates. This is a significant shift, as Part-Time Faculty originally demonstrated a negative coefficient of -0.067, but when interacted with Pell, changes to positive.

Interestingly, the implications of these results suggest student completion rates, as they pertain to increasing staffing levels, experience diminishing returns as the percentage of Pell grant recipients at a campus decreases. Furthermore, these results demonstrate that increases in full-time faculty are most effective at schools with high percentages of Pell grant recipients, and at those campuses, increases in both part-time faculty and administrative staff become statistically significant. Another interesting effect of the interaction between terms is that Part-Time Faculty, while a negative effect

alone, transforms into a positive coefficient when interacted with the Pell variable. This suggests that schools in lower socioeconomic areas with greater numbers of Pell grant recipients experience greater effects on student completion rates from increases in staffing levels than schools in higher socioeconomic areas with fewer numbers of Pell grant recipients, and the positive effects experienced from increasing part-time faculty levels at a campus also diminishes at higher socioeconomic campuses.

In the following chapter, I will discuss what these results mean relative to the current funding structure of the California Community College system as it pertains to staffing and provide broad-based policy recommendations with consideration to these findings. Lastly, I will detail opportunities for further research into student completion rates at the California Community College.

Chapter 5

CONCLUSION

The purpose of this study is to identify how staffing roles within the community college system influence student completion rates and, if feasible, to provide recommendations on policies that could increase student completion rates. I obtained six years of cohort data across all the available campuses in the California Community College system. I then used panel regression analysis to identify the statistically significant factors that impacted student completion rates and measured the magnitude of their effects.

In this chapter, I begin by presenting the implications of my study results. Following this I introduce my recommendation for community colleges in California to increase student completion rates. Lastly, this chapter concludes by explaining the limitations of my study and identifying opportunities for further research.

Implications of Results

The regression results for this thesis imply that staffing levels of full-time and part-time teachers have a small but statistically significant effect on increasing and decreasing student completion rates, respectively. At the same time, the results suggest that through interaction with the Pell variable that campuses experience diminishing positive effects on student completion rates related to additional faculty, regardless of type, as the percentage of Pell grant recipients goes down.

These results carry implications for state funding policy by supporting policy to favor full-time faculty over part-time. As a stand-alone variable, full-time faculty showed a stronger positive effect on student faculty than part-time faculty. When considering these results in relation to legislative funding rules governing the community college system, such as the 75/25 Ratio or Faculty Obligation Number (FON), this regression strongly supports current legislative policy aimed towards increasing levels of full-time faculty.

However, part-time faculty also showed a positive effect when interacted with the Pell variable. In schools with higher percentages of Pell grant recipients, an increase in part-time faculty demonstrated a positive impact on student completion rates with diminishing returns as the percentage of Pell recipients drops. In practice, this finding may be demonstrated in schools in poorer areas of the state, where they may be dealing with overcrowding in the classrooms or simply fewer faculty on campus. Therefore, poorer schools may be experiencing this positive effect simply due to faculty filling empty or overcrowded classrooms. This suggests that, under the current funding formula, high Pell grant recipient schools may be unable to maximize their financial resources to fill their classrooms through hiring part-time faculty due to statutory obligations. Although the legislature's current policy aim is to increase the numbers of full-time faculty members at all California Community College institutions, lawmakers continue to constrain financial resources required to realistically achieve this goal in the state budget. Additionally, recent large fluctuations in the state education budget may make it difficult for districts to hire full-time faculty as they are a long-term investment.

Table 7 demonstrates a practical application of this thesis' results, acting as a predictive model to forecast the effect that a ten percent increase in part-time faculty, and then separately the effect a ten percent increase in full-time faculty has on student completion rates. The Community College data used in the table originates from the most recent available cohort year 2011-2012. The predictive model uses these data points to ascertain the effects of staffing level changes through interaction with regression coefficients. The below formula demonstrates the calculation:

Base value = (Regression coefficient * Staffing variable) + (Regression coefficient*(Staffing variable * Pell variable))

Increased staffing value = (Regression coefficient * (1.1) Staffing variable) + (Regression coefficient*((1.1) Staffing variable * Pell variable))

Increase in student completion rate = (Increased staffing value – base value)

Within the table, this calculation runs for each statistically significant staffing type, for each campus contained within the study. As discussed previously, campuses experience diminishing returns from increased staffing levels as percentage of Pell grant recipients decreases. This is true for both part-time and full-time faculty. An interesting finding within the table is that as Pell grant percentages reach their lowest for campuses, increases in part-time faculty show decreasing student completion rates, while full-time faculty continue to maintain a positive, albeit lower effect on student completion rates at lower Pell levels.

Table 7: Effects of Increases in Part-Time and Full-Time Faculty by Campus

Effects of Increases in Part-Time and Full-Time Faculty by Campus							
College Name	**Student Count**	**Pell Grant**	**Part-Time Faculty per Thousand Students**	**Full-Time Faculty per Thousand Students**	**Student Completion Rate**	**10% Increase in Part-Time Faculty**	**10% Increase in Full-Time Faculty**
Imperial	9,978	52.4%	18.64	14.03	46.6%	4.7%	7.0%
Barstow	5,020	52.2%	20.72	5.78	39.9%	5.2%	2.9%
Porterville	5,491	49.5%	13.48	11.84	45.1%	3.1%	5.8%
Antelope Valley	18,150	49.3%	22.20	9.97	41.8%	5.2%	4.9%
Copper Mountain	3,064	46.5%	30.68	10.77	30.0%	6.6%	5.1%
Butte	18,335	44.8%	27.98	9.16	45.8%	5.7%	4.3%
Merced	15,750	43.4%	20.32	10.98	38.8%	4.0%	5.1%
Bakersfield	23,985	42.9%	10.09	10.30	41.8%	2.0%	4.7%
Yuba	9,986	42.7%	19.03	9.01	44.6%	3.7%	4.1%
Sequoias	14,902	42.2%	18.25	10.40	43.6%	3.5%	4.8%
Long Beach	33,912	40.8%	17.25	9.26	39.5%	3.1%	4.2%
Victor Valley	17,184	40.7%	26.13	6.81	32.8%	4.7%	3.1%
Chaffey	24,110	38.7%	25.72	8.05	43.0%	4.3%	3.6%
Cerritos	30,833	38.5%	14.98	9.37	41.0%	2.5%	4.1%
Desert	13,164	38.2%	23.78	8.20	40.8%	3.9%	3.6%
Redwoods	8,256	37.5%	26.41	10.54	35.4%	4.3%	4.6%
San Joaquin Delta	25,383	36.5%	11.03	8.04	48.8%	1.7%	3.5%
Fresno City	28,230	35.9%	21.64	10.91	41.4%	3.3%	4.7%
Modesto	23,693	35.7%	13.08	9.62	42.9%	2.0%	4.1%

College Name	Student Count	Pell Grant	Part-Time Faculty per Thousand Students	Full-Time Faculty per Thousand Students	Student Completion Rate	10% Increase in Part-Time Faculty	10% Increase in Full-Time Faculty
Oxnard	9,998	35.6%	12.90	8.60	44.5%	1.9%	3.7%
Siskiyous	3,886	33.5%	36.54	12.09	46.8%	5.0%	5.1%
Riverside	26,959	33.0%	14.99	8.01	41.9%	2.0%	3.4%
San Diego City	23,314	32.2%	20.67	7.94	45.5%	2.7%	3.3%
Shasta	12,727	31.0%	22.08	9.35	42.6%	2.7%	3.8%
LA Harbor	14,230	30.7%	20.52	5.69	42.6%	2.5%	2.3%
Mt. San Jacinto	20,661	30.3%	34.51	7.26	43.2%	4.0%	3.0%
Citrus	16,715	30.0%	11.91	9.27	51.3%	1.4%	3.8%
Sierra	25,160	29.7%	25.08	8.78	50.8%	2.9%	3.6%
Reedley College	19,230	29.5%	21.53	9.36	47.5%	2.4%	3.8%
West Hills Coalinga	4,490	29.3%	9.80	8.69	49.0%	1.1%	3.5%
West LA	14,426	28.9%	18.99	5.34	37.9%	2.1%	2.1%
LA Swest	12,352	28.5%	15.30	4.53	32.5%	1.6%	1.8%
LA Valley	26,991	28.2%	12.37	6.59	46.1%	1.3%	2.6%
LA Mission	14,345	27.7%	17.71	4.39	37.9%	1.8%	1.7%
LA Pierce	29,372	27.3%	17.02	5.96	52.0%	1.7%	2.4%
Mendocino	6,015	26.7%	36.74	8.65	39.7%	3.5%	3.4%
Glendale	28,294	26.4%	18.77	8.02	51.4%	1.8%	3.1%
San Bernardino	16,593	26.3%	18.62	9.10	36.7%	1.7%	3.6%
American River	46,557	25.4%	12.97	8.51	42.5%	1.1%	3.3%
Cypress	19,604	25.2%	19.13	10.10	50.5%	1.7%	3.9%
LA Trade	25,274	25.2%	10.09	6.25	38.6%	0.9%	2.4%

College Name	Student Count	Pell Grant	Part-Time Faculty per Thousand Students	Full-Time Faculty per Thousand Students	Student Completion Rate	10% Increase in Part-Time Faculty	10% Increase in Full-Time Faculty
Contra Costa	12,229	25.1%	17.09	6.71	47.6%	1.5%	2.6%
Hartnell	13,908	25.0%	18.84	6.40	45.5%	1.6%	2.5%
Ventura	20,238	24.8%	15.12	6.97	49.6%	1.3%	2.7%
Los Medanos	13,340	24.6%	15.82	8.25	48.3%	1.3%	3.2%
Cuyamaca	12,604	24.0%	20.63	6.35	45.9%	1.6%	2.4%
Chabot Hayward	18,660	23.9%	14.90	9.32	46.0%	1.2%	3.5%
Evergreen Valley	16,529	23.9%	11.49	6.90	46.6%	0.9%	2.6%
Sacramento City	35,554	23.3%	11.84	8.83	48.8%	0.9%	3.3%
El Camino	32,898	23.0%	15.84	9.76	47.8%	1.2%	3.7%
Golden West	17,772	22.9%	16.43	6.86	56.0%	1.2%	2.6%
LA City	33,714	22.9%	14.30	5.40	37.5%	1.0%	2.0%
San Francisco	47,870	22.7%	20.97	16.92	53.0%	1.5%	6.4%
Mt San Antonio	52,953	22.7%	15.13	7.48	48.0%	1.1%	2.8%
Cabrillo	18,933	22.5%	19.01	10.77	45.9%	1.3%	4.0%
Pasadena	37,355	22.4%	19.22	9.66	55.9%	1.3%	3.6%
Solano	16,097	22.1%	15.78	9.44	48.5%	1.1%	3.5%
Napa	9,665	22.0%	26.28	9.21	51.2%	1.8%	3.4%
Cosumnes River	20,495	21.8%	11.17	8.69	41.5%	0.7%	3.2%
Grossmont	25,244	21.5%	21.67	8.44	48.0%	1.4%	3.1%
East LA	58,561	21.5%	9.96	4.03	41.2%	0.6%	1.5%
Columbia	4,562	21.1%	20.60	10.30	40.6%	1.3%	3.8%
Feather River	3,021	20.7%	19.53	7.61	48.8%	1.2%	2.8%

College Name	Student Count	Pell Grant	Part-Time Faculty per Thousand Students	Full-Time Faculty per Thousand Students	Student Completion Rate	10% Increase in Part-Time Faculty	10% Increase in Full-Time Faculty
Fullerton	26,169	20.7%	15.09	10.85	53.4%	0.9%	4.0%
San Jose City	14,861	20.5%	17.90	6.66	44.5%	1.0%	2.4%
Rio Hondo	30,574	19.8%	11.74	6.28	39.0%	0.6%	2.3%
Santa Barbara	26,616	19.7%	16.31	9.20	62.0%	0.9%	3.3%
Mission	16,573	19.2%	13.64	8.51	50.3%	0.7%	3.1%
Marin	11,739	19.0%	21.64	7.24	51.0%	1.0%	2.6%
Compton	14,598	19.0%	12.60	5.82	35.9%	0.6%	2.1%
Santa Monica	45,931	19.0%	20.88	6.75	47.8%	1.0%	2.4%
Orange Coast	29,428	18.6%	15.16	8.56	60.9%	0.7%	3.1%
Merritt	10,870	18.5%	11.78	6.62	33.3%	0.5%	2.4%
Southwestern	30,737	18.2%	23.07	6.60	42.1%	1.0%	2.4%
Crafton Hills	7,432	18.1%	19.24	8.88	42.3%	0.8%	3.2%
Gavilan	12,200	17.9%	18.85	6.15	46.3%	0.8%	2.2%
Las Positas	11,456	17.1%	20.34	8.12	57.4%	0.8%	2.9%
Coastline	15,741	17.1%	15.63	2.67	44.8%	0.6%	0.9%
Folsom Lake	12,110	16.9%	13.79	8.67	50.0%	0.5%	3.0%
Skyline	16,289	16.4%	15.90	6.63	52.6%	0.5%	2.3%
Cerro Coso	8,371	15.7%	15.65	6.45	44.0%	0.4%	2.2%
San Diego Mesa	33,933	15.7%	15.27	7.69	54.5%	0.4%	2.7%
Alameda	11,057	15.7%	11.40	5.16	50.3%	0.3%	1.8%
Moorpark	20,779	15.4%	15.54	7.70	64.0%	0.4%	2.7%
Canyons	27,535	15.2%	15.73	6.86	57.3%	0.4%	2.4%

College Name	Student Count	Pell Grant	Part-Time Faculty per Thousand Students	Full-Time Faculty per Thousand Students	Student Completion Rate	10% Increase in Part-Time Faculty	10% Increase in Full-Time Faculty
Allan Hancock	20,933	14.8%	19.16	6.59	47.6%	0.4%	2.3%
Laney	21,173	14.6%	14.41	5.34	48.3%	0.3%	1.8%
Lake Tahoe	5,930	14.6%	21.42	6.75	43.7%	0.5%	2.3%
San Diego Miramar	19,018	14.4%	12.62	5.68	56.4%	0.3%	1.9%
Cuesta	15,406	13.7%	23.30	9.80	50.2%	0.4%	3.3%
Berkeley City	11,412	13.5%	14.81	3.68	45.0%	0.2%	1.2%
Canada	10,588	13.3%	17.00	6.89	52.8%	0.2%	2.3%
Santa Rosa	38,436	12.9%	24.51	7.34	52.3%	0.3%	2.5%
Ohlone	15,555	12.5%	20.25	7.39	59.0%	0.2%	2.5%
Palomar	38,319	11.8%	21.22	7.10	49.0%	0.1%	2.3%
San Mateo	15,380	11.5%	14.82	8.71	56.4%	0.0%	2.9%
Deanza	37,615	11.4%	12.04	7.66	63.5%	0.0%	2.5%
Lassen	5,058	11.1%	14.43	6.13	30.3%	0.0%	2.0%
Diablo Valley	29,311	10.9%	16.96	7.81	62.0%	0.0%	2.5%
West Valley	19,885	10.7%	11.72	8.30	60.9%	0.0%	2.7%
Palo Verde	4,310	9.5%	14.39	8.58	31.6%	-0.1%	2.7%
Taft	12,057	8.5%	4.81	4.06	43.1%	-0.1%	1.3%
Saddleback	39,739	8.4%	15.90	5.23	58.2%	-0.3%	1.7%
Irvine	22,442	7.9%	15.46	4.95	62.8%	-0.3%	1.5%
Monterey	20,068	7.8%	13.45	4.93	48.5%	-0.3%	1.5%
MiraCosta	24,305	6.8%	21.27	7.04	55.9%	-0.5%	2.2%
Foothill	27,341	6.5%	11.41	7.06	60.4%	-0.3%	2.2%

College Name	Student Count	Pell Grant	Part-Time Faculty per Thousand Students	Full-Time Faculty per Thousand Students	Student Completion Rate	10% Increase in Part-Time Faculty	10% Increase in Full-Time Faculty
Santa Ana	71,277	5.9%	8.87	2.97	43.9%	-0.3%	0.9%
Santiago Canyon	34,819	4.8%	8.27	2.81	59.6%	-0.3%	0.8%

Policy Recommendation

As this thesis found, part-time faculty demonstrated a positive effect on campuses with high percentages of Pell grant recipients, but a negative effect overall. While the positive effects from part-time faculty on campuses with high percentages of Pell grant recipients in their student population seems to conflict with the general recommendation favoring full-time faculty, these results demonstrate that, while full-time faculty do more to improve student completion rates in all situations, specifically at high-Pell grant campuses, part-time faculty can also be used to improve student completion rates.

Within the proposed California budget for 2018-19, Governor Brown's new funding formula presents a significant shift in future community college allocations with half of future funding tied to full-time student enrollment in a district, a quarter of funding tied to enrollment of low-income students receiving fee waivers and Pell grants, and a quarter tied to students' academic success, with different percentages tied to specific outcomes such as certificates awarded, degree completion, or associate degree for transfer awarded (Taylor, 2018). This is a significant change from current policy, where in 2017-18, $6.2 billion, or 72% of the community college budget, was allocated based on the number of enrolled students (Taylor, 2018).

Linking funding to student success measures and outcomes incentivizes the California Community College to shift focus from enrollment to student success. Additionally, allocating funding based on student outcomes is in line with current trends in higher education policy at the state level, notably the Student Success Act (CA Senate Bill 1456, 2012). However, linking funding to academic performance presents the

danger of unfairly rewarding schools that have more students originating from affluent households, essentially penalizing colleges that serve needier populations. The Legislative Analyst's Office recommends amending the funding plan to allocate even more money to student success funding, but in a separate category to reward colleges that graduate low-income, minority, and older students (Taylor, 2018). This student success funding is in addition to the category of funding already reserved for those colleges that enroll low-income students receiving fee waivers and Pell grants.

The Governor's funding formula will potentially increase the allocated funds available for schools in poorer areas, with even more funds available pending the inclusion of LAO recommendations on student success funding for low-income schools. As the greatest increases in student completion rates in my regression results occur in colleges with a high percentage of Pell grant recipients, I recommend granting districts the ability to hire additional part-time faculty at those campuses where there is a positive effect on student completion rates without facing penalties for failing to meet faculty quotas under the FON. Governor Brown's plan allocates money with the goal of bettering student outcomes, and colleges are expected to use that money on efforts to increase student completion rates. As this thesis demonstrates, the hiring of part-time and full-time faculty meets this goal. The ability to hire part-time faculty without facing repercussions would allow colleges with poorer student populations to quickly respond to hiring issues that are specific to their district, such as impaction or large enrollment increases that may not be felt system wide. However, further research is necessary to determine a specific requirement for Pell grant recipient percentage within a community

college district to apply exemptions from current hiring restrictions. While these exemptions would allow for short-term hiring of part-time faculty, these should only be stop gap measures to respond to faculty shortages as my research shows that full-time faculty have the greatest positive effect on student completion rates.

Current Limitations and Future Research

However, when considering the original question of the study: "*To what extent does the composition of staffing levels per student of full-time, adjunct faculty, and administrators affect student completion rates at the community college level?",* additional research is needed to ascertain the effects of administrative staff on student completion rates. In particular, future research into this area would be greatly aided by breaking out the administrative staff variable into their specific roles on campus. Of particular interest for future study within the administrative staff role are campus counselors. These campus administrators provide a multitude of student services and pathway programs and a better understanding of their effect on student completion rates would greatly benefit the literature on the subject. While current available data did not support this thesis' ability to research this specific point at the institution level, DataMart moving forward is tracking those figures and will have enough data in 2020 to perform a longitudinal study into specific administrative staffing types.

Other improvements to quantitative analysis of student completion rates should also be considered. In future models, more diverse variables should be integrated into the study. While the panel data regression succeeded in isolating each campus in the

analysis, more factors such as average rent in the area or urban/suburban/rural classifications could add nuance to the dataset and expand research coverage into more areas related to the socioeconomic status of each campus region. I expect these variables would show results comparable to the Pell variable because the financial need demonstrated to receive a Pell grant mirrors many of the economic factors seen regionally in variables like average rent. Measuring socioeconomic status using more variables could potentially raise the correlation coefficient of the panel data regression through explaining more of the reasoning behind changes in student completion rates.

Also, by adding more cohort years to the analysis, more statistically significant variables may rise from the model through increased sample size and a narrower margin of error. The panel regression method is useful for striating this dataset and isolating cohort years by campus, however, this also has the effect of limiting sample size. Instead of 654 instances of data, the sample breaks out into 6 years of data for 109 campuses. By adding more cohort years to the dataset, it may ameliorate potential problems that arising from smaller sample sizes. Additionally, future studies may use bootstrapping to compensate for this sample size issue in lieu of adding more years. By sampling from plotted residuals, bootstrapping would allow the study to artificially increase the sample size of the study.

Lastly, the addition of a qualitative component to the study could shed light into what parts of the administrative variable have the greatest effect on student completion rates. Through interviews with students and administrators surrounding campus programs and student success, categorical variables could be created to add into the

analysis. Specifically, survey questions could be used to gauge how effective students felt campus programs to be in helping students reach "student completion" and then note the difference in administrators' feelings. This feeling thermometer would then inform a review of pathways programs on campuses through interviews with program administrators. After coding these interviews, the results could then be compared to student completion rates at those campuses. Due to the number of campuses and programs in the system, this would be a large undertaking, but beneficial to the study of student completion rates in the long run.

Concluding Thoughts

Despite these limitations, this thesis accomplishes several goals. As noted above, my research findings support current fiscal policy favoring the hiring of full-time faculty, but add nuance by showing that part-time faculty are also effective at raising student completion rates at schools with high numbers of Pell grant recipients. My research also casts doubt on past literature suggesting that part-time faculty consistently have a negative effect on student completion rates.

The findings from my research only underscore the importance of perpetuating the new "knowledge economy" in the state. Giving the California Community College system the autonomy to hire the most effective division of staff to raise student completion rates is an economic imperative for the state, and I hope my findings have brought to light the importance of further research and policy action on the topic.

APPENDIX A: TABLE OF REGRESSION ARTICLES

Author, Publication Date	**Date and Functional Forms (Sample, Method, etc.)**	**Dependent Variable**	**Key Explanatory Variable(s)**	**General Conclusions**
Adelman (1999)	**Data Source:** 1998 Restricted edition of the High School & Beyond/Sophomore cohort file **Method of Analysis:** OLS Regression, Logistic Regression **Sample Size:** National sample of students from 10th grade in 1980 to 1993	College graduation, second-year persistence	Academic preparedness prior to entering community college	Positive linear relationship exists between students who take higher levels of math and English prior to entering community college. Students who complete a high school course load comprising four years of math and English are 87% more likely to graduate. Students who did not complete comparable coursework and took less than four years of both subjects were only 62% likely to persist to the second year of community college.
Bound & Turner (2010)	**Data Source:** National Longitudinal Study of the High School Class of 1972 and 1988 **Method of Analysis:** OLS Regression, logistic regression, descriptive statistics **Sample Size:** National sample of students	College completion rates	High School math test percentile, Father's education level, mother's education level	Positive relationship between the three explanatory variables and college completion rates. Of particular note, is that both father's and mother's education for the class of 1972 correlated to the highest levels for college completion at the BA level, and dropped down to levels similar to no HS diploma for parents who had attended graduate school. For the class of 1988, this relationship was purely linear, and increased incrementally at each higher level of education.
Bryant (2014)	**Data Source**: Texas Higher Education Coordinating Board Accountability Interactive System (THECB) **Method of Analysis**: Correlational research design, conducted using standard multiple regression **Sample Size**: 74 Texas Community Colleges	Community college rate of student success	Receipt of financial assistance, changes in percentage of full-time faculty and part-time faculty	Positive linear relationship existed between receipt of financial assistance and graduation rates. Full time faculty were found to improve graduation rates. Alternately, the number of part-time faculty employed had a significant negative relationship with community college graduation rates decreasing 2.5% for every 1% increase in part-time faculty.
Chen & St. John (2011)	**Data Source:** 1996 cohort of the Beginning Postsecondary Survey **Method of Analysis:** Hierarchical generalized linear modeling **Sample Size:** 12,000 students	Student persistence	Socioeconomic status (SES), race/ethnicity	High SES students persisted at a substantially higher rate than students from low-SES groups (70.63% vs. 44.10%). In terms of racial/ethnic differences, Native Americans and African Americans dropped out at the highest rates (57.89% and 53.73%). In comparison, Asian Americans (69.15%) and Whites (59.30% had higher rates of persistence than other ethnic groups.

Choy (2002)	**Data Source:** National Education Longitudinal Study (NELS), Beginning Postsecondary Student Longitudinal Study (BPS), Baccalaureate and Beyond Study (B&B) **Method of Analysis:** Linear modeling, descriptive statistics **Sample Size:** 8,000 students	College persistence	Parents educational status, support from family and peers	The analysis shows that students who are moderate or high-risk (defined as having two or more of the following factors: low SES, single-parent family, older sibling who dropped out, low achievement in high school, repeating a grade between first and eigth grade), are twice as likely to persist to the second year (37%) if their parents have earned a bachelor's degree or above.
Eagan & Jaeger (2008a)	**Data Source**: Carnegie Foundation for the Advancement of Teaching **Method of Analysis**: three logistic regressions **Sample Size**: 15,142 students from a doctoral-extensive institution, 13,588 students from two doctoral-intensive institutions, 2,000 students from a master's comprehensive institution	Student second-year persistence	Adjunct faculty exposure in first-year courses, contingent faculty (graduate student) exposure in first-year courses	Students were not significantly affected by having graduate students as instructors for introductory coursework. Students appeared to be significantly and negatively affected by having gatekeeper courses taught by part-time faculty and were found to be 20% less likely to persist.
Eagan & Jaeger (2008b)	**Data Source**: CA Community College System **Method of Analysis**: Hierarchical Generalized Linear Modeling (HGLM), standard logistic regression **Sample Size**: two cohorts of first-time, credit-seeking students in 2000 and 2001. Amounts to roughly 1.5 million students in 107 campuses between both cohorts	Student likelihood of transferring to four-year college or university	Level of exposure to part-time faculty	Findings suggest that students tend to be significantly less likely to transfer as their exposure to part-time faculty increases. Every 10% increase in students' exposure to part-time faculty found to decrease likelihood to transfer by 2%.
Ehrenberg & Zhang (2005)	**Data Source:** College Board **Method of Analysis:** Regression, Time Series T-Test **Sample Size:** All 4 and 2 year American Colleges 1986-2000 N=1159	Graduation Rate	Percentage of contingent faculty as part of teaching staff	Graduation rates are negatively correlated with percentage of contingent faculty. A 10% increase in percentage of non-tenure, part-time faculty is associated with a 3% reduction in graduation rate.

Ellingson, Gruys & Sackett (1998)	**Data Source:** Study-administered survey **Method of Analysis:** Comparative analysis, descriptive statistics **Sample Size:** 174 temporary employees from a temporary help service firm	Work performance	Job attitudes	Analysis concluded that while part-time workers tend to hold more negative attitudes towards their work, there is no significant linkage between part-time workers' job attitudes and performance.
Jacoby (2006)	**Data Source**: National Center for Educational Statistics (NCES; Integrated Postsecondary Data System (IPDES) **Method of Analysis**: Multiple regression analysis **Sample Size**: 1,209 public two-year colleges in 50 states for year 2001	Graduation rates	Part-time faculty ratio	Increases in the ratio of part-time faculty at community colleges have a highly significant and negative impact upon graduation rates, for every 1% increase in part time faculty, Jacoby found a 6% decrease in completion rates.
Jaeger & Eagan (2011)	**Data Source**: National Center for Public Policy and Higher Education (NCPPHE) **Method of Analysis**: Descriptive statistics and instrumental variable probit regression	First-year student retention	Level of exposure to part-time faculty	High levels of exposure to part-time faculty in the first year of college are consistently found to negatively impact student retention to the second year, lowering retention by 2% for every 1% increase in part time faculty.
Jones (2011)	**Data Source**: Community College Faculty Survey of Student Engagement **Method of Analysis**: stepwise multivariable regression	Course-level grade and completion	Adjunct faculty attributes (education, experience)	Faculty characteristics strongly correlate to student success in course grades and course completion, with years of experience in a stepwise linear regression showing a positive significant relationship of 11% for all faculty with over 10 years of experience.
Kuh, Cruce, Shoup, Kinzie & Gonyea (2008)	**Data Source:** National Survey of Student Engagement (NSSE) **Method of Analysis:** OLS Regression, conditional effects analysis **Sample Size:** 18 college student populations	Student persistence	Student engagement during first year (defined as time spent studying, time spent in co-curricular activities, and a global measure of institutional engagement)	Student engagement in educationally purposeful activities during the first year of college had a postitive, statistically significant effect on persistence, even after controlling for background characteristics. The research model states that students are 72% more likely to persist to the second year by increasing engagement in educationally effective activities. Of note, African Americans experienced a higher benefit than Whites from engagement during the first year, becoming 6% more likely than Whites to return at the average amount of engagement.

Kuh & Hu (1999)	**Data Source:** College Student Experiences Questionnaire **Method of Analysis:** Multivariate analysis of co-variance, cluster analysis **Sample Size:** 2.000 random sampled from 250,000 student records	Learning productivity of students at research universities(defined as the relationship between student engagement in educationally purposeful activity and gains in desired learning outcomes of college	Faculty contact, reading and writing activities, time spent on schoolwork, class attendance, peer cooperation, overall student effort, type of university	Effects of student faculty interaction on student outcomes varied between distinct groups of students. Students who were more academically prepared for college and those who devote more time to studying interact more frequently with faculty. Utilizing their cluster analysis, their results showed that "high-performing" students were 12% more likely to interact with faculty, drawing the conclusion that faculty interaction does not cause better student outcomes for all groups, but students who are better prepared and more high-achieving utilize faculty interaction to greater effect.
Paulsen & St. John (2002)	**Data Source:** National Postsecondary Student Aid Study 1987 **Method of Analysis:** Logistic Regression, Sequential Logistic Regression **Sample Size:** 30,000 students	Student persistence	Socioeconomic status, income groups	Financial nexus model developed establishing linkage between college choice and persistence. Financial nexus theory argues that if students perceive low tuition or low living costs to be very important in their choice of college, such cost-consciousness may also have a direct impact on their subsequent persistence decisions. Similarly, the actual dollar amounts of costs and aid a student experiences at the time of a persistence decision have a direct effect on persistence. Low income students were found to be 7% less likely than high income students to persist all other factors held constant.
Perna & Titus (2005)	**Data Source:** National Education Longitudinal Study of 1988 **Method of Analysis:** Multinomal extension of hierarchical linear modeling (HLM) **Sample Size:** 9,810 high school graduates	College Enrollment	Parental involvement (as form of social capital), race/ethnicity	The odds of enrolling in either a 2 year or 4 year college relative to not enrolling increases with the frequency with which the parent discusses with the student education-related topics (odds-ratio for 2 year = 1.130; odds-ratio for 4-year = 1.164), and decline as the frequency of those contacts decrease (odds-ratio 2 year = 0.849; odds-ratio for 4 year = 0.786)
Rogers (2015)	**Data Source**: Maricopa County Community College District's (MCCCD) Student Information System database **Method of Analysis**: chi-square analysis, logistic regression **Sample Size**: 9,679 students	Student passing the second of a two-course sequence with a "C" or better	Percent of Adjunct and Tenured Faculty	Students who took the first of a two-course English sequence with adjunct faculty were statistically 6% more likely to receive a grade below a "C" in the second course. The employment status of the second course faculty was not statistically significant in the study. Faculty employment status had no statistically significant effect on Math sequence courses.
Ronco & Cahill (2004)	**Data Source**: Florida Atlantic University **Method of Analysis**: Descriptive statistics, logistic regression, OLS regression, and analysis of covariance **Sample Size**: 3,787 students	Retention, academic achievement, and student rating of instruction	Percent of regular full time faculty, adjunct faculty, and graduate teaching assistant	This study uncovered little evidence that instructor type has an impact on student outcomes. However, there was a large statistical correlation between non-full time faculty instruction hours and 2nd year retention amongst students, amounting to a 13% drop in retention for students taught by adjunct faculty or graduate students for the first year.

Warburton, Bugarin & Nunez (2001)	**Data Source:** Beginning Postsecondary Students Longitudinal Study 96/98 **Method of Analysis:** Comparative analysis, descriptive statistics **Sample Size:** 12,000 students	College completion and persistence	Academic preparation (high school math, rigor of high school courses, SAT scores, AP test-taking)	Compared with their peers, students who are "low preparation" are 22 percent more likely to not persist to the next year, and are 21 percent more likely to not return after leaving their first institution. Students who are classified as "high preparation" were 87 percent more likely to persist to the next year. As the rigor of high school coursework increases for a student, so does the likelihood that they will persist to degree completion.
Wirt (2010)	**Data Source**: Community College Survey of Student Engagement (CCSSE) **Method of Analysis**: Multiple regression **Sample Size**: 1,990,347 community college students	Level of faculty student interaction	Percent of regular full time faculty, adjunct faculty, student GPA, financial aid, student full/part time	Full time students and students with higher GPAs more likely to increase interaction with faculty. Students who receive financial aid to attend school are more likely to experience increased faculty interaction. Part-time faculty lowers the occurrence of significant interaction. Significant interaction with faculty, as defined by the study, showed a retention rate of 81.3%.

APPENDIX B: PAIRWISE CORRELATION COEFFICIENTS

	DISTRI~X	COLLEG~X	COHORT~X	COHORT05	COHORT06	COHORT07	COHORT08	COHORT09
DISTRICTIN~X	1							
COLLEGEINDEX	0.6453	1						
COHORTINDEX	0	0	1					
COHORT05	0	0	-0.6547	1				
COHORT06	0	0	-0.3928	-0.2	1			
COHORT07	0	0	-0.1309	-0.2	-0.2	1		
COHORT08	0	0	0.1309	-0.2	-0.2	-0.2	1	
COHORT09	0	0	0.3928	-0.2	-0.2	-0.2	-0.2	1
COHORT10	0	0	0.6547	-0.2	-0.2	-0.2	-0.2	-0.2
STUDENTS	0.0381	0.1092	0.0455	-0.0548	-0.0328	0.0129	0.0594	0.039
OVERALL_CO~E	0.073	0.056	-0.0885	0.0437	0.0634	0.029	-0.0368	-0.0802
PELL_PER	-0.0585	-0.0217	0.1333	0.2063	-0.2122	-0.1947	-0.1359	0.0625
ACAD_TEMP_~R	-0.033	0.0496	-0.0119	-0.0058	0.0275	0.0164	-0.0199	-0.0356
ACAD_TENUR~R	0.0187	0.0176	-0.0894	0.0792	0.0861	-0.0172	-0.1118	-0.0556
CLASSIFIED~R	0.0772	0.1405	-0.0348	0.0295	0.0359	0.0078	-0.0613	-0.0329
ED_ADMIN_PER	0.0045	0.0583	-0.0162	0.0059	0.0111	0.0179	-0.0231	-0.0073
FEMALE_PER	-0.1242	-0.115	-0.1255	0.0676	0.0615	0.0346	-0.0304	-0.052
EOP_PER	0.0011	0.0175	-0.5663	0.2935	0.2672	0.2479	-0.1933	-0.298
AGE_2024_PER	-0.0103	-0.0378	0.1736	-0.0388	-0.0697	-0.0865	-0.0579	0.0528
AGE_2529_PER	0.044	0.0609	0.2032	-0.1137	-0.0886	-0.0428	0.0221	0.0754
AGE_3034_PER	0.0317	0.0453	0.0014	0.0307	-0.0087	-0.0224	-0.026	-0.006
AGE_3539_PER	0.0039	0.0083	-0.1806	0.0944	0.0805	0.0452	-0.008	-0.0862
AGE_4049_PER	-0.0264	-0.0053	-0.2122	0.1372	0.0912	0.0298	-0.0373	-0.0928
AGE_50PLUS~R	0.0235	-0.006	-0.1002	0.024	0.0515	0.0408	0.0214	-0.0319
AFAM_PER	-0.1831	-0.1104	-0.0189	0.0126	0.0072	0.0071	-0.0028	-0.0211
NATAMER_PER	0.0706	0.0907	-0.124	0.0468	0.0506	0.0415	0.0418	-0.0764
ASIAN_PER	0.0192	-0.0369	-0.027	0.0141	0.0144	0.0107	-0.0055	-0.0251
FILIPIN_PER	0.07	0.1093	-0.0611	0.0272	0.0273	0.021	0.0069	-0.042
HISPANIC_PER	-0.0319	0.0369	0.1109	-0.054	-0.0379	-0.0227	-0.0196	0.0209

	DISTRI~X	COLLEG~X	COHORT~X	COHORT05	COHORT06	COHORT07	COHORT08	COHORT09
PACISLAN_PER	0.0189	0.0467	-0.0625	-0.0125	0.0057	0.0468	0.1155	-0.0453
UNKNOWN_RA~R	-0.0547	-0.154	0.0219	-0.0768	-0.0423	0.0022	0.1246	0.1973
WHITE_PER	0.1165	0.0726	-0.1046	0.0679	0.0443	0.0184	-0.0127	-0.0674

	COHORT10	STUDENTS	OVERAL~E	PELL_PER	AC~P_PER	AC~E_PER	CLASSI~R	ED_ADM~R	FEMALE~R
COHORT10	1								
STUDENTS	-0.0238	1							
OVERALL_CO~E	-0.0192	0.2831	1						
PELL_PER	0.274	-0.1714	-0.3979	1					
ACAD_TEMP_~R	0.0175	-0.1951	-0.0732	0.248	1				
ACAD_TENUR~R	0.0193	-0.1231	0.0704	0.4239	0.3476	1			
CLASSIFIED~R	0.0209	-0.2695	-0.2087	0.3354	0.3378	0.4637	1		
ED_ADMIN_PER	-0.0045	-0.3316	-0.1574	0.2487	0.2842	0.3101	0.6782	1	
FEMALE_PER	-0.0812	-0.1644	-0.0201	0.2987	0.3043	0.2107	0.085	0.0708	1
EOP_PER	-0.3172	-0.2708	-0.248	0.214	0.1155	0.2472	0.2736	0.1511	0.2199
AGE_2024_PER	0.2001	0.2239	0.199	0.3238	0.1013	0.2888	-0.0523	-0.0348	0.2107
AGE_2529_PER	0.1475	0.0583	-0.2146	0.1312	-0.1568	-0.0553	-0.2054	-0.1029	-0.1487
AGE_3034_PER	0.0324	-0.126	-0.3922	-0.0091	-0.2686	-0.2055	-0.1056	-0.0062	-0.3645
AGE_3539_PER	-0.1259	-0.1582	-0.351	-0.1745	-0.2783	-0.2718	-0.0642	-0.0073	-0.4419
AGE_4049_PER	-0.128	-0.2509	-0.2881	-0.2388	-0.1659	-0.241	-0.0164	0.0132	-0.4206
AGE_50PLUS~R	-0.1057	-0.1884	0.0735	-0.3738	0.1133	-0.1526	0.0782	-0.0113	-0.0409
AFAM_PER	-0.003	-0.1039	-0.3751	0.0884	-0.1676	-0.1438	-0.1437	-0.078	0.2671
NATAMER_PER	-0.1043	-0.347	-0.23	0.1744	0.4409	0.1814	0.3955	0.2662	-0.0225
ASIAN_PER	-0.0085	0.2822	0.4669	-0.2457	-0.2859	0.0114	-0.2822	-0.2244	-0.0225
FILIPIN_PER	-0.0403	0.0821	0.2259	-0.1462	-0.0777	0.0804	-0.2221	-0.137	0.0518
HISPANIC_PER	0.1133	0.1179	-0.3707	0.3371	-0.1719	-0.0318	0.0931	0.0418	-0.0367
PACISLAN_PER	-0.1103	-0.0673	0.1321	-0.13	0.0059	0.1514	-0.1138	-0.0569	0.0242
UNKNOWN_RA~R	-0.205	0.0824	0.0294	-0.1489	-0.0775	-0.218	-0.2107	-0.0863	-0.053
WHITE_PER	-0.0506	-0.2111	0.2433	-0.1585	0.3944	0.1427	0.2287	0.1594	-0.0857

	EOP_PER	AGE_20~R	AGE_25~R	AGE_30~R	AGE_35~R	AGE_40~R	AGE_50~R	AFAM_PER	NATAME~R
EOP_PER	1								
AGE_2024_PER	-0.1432	1							
AGE_2529_PER	-0.0809	0.2374	1						
AGE_3034_PER	0.0662	-0.4253	0.6785	1					
AGE_3539_PER	0.1561	-0.6828	0.3013	0.8611	1				
AGE_4049_PER	0.1614	-0.8065	0.0346	0.671	0.9116	1			
AGE_50PLUS~R	-0.0214	-0.7154	-0.333	0.0464	0.2484	0.4649	1		
AFAM_PER	0.1429	-0.0147	0.276	0.2681	0.1747	0.0589	-0.209	1	
NATAMER_PER	0.3414	-0.2393	-0.0833	0.0211	0.0766	0.1908	0.2758	-0.2269	1
ASIAN_PER	-0.1334	0.1962	0.2064	0.0554	-0.0683	-0.2019	-0.1169	0.0197	-0.3344
FILIPIN_PER	-0.0679	0.2176	0.1076	-0.0514	-0.1138	-0.1833	-0.2186	0.0298	-0.3216
HISPANIC_PER	0.0802	0.179	0.0785	0.0681	0.023	-0.0987	-0.424	0.0093	-0.3205
PACISLAN_PER	0.0018	0.128	0.1372	0.022	-0.0277	-0.0498	-0.1055	0.0696	-0.0346
UNKNOWN_RA~R	-0.1735	-0.1406	0.0166	0.0508	0.0629	0.0546	0.1866	-0.0977	-0.0536
WHITE_PER	-0.002	-0.24	-0.3497	-0.2358	-0.0701	0.1722	0.5031	-0.5073	0.5887

	ASIAN_~R	FILIPI~R	HISPAN~R	PACISL~R	UNKNOW~R	WHITE_~R
ASIAN_PER	1					
FILIPIN_PER	0.4333	1				
HISPANIC_PER	-0.3104	-0.0444	1			
PACISLAN_PER	0.2691	0.5413	-0.2351	1		
UNKNOWN_RA~R	0.0578	-0.0503	-0.2397	-0.0439	1	
WHITE_PER	-0.3272	-0.3315	-0.5984	-0.0632	-0.0856	1

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