



# Assessment of the Economic Impact of Florida Poly

Prepared for:  
The Florida Polytechnic University Board of Trustees

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## Preface

Florida Poly contracted in July 2019 with Economic Consulting Services, Inc. to assess the annual economic impact of Florida Poly in 2018-19. This analysis and accompanying report, authored by Rick Harper, Ph.D., is the product of that contract. The author wishes to thank the Board of Trustees of Florida Poly, along with President Randy Avent, Ph.D., and Provost Terry Parker, Ph.D., for their efforts in support of this work. Special thanks are due to Mr. Rick Maxey, Assistant Vice President for Board Operations and Economic Development, for serving as principal liaison to the project, and to faculty and staff of the University for the time they have taken in describing the operations and impacts of the University.

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## Introduction

In 2011, the Florida Legislature described a vision of a new State University System (SUS) institution built on a polytechnic model with academic program offerings in advanced engineering, scientific research, and professional education in science, technology, engineering and mathematics (STEM) fields and STEM-related fields.<sup>1,2</sup> The plan evolved into a 2012 bill in the Florida Legislature that established the Florida Polytechnic University as the 12<sup>th</sup> SUS member university. The legislation that was passed and signed into law included schedules for achieving accreditation, increasing student enrollment, adding new degree programs in STEM, STEM-related, and liberal arts fields, and completing facilities construction.<sup>3</sup>

In 2019, Florida Poly continues to meet and exceed the standards set by the 2012 Legislature. It is unique among SUS institutions in its singular focus on “core STEM” degree programs in engineering, analytics and informatics, and computer science. These programs are considered key to economic growth and prosperity for Florida and the nation as a whole.<sup>4</sup> Florida Poly provides key elements of the market-relevant post-secondary education and training that is critical to Florida’s tech-driven economic development vision.<sup>5</sup>

The technological change that drives economic progress and in doing so provides higher family incomes and living standards is biased in favor of highly skilled workers. This has resulted in higher growth rates for wages for highly educated workers generally, and particularly for those with scarce technical and cognitive skills. In contrast, wages of those possessing only a high school degree, or less than a high school degree, have stagnated over the last several generations. By 2017, inflation-adjusted average weekly earnings of men with only a high school degree were only seven percent higher than they were in 1963. Over that same period, the inflation-adjusted average weekly earnings for men with a bachelor’s degree grew by 37 percent.

An examination of Florida data finds that in 2018 the median annual earnings in 169 occupations where the normal entry level credential was a bachelor’s degree, at \$68,031, were 86 percent higher than the median annual earnings, at \$36,612, of the 334 occupations where the normal entry level credential was a high school degree.<sup>6</sup> Growth in the number of jobs for occupations requiring a Bachelor’s Degree was 25.6 percent over the 2008 – 2018 period, versus 13.1 percent for jobs requiring a High School Degree. Job growth in the Florida Poly target occupation codes was 28.4 percent.

The 21<sup>st</sup> century job market places a high value on workers that can apply the latest technologies, and this creates a pressing need for Florida to supply the STEM-trained labor force that will attract the high wage firms that use these skills intensively.<sup>7</sup> Because the economic structure of the state reflects its role as a premier vacation destination to the world, and a premier destination for U.S. retirees, Florida is at risk of falling farther behind in terms of its high-wage, STEM-based workforce.<sup>8</sup> The most recent data from the National Science Board (NSB) indicated that Florida ranks in the bottom quartile of states in terms of the share of doctoral degree STEM workers, and thus STEM workers generally, in the economy.<sup>9</sup> Florida Poly helps fill that gap and in doing so raises living standards for Floridians.

## Executive Summary

The mission of Florida Polytechnic University is to serve students and industry through excellence in education, discovery and application of engineering and applied sciences.<sup>10</sup> The University provides the training necessary to qualify workers for high skill, high wage jobs, and does so at a very low cost to students and taxpayers.<sup>11</sup> We show in this report that the State's investment in Florida Poly yields a high return on investment, both for taxpayers and for students.

### Overall Economic Impact of Florida Poly

The following Table shows the economic impact of Florida Poly activities during the 2018-19 fiscal year, measured in current (2019) dollars. **The current annual impact of the University to the Florida economy is calculated to be more than \$161 million in gross domestic product at the local and state level, almost \$98 million in labor income, and more than \$289 million in overall sales, along with 2,350 jobs.<sup>12</sup> This annual impact continues today and will grow with enrollment.**

Table ES1: Summary of economic impact of Florida Poly, by activity, FY2018-19

Activity	Jobs	Labor Income	GDP	Total Output
University Operations	728	\$30,125,069	\$39,283,089	\$68,498,083
Capital Expenditure	200	\$8,494,443	\$14,263,878	\$32,354,361
Student Spending	199	\$5,129,403	\$8,992,329	\$15,724,088
PV Lifetime Earnings Differential	1,223	\$53,886,009	\$98,836,845	\$172,582,638
Grand Total	2,350	\$97,634,924	\$161,376,141	\$289,159,170

Source: IMPLAN, author's calculations

The 2,350 jobs created by Florida Poly activities occur both locally and across Florida. The 1,223 jobs that are created by the higher spending enabled by the present money value of the lifetime earnings differential to Florida Poly grads occurs across the state, in proportion to the location decisions of graduates. The 1,127 jobs associated with University operations (including faculty and staff payroll), capital outlays, and student spending, are associated with spending done in Polk County.

The flows of economic activity from increased family incomes for Florida Poly grads along with operations of Florida Poly, capital improvements, and student spending generate a substantial increase in annual federal, state and local tax revenue each year. At current levels of enrollment, annual federal, state and local tax revenue due to the economic impacts of Florida Poly is \$38,235,650.

### Wages, Costs, and Return on Investment

The share of the Present Value of Lifetime Earnings Differential in the Table is responsible for the largest share of the annual economic impact of the institution to the economy. Because of the

relatively high earnings in the occupations that Florida Poly trains for, that share is higher for Florida Poly than for the SUS as a whole.<sup>13</sup>

Statewide, the differential between median wages for occupations for which a bachelor's degree is the normal entry credential versus high school degree occupations is currently calculated to be 86 percent. The gap between high school degrees and those with jobs in Florida Poly majors statewide is even larger, at 125 percent, due to the University's highly focused core STEM curriculum that produces well-trained, in-demand graduates.<sup>14</sup>

The job mix in the Florida Poly six-county core market area is especially supportive of the University's core STEM focus<sup>15</sup>. While statewide 2018 median average earnings in Florida Poly occupations are \$82,524, median average earnings in the six-county core market in these occupations are \$89,326.<sup>16</sup> Given the STEM focus and the geography of Florida Poly's core market and graduates, the value of the wage benefit accruing to the average Florida Poly student is substantially higher than the average across all SUS institutions.

The net change in the number of jobs in the core market area in occupations that are most closely associated with the instructional programs offered by Florida Poly is projected to be 10,904 from 2019 to 2029. However, because of retirements and other job transitions, projections suggest that there will be 66,821 openings over the same timeframe that will be needed to generate the net 10,904 job increase. This represents strong labor market demand for Florida Poly graduates.<sup>17</sup>

The cost to students of attending Florida Poly as reported by the Board of Governors is below the (unweighted) SUS average.<sup>18</sup> Some of this differential is due to lower cost of living in less densely populated metro areas, some is also due to Florida Poly tuition and fees that were substantially below the SUS average.<sup>19</sup> However, Florida Poly plans to return closer to the SUS average cost over time.<sup>20</sup>

The combination of high wages for graduates and low costs for students has predictable outcomes. Because the cost to taxpayers of providing this education is somewhat lower than the SUS average and wages for graduates are substantially higher, the projected average return on investment for a Florida Poly undergraduate degree is the highest, both for students and for taxpayers, of any university in the SUS. This study finds that the average Florida Poly graduate can expect to earn over \$13 in additional personal income (in present money value) over a working career for every dollar of current outlay to pursue a degree. Using the same costs of a degree but with wage differentials taken from the 2016 study of the SUS, the average SUS graduate can expect to earn about \$4.1 in discounted additional personal income over a working career for every dollar of current outlay to pursue a degree.

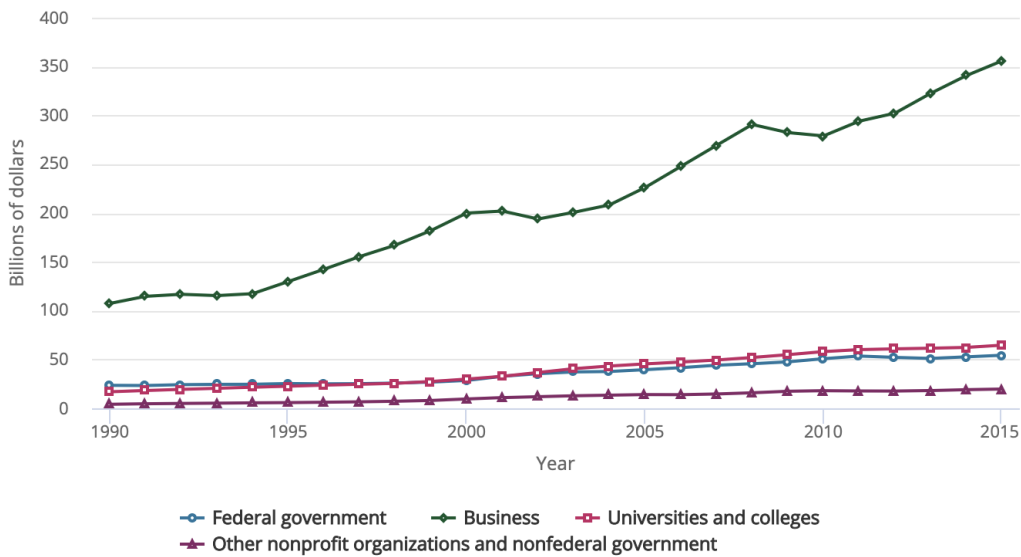
### Research, Industry Linkage, and Entrepreneurship Strategy at Florida Poly

The University's focus on applied research conducted jointly with regional businesses to meet their technology development needs is particularly valuable for Florida. The availability of research scientists to partner with private firms and governmental entities enhances the regional community's ability to recruit and retain higher wage firms that depend on a deep pool of skilled labor.

The University’s plan calls for capitalizing on its strategic location on the I-4 corridor by creating a high-tech economy around Florida Poly. This effort includes a strong faculty recruiting initiative that deepens the growing basic and applied research footprint catalyzed by the Applied Research Center. National research growth trends suggest that Florida Poly’s applied research engagement is appropriate and also can be sustainable.

In absolute terms, the overall volume of R&D done by business is about 4.7 times the dollar volume of R&D expenditures at the nation’s universities, as can be seen in the Figure below.

Figure ES1: U.S. Research and Development Activity by Sector, 1990 - 2015



Source: National Science Board, Science and Engineering Indicators, 2018.

This collaborative research with businesses is not restricted to faculty. As of 2019, Florida Poly had established relationships with 301 industry partners, with some 234 of them serving as career collaborators who hire interns or graduates, participate in career recruitment events, or sponsor senior capstone projects. 21 companies provided 35 of the 36 senior capstone projects completed during the past year. Helping students apply their research and commercialize business concepts is also key to Florida Poly. All students must complete an internship, and as of this year, 135 students have taken advantage of the University’s Phoenix Nest services that streamline assistance for entrepreneurial projects.

The presence of the long-established Florida Industrial and Phosphate Research Institute (FIPR Institute) at Florida Poly adds expertise and research focus to the University. The Advanced Mobility Institute, established to focus on the development and testing of autonomous vehicles, and the partnership with the Florida Turnpike’s Suntrax initiative has the potential to participate in industry research. The newly created Institute for Health Informatics has similar potential.

Introducing this focus provides an additional channel beyond traditional federally funded basic science research into the niche of industry-linked applied technology research will provide

opportunities for students and will likely to be a fruitful path towards increased research expenditures and thus increased availability of resources for the University. Florida Poly has provided seed funding to 13 projects intended to help faculty grow their extramural research.

To raise awareness of what Florida Poly can offer, the University has hosted an Economic Development Symposium for area business leaders, and it has created industry advisory boards for academic programs. These efforts to bring business community input to faculty, staff, and students helps ensure that curriculum will be relevant and that University assets will be viewed as valuable to the regional community.

The focus on applied research in the region does not mean that traditional federal funding channels are being ignored. Faculty have submitted over 100 research proposals to Federal funding entities including the National Science Foundation (NSF), the U.S. DoD Strategic Environmental Research and Development Program (SERDP), the Department of Energy (DOE), and the National Aeronautics and Space Administration (NASA), as well as to agencies such as the Florida Department of Transportation. These proposals have resulted in \$3,757,308 in funding.

The overall impact of Florida Poly to the region is seen in the hiring done and incomes paid to faculty and staff, in the construction of its buildings and physical plant, and in the spending done by students. Most important, however, is the increased income earning potential that accrues to its graduates and in the research potential embodied in the skills of faculty, staff, and students. The impact of the University at current activity levels is already large, at some 2,350 jobs and \$161 million in gross domestic product at the regional level. These impacts will grow as the university grows over time.



## Key Findings

- The current annual impact of the University to the Florida economy is calculated to be more than \$161 million in gross domestic product at the local and state level.
- This annual level of economic activity sustains 2,350 jobs and generates an annual total of \$97.6 million in wages to workers and income to business proprietors.
- Of this annual economic impact, more than \$72 million per year of this GDP impact occurs in Polk County alone, assuming that about 10 percent of Florida Poly graduates go on to live and work in Polk.
- At current levels of enrollment, annual federal, state and local tax revenue due to the economic impacts of Florida Poly is \$38,235,650.
- A Florida Poly education is becoming increasingly valuable over time, relative to both a High School diploma and an average SUS degree. All signs indicate that these trends will continue.
- While the average Florida job paid about \$46,155 in 2018, the jobs most highly associated with the Florida Poly CIP codes paid an average of \$82,524 on a statewide basis.
- The average annual differential between the earnings of a Florida Poly graduate and a worker in Florida with only a High School degree, at \$45,913 per year (when measured at median earnings per year by occupation across occupations typically requiring a degree credential in a Florida Poly concentration versus typically requiring a High School diploma), is the highest of any university in the SUS.
- The high earnings differential means that the average Florida Poly graduate can expect to earn over \$13 in additional personal income (in present money value) over a working career for every dollar of current outlay to pursue a degree. Using the same costs of a degree but with wage differentials taken from the 2016 study of the SUS, the average SUS graduate can expect to earn about \$4.1 in discounted additional personal income over a working career for every dollar of current outlay to pursue a degree.
- About 61 percent of the economic impact of the University, as measured by the increment to state and local GDP, is driven by the skills, credentials, and increased earning capacity of the graduating students.
- As of 2019, Florida Poly had established relationships with 301 industry partners, with some 234 of them serving as career collaborators who hire interns or graduates, participate in career recruitment events, or sponsor senior capstone projects. 21 companies provided 35 of the 36 senior capstone projects completed during the past year.

## Assessing the Economic Impact of Florida Polytechnic University

The following report evaluates and provides quantitative estimates of the economic value of Florida Poly activities. We first discuss how demographic, economic and market characteristics of the modern economy and of Florida influence the need for STEM education. We then examine trends in enrollment, research and outreach that contribute importantly to the impact of Florida Poly; and we conclude with estimates of economic impacts and economic development benefits to Florida from Florida Poly operations and wages of graduates, from both the perspective of the institution as a whole, and from the perspective of students and taxpayers.

We approach the economic development benefits of Florida Poly from two perspectives. One is the standard approach of applying a multiplier model to track the dollar flows of university spending on faculty and staff, on infrastructure, certain elements of student spending, and, most importantly, the increment to wages of graduates relative to peers who did not graduate, that would not have occurred in Florida but for the presence of Florida Poly. Because the University is small and new, this standard impact measure is small relative to the behemoths of the SUS.<sup>21</sup> The second perspective is that of the individual student. Given the highly targeted programmatic focus of Florida Poly, the typical student who enrolls will finish in a timely fashion, graduate with highly relevant and marketable skills in a high-wage sector, all while finishing with a relatively modest debt burden. This means that on a per-student basis, the benefit to cost ratio is high and thus attractive to policy makers seeking the best outcomes at the lowest cost. While the school isn't large, it punches above its weight in terms of economic benefit to Floridians, both students and taxpayers.

### Why is Core STEM Education So Important to Florida?

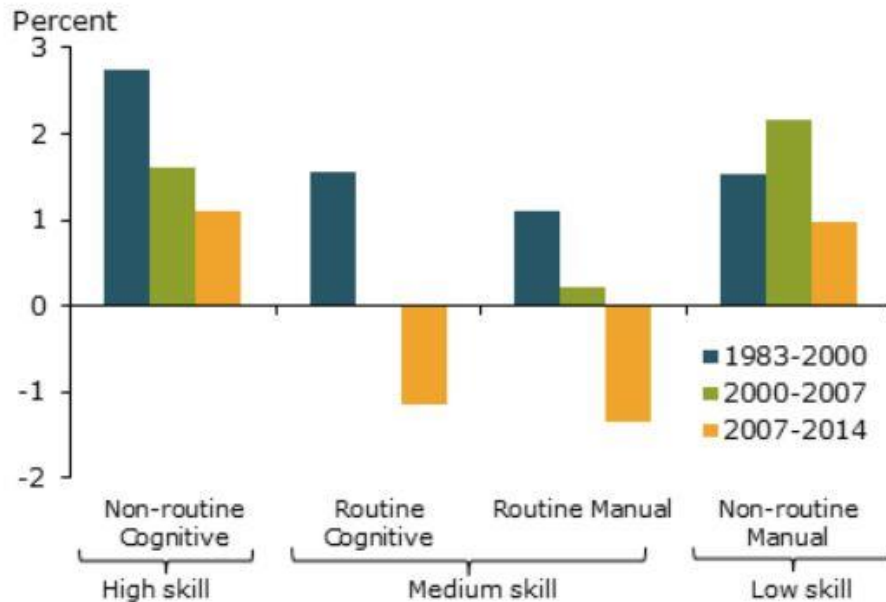
There has never been more knowledge in the world than there is today, and the amount of knowledge is increasing at an increasing rate. The demand for human skills that enable productive use of new knowledge will grow strongly as employers work to master the emerging technologies that drive economic success in a competitive market. Universities that provide the instruction that enables effective learning of these skills will likely thrive. Communities that successfully build and retain the human skills that enable useful new technologies will likely see higher incomes and a self-reinforcing dynamic of high-quality growth.<sup>22</sup>

It can easily be the case that the use of new processes will make certain workers obsolete more quickly than those workers can obtain the skills needed to take a new job.<sup>23</sup> This has been true throughout the history of innovation in goods- and service-producing processes.<sup>24</sup> There has been consensus around the idea that the same things that lead to productivity growth in the economy (i.e., more output per worker) use technologies and processes that substitute automation and more highly skilled labor for less skilled workers, or that substitute less expensive labor in other nations for domestic labor via international trade.<sup>25</sup> Such substitution is particularly likely for occupations in which the job duties of workers are characterized by relative intensity in performing repetitive and manual tasks, as these are the easiest to automate or send offshore.<sup>26</sup>

It is clear that these technology changes will result in shifts in demand for different types of labor. They will tend to raise the incomes of those workers with in-demand skills, while workers with less than cutting edge skills will likely see wages rising less rapidly. The following Figure from authors at the San Francisco Federal Reserve Bank shows the consequences of this

substitution in terms of changes in the number of people employed by type of occupation. As can be seen, employment has grown over the past dozen years in occupations requiring non-routine cognitive skills and non-routine manual skills, but has shrunk in occupations characterized by routine cognitive skills and routine manual skills.

Figure 2: Annual Change in Employment by Occupation Category, 1983 - 2014



Source: Valletta, FRBSF, Jan 2015

Various authors have commented that these innovations have been largely responsible for the observed growing wage gap between those with higher levels of skill attainment (as proxied by educational attainment of bachelor's degree or higher) and those who go to work with only a high school degree (or less).<sup>27</sup> That wage gap grew from the late 1970's through the 1990's, although its growth has since slowed over the period following the 2001 bursting of the dot-com bubble. Beaudry, Green and Sand explain the decreased rate of growth in the wage gap as being the result of a decline in the demand for skilled workers in manufacturing and the trades in the years since 2000, even as the supply of high education workers grew. They hypothesize that more sophisticated automation led to a demand reversal for cognitive skills in middle-skill jobs traditionally filled by non-college educated craft workers. In response, many college-educated workers were forced to move down the occupational ladder and perform jobs traditionally performed by lower-skilled workers.<sup>28</sup> This de-skilling process lowered measured wages for low-skilled workers and for some college-educated workers. Valletta also finds that the wage gap widening rate slowed after the 1980's and that the wage gap remained essentially unchanged in recent years.<sup>29</sup> He attributes this to a technology-driven shift away from middle-skilled occupations, and to a weakening in demand for advanced cognitive skill and suggests that both of these have been factors in the flattening of the higher education wage premium and an increase in income polarization.

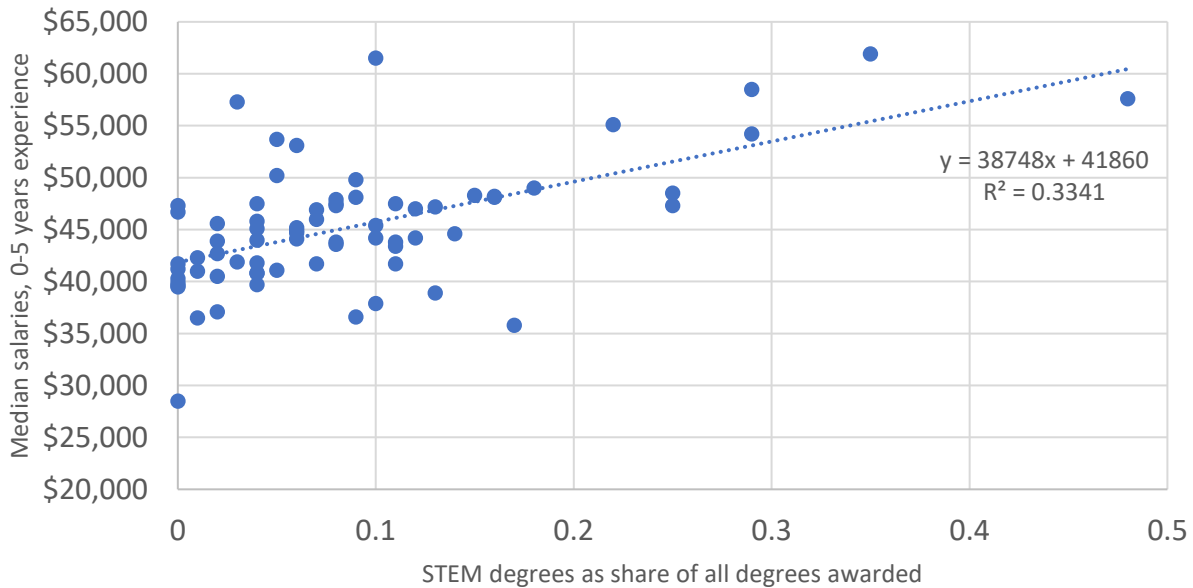
More recently, scholars have looked closely at technology-driven shifts in the task content of occupations. The displacement effect that characterizes adoption of machines and artificial

intelligence (AI) can be quite large in occupations embodying routine and manual tasks. Autor (2019) concurs with previous scholars in finding that there are fewer middle-skill jobs than before, both for college-educated and non-college educated workers. However, these education groups fare differently in the labor market. Among college-educated workers, any loss in middle-skill jobs has been substantially offset by upward movement in the skill hierarchy of occupations. In contrast, non-college workers have moved almost exclusively towards the bottom of the occupational distribution. Autor finds that technology change has narrowed the set of jobs in which non-college workers perform specialized work that has commanded higher pay rates.<sup>30</sup> These trends are important for Florida Poly grads.<sup>31</sup>

### Future earnings of graduates

The Figure below shows values taken from Payscale.com for the 71 colleges and universities in Florida that are covered in the Payscale salary survey.<sup>32</sup> The vertical axis shows estimated median salaries for graduates with 0 to 5 years of experience in the labor force for each of the 71 schools, while the horizontal axis shows the share of degrees at each school that are awarded in STEM disciplines. The positive slope of the ordinary least squares regression line shows the positive correlation between STEM degrees and salaries. It suggests Florida Poly graduates can expect to be top performers among Florida college and university graduates in terms of wages, both because Poly has a selective admissions policy that focuses admits on students likely to succeed, and because the core STEM programs of study are focused on occupations that command wages that are well above average.

Figure 3: Median Graduate Salaries and STEM degree share at 71 Florida Institutions



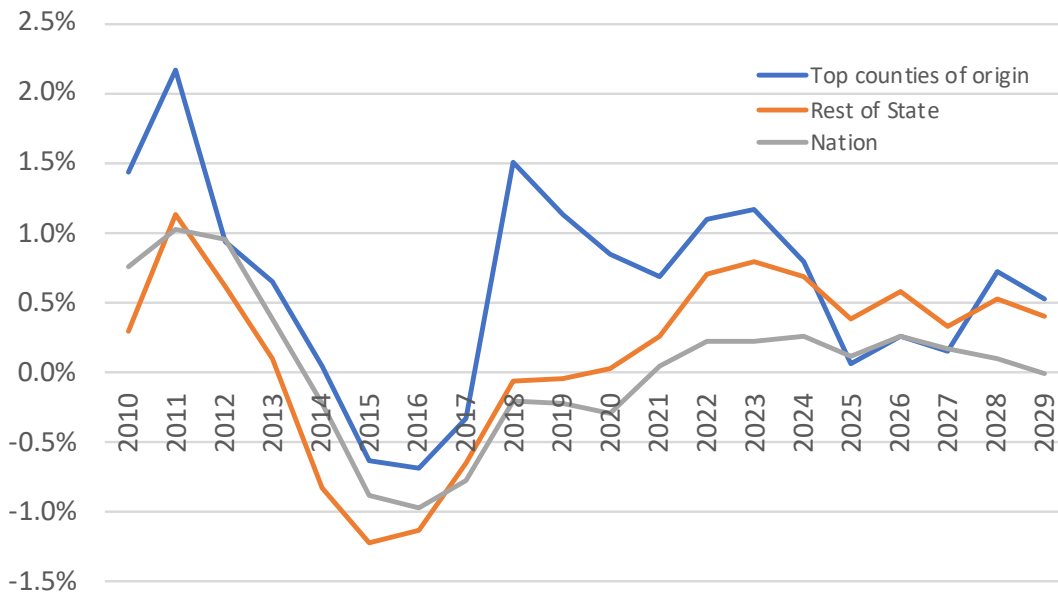
Source: Payscale.com

This skill content distinction is critical in understanding the importance that a Florida Poly education makes for its students. The 2018 Florida Department of Economic Opportunity (DEO) annual report on the wages of graduates finds that the average Bachelor’s Degree graduate of the Florida College System (FCS) earns more one year after graduation (median earnings \$43,584) than does the average Bachelor’s Degree graduate of the Florida SUS (median earnings

\$36,000).<sup>33</sup> The reason for the difference is the predominance of business and health occupations in the FCS Bachelor’s Degree mix versus lower paid majors in the SUS.<sup>34</sup> The high pay rates for core-STEM occupations is apparent in the occupational wage data, and the data suggest that Florida Poly graduates will on average be among the highest paid of all graduates of SUS and FCS institutions. Further, Florida Poly graduates will be poised to take on higher paid positions as they progress through their careers. These objectives are apparent in the University’s planning documents.

As can be seen in the Figure below, the number of potential first-time-in-college (FTIC) freshmen appears to be increasing in Florida after a several year period of decline. The current increase begins earliest and is most notable in the six counties (Polk, Hillsborough, Broward, Orange, Palm Beach, and Pasco) that provide almost 60 percent of Florida Poly enrollment. Given the challenges of recruiting qualified students into a demanding and quantitatively intensive curriculum, Florida Poly needs these additional students to draw from, and will benefit from the upswing in the rest of the state as the University continues to mature. The projected persistence in the higher rate of growth of college-aged residents in Florida relative to the U.S. points to the need for the STEM capacity Florida Poly provides.

Figure 4: Past and future growth rates of prime age population, 2010 - 2029



Source: Woods & Poole Economics, 2019 CEDDS

People with more education generally live longer, work later in life, and have higher earnings.<sup>35</sup> By holding costs and associated debt burdens to students down, the SUS Board of Governors encourages a level of educational attainment that is higher than would otherwise occur in a state economy driven by a high share of retirees that results in a service-oriented industry structure and occupational demand profile.<sup>36</sup> By focusing on core STEM education, Florida Poly provides these benefits while also directly supporting Florida’s high-skill, high-wage economic development strategy.

### The University's Mission, Vision, and Strategic Plan.

A primary conclusion of this report is that Florida Poly offers excellent value for monies expended to operate the University, yielding benefits well in excess of costs to students and the taxpayer alike. Like other SUS institutions, Florida Poly scores well in terms of its value proposition, providing top quality higher education outcomes as price well below the national average.<sup>37</sup>

The mission of Florida Polytechnic University as noted in the 2019 Accountability Plan is to serve students and industry through excellence in education, discovery and application of engineering and applied sciences.<sup>38</sup> The accompanying vision statement is that Florida Poly will be a premier STEM university known for producing highly desirable graduates and new technology solutions.<sup>39</sup>

### Meeting Labor Market Needs

On the workforce skills side, the vision of Florida Poly is to serve as a relatively small but world-renowned “University of Distinction” that produces a dynamic pool of info-tech talent. Students will finish their programs with the capacity to lead global high-tech industries due to customized undergraduate and graduate STEM- enriched academic curriculum, access to operating space and facilities, collaboration in entrepreneurial research and participation in interactive business industry partnerships. In doing so, Florida Poly prepares 21st century learners in advanced STEM fields to become innovative problem-solvers and high-tech professionals through interdisciplinary teaching, leading-edge research, and collaborative local, regional and global partnerships.

Florida Poly offers six undergraduate degree programs and two master's degrees, with three additional BOG-approved undergraduate degree plans being implemented. All degree programs provide students with a strong foundation in the fundamentals of their chosen discipline with opportunities to focus in leading-edge areas or simply explore a range of possibilities within the program. Over 59 percent of students come from the six counties that this report considers to be the core market area. The most popular majors for the 1,424 students studying in Fall 2018 at the University were in computer science (32.3 percent of students), mechanical engineering (20.5 percent), computer engineering (15.5 percent), and computer science and information technology (10.5 percent).

The Florida State University System Board of Governors initially authorized six Florida Poly academic programs and has subsequently authorized three more. These six original programs can be identified by their Classification of Instructional Programs (CIP) codes, and these CIP codes in turn can be linked to labor market specific occupations (listed by standard occupational classification, or SOC codes) using IPEDS CIP-SOC crosswalk tools.<sup>40</sup> Using such a crosswalk, 18 STEM occupations are found as the most likely occupations for graduates qualified in those CIP codes. It is clear that wages are much better than for the average Florida job. While the average Florida job paid about \$46,155 in 2018, the jobs most highly associated with the Florida Poly CIP codes paid an average of \$82,524 on a statewide basis.

The weighted average cumulative job growth rate for the 2008 - 2018 period was 28.4 percent for the Florida Poly SOC codes across the primary six-county market footprint. This contrasts with 25.6 percent for other Bachelor's Degrees not in the Florida Poly CIP-SOC code crosswalk. It is clearly higher than the 19.2 percent for Associate's Degrees, and the 13.1 percent for those with High School diplomas over the 2008 – 2018 period.<sup>41</sup>

In the Table below we present data on jobs, job growth, number of openings, and median hourly earnings for 18 occupations that most closely match the instruction programs that Florida Poly offered in academic year 2018-19.<sup>42</sup> As can be seen, job growth over the 10-year window for the six-county area is projected to total 10,904 in occupations that are best fits for Florida Poly programs. Over that same time period, there will be about ten times as many openings to be filled, with the multiple attributable to retirements and transfers.

Table 2: Projected change in jobs and job openings in core market area, 2019 - 2029

Description	2019 Jobs	Projected 2029 Jobs	2019 - 2029 % Change	2019 - 2029 Openings	2018 Median Hourly Earnings
Computer and Information Systems Managers	7,594	8,550	13%	6,819	\$60.45
Architectural and Engineering Managers	2,984	3,275	10%	2,436	\$61.65
Cost Estimators	5,316	5,949	12%	6,098	\$27.95
Computer and Information Research Scientists	167	237	42%	206	\$46.28
Information Security Analysts	2,403	2,920	22%	2,289	\$43.93
Computer Programmers	4,789	4,743	(1%)	3,102	\$35.39
Software Developers, Applications	17,722	22,183	25%	17,141	\$46.03
Software Developers, Systems Software	7,607	8,510	12%	6,027	\$48.90
Web Developers	4,194	4,790	14%	3,714	\$27.38
Computer Network Architects	4,446	4,607	4%	3,048	\$44.04
Computer Network Support Specialists	3,872	4,212	9%	3,269	\$26.98
Computer Occupations, All Other	5,077	5,937	17%	4,529	\$36.49
Aerospace Engineers	838	963	15%	653	\$52.40
Computer Hardware Engineers	704	802	14%	571	\$48.87
Electrical Engineers	2,288	2,610	14%	1,879	\$43.67
Electronics Engineers, Except Computer	1,732	1,851	7%	1,257	\$45.05
Mechanical Engineers	3,104	3,558	15%	2,539	\$40.32
Career/Tech Ed Teachers, Secondary School	1,700	1,745	3%	1,244	\$26.85
	76,538	87,442	14.25%	66,821	

Source: EMSI 2019.3 – QCEW Employees, Non-QCEW Employees, and Self-Employed

Taking an average of the median earnings associated with these occupations, and weighting that average to reflect the number of employees in each occupation, shows expected earnings per employed Florida Poly graduate of \$89,326. Performing a similar calculation across all other occupations among the 775 occupations tracked for these six counties yields expected earnings of \$43,559. The wages expected to be earned per Florida Poly graduate are thus more than double the median expected wage across all other job categories.

If we restrict the above calculation to those occupations that typically require a bachelor's degree, but not in one of the Florida Poly occupations, the earnings per job are expected to be \$67,583.<sup>43</sup> The expected earnings differential for a Florida Poly graduate versus someone with a bachelor's degree in a non-Poly field is \$21,743, representing a 32.2 percent earnings premium

over non-Poly bachelor's degrees. In undiscounted terms and not accounting for wage growth, this would amount to \$869,720 over a 40-year work life.<sup>44</sup> Given that the SUS calculates that the average cost of attendance for a Florida Poly student is 4.1 percent lower than at other SUS schools, the net benefit is that much larger.<sup>45</sup>

The strategy for Florida Poly is to strive to be the premier, core STEM public institution in the southeast region of the United States. The tactic of increasing selectivity supports the University's model of delivering small classes with strong student-faculty interaction engaged in project-based, curricular experiences. Coupled with a carefully engineered curricular and co-curricular focus on professional and leadership skills, the University offers industry-aligned majors in fast-growing, high-paying sectors. Florida Poly's priority on strong relationships with local and regional industry serves to fulfill its directive to enhance economic development in the state. A key component of this is the University's focus on connecting students with small and medium-sized business through internships, projects, and eventual employment. These efforts reflect key goals in Florida Poly's new strategic plan that calls for stronger efforts to grow the University's program portfolio and student experience initiatives to meet its goals of delivering programs in high-paying industries and maximizing value for students by preparing them for a lifetime of success.

### Research Potential

The University's plan also calls for capitalizing on its strategic location on the I-4 corridor by creating a high-tech economy around Florida Poly. This effort includes a strong faculty recruiting initiative that deepens the growing basic and applied research footprint catalyzed by the Applied Research Center. By connecting with local stakeholders, and its relationship with SunTrax, and the newly created Advanced Mobility Institute, the plan calls for building out the campus and surrounding area with space for high-tech business and industry, a convention center, and full-service living community. These activities help provide an established set of assets in addressing cutting edge issues that confront today's technology-intensive businesses. While Federal research funding faces budgetary pressures, with no respite in sight, the types of industry partnerships envisioned by Florida Poly are increasingly at the forefront of innovation.

In discussing overall R&D activity, which the NSB report estimates to have been at between 2.6 and 2.8 percent of U.S. GDP during the most recent 15 years of data, NSB notes "Business R&D in the United States is concentrated in selected areas: chemicals manufacturing; computer and electronic products manufacturing; transportation equipment manufacturing; and information and professional, scientific, and technical services. These industries account for the clear majority (83%) of business R&D performance." The NSB also reports that overall university R&D research has grown at a more rapid rate over time since 1990, with cumulative growth of 110 percent in constant 1990 dollars, versus 83 percent for business R&D research. However, the dollar volume of growth in research by businesses has been \$89 billion since 1990 (in constant 1990 dollars) versus \$19 billion for universities and colleges. This suggests latitude for productive Florida Poly partnerships with private business in areas of mutual interest.

The most recent IPEDS methodology report found 2,836 four-year colleges and universities in the United States. Some 131 of them, or just less than 5 percent, are considered to be "very high research activity" universities. In Florida this list includes FIU, FSU, UCF, UF, USF, and the



University of Miami. In terms of federally funded research, which is the *sine qua non* of very high research activity universities, the trend has been flat or downward since 2011 in nominal terms, with only a modest recovery in the most recent years. By 2015, the most recent NSF data year, university R&D funding from the federal government was down 11.2 percent in inflation-adjusted dollars from the high-water mark of 2010. The Congressional Budget Office's January 2019 Budget and Economic Outlook forecasts Social Security outlays increasing from 4.9 percent of GDP in 2016 to 6.0 percent in 2029, health care program outlays going from 5.5 to 8.2 percent over that period, and net interest outlays going from 1.4 to 3.0 percent over that period. Nondefense discretionary spending, the source of most federal research funding, is projected by CBO to fall from 3.2 percent of GDP today to 2.4 percent in 2029. Defense spending, which would be a logical area of focus for Florida Poly engineering and science research programs, is projected to fall from 3.1 percent of GDP to 2.5 percent over that period. It will be difficult to increase the dollar value of Florida Poly's slice of what may become a shrinking federal research pie. While Florida Poly has had noteworthy successes in recent months with highly competitive federal agency research funding programs, campus-wide federal research funding success necessarily remains aspirational and will increase over time as the campus grows.

Given the budgetary pressures imposed by tax cuts, interest expense on the federal debt, and the baby boomers demands on social security, traditional federal funding sources for scientific research are likely to be increasingly unavailable. The limited number of faculty members who can self-fund via competitive federal grant and contract awards are already in high demand across any number of universities. This means that recruiting clusters of instructional faculty in areas with growing basic science research funding is expensive, as their wages will reflect options both at Florida Poly or with other organizations inside and outside of academia.

The University's strategy of applied research conducted jointly with regional businesses to meet their technology development needs is likely to be a fruitful path towards increased research expenditures and thus increased availability of resources. This strategy will deepen and expand cross-sector collaboration and align higher education programs with targeted industry needs. It will help ensure innovations in Florida's universities and research institutes stay in Florida by increasing commercialization through licensing, reduced barriers, and access to capital.<sup>46</sup>

### Sources of Florida Poly Economic Impact

Increased economic activity in the community and in the State of Florida due to the presence of Florida Poly flow from several sources. These include the operations expenditures of the university (including payroll), the average annual capital outlays of the University, the student spending done in the community, and, most importantly, from the increased future earnings of Florida Poly graduates relative to their peers. Specific assumptions are detailed in the Appendix.

To the extent possible we use measurement protocols that follow the most recent systemwide assessment for the SUS.<sup>47</sup> The economic impact of Florida Poly is substantially greater than it was during the most recent assessment of the statewide impact of the Florida SUS. While the present study was conducted using the same basic methods, several differences are key. First is the difference in the University itself. Florida Poly had not yet graduated students at the time the prior assessment was conducted, meaning that the present value (PV) of the expected lifetime earnings differential relative to a high school graduate could not be calculated. Further, the

number of students enrolled was smaller than it is today, meaning that university spending was lower. Also, the 2016 study did not account for the targeted core STEM curriculum that guides Florida Poly. Because the 2016 study assumed a consistent wage differential across all fields of study at the Bachelor’s Degree level versus the High School diploma level, it does not adequately reflect the wage premium that Florida Poly graduates will enjoy in the market relative to their peers. The 2018 Economic Security Report produced by the Florida Department of Economic Opportunity found that the median wage for the most recent cohort of bachelor’s degree completers for the SUS was \$36,000, ranging from a high of \$37,476 at Florida International to a low of \$23,760 at New College of Florida. Much of this is due to choice of majors by students. The most popular major in the SUS over the study period was psychology, with first-year median wages of \$28,588, while the second most popular major was biology, with wages of \$27,272. These are well below the median wages being reported in Florida Poly surveys of graduated students, and below the levels reported in the EMSI wage data for Florida Poly occupations.

The elements of net new direct spending described in the Appendix are entered into the IMPLAN model, and direct, indirect, and induced impacts of Florida Poly spending impacts, along with job creation, labor income, GDP and total output, are reported below.

Table 3: Economic Impacts from Florida Poly, by Activity, FY2018-19

Activity	Jobs	Labor Income	GDP	Total Output
University Operations	728	\$30,125,069	\$39,283,089	\$68,498,083
Capital Expenditure	200	\$8,494,443	\$14,263,878	\$32,354,361
Student Spending	199	\$5,129,403	\$8,992,329	\$15,724,088
PV Lifetime Earnings Differential	1,223	\$53,886,009	\$98,836,845	\$172,582,638
Grand Total	2,350	\$97,634,924	\$161,376,141	\$289,159,170

Source: IMPLAN, author’s calculations

These impacts can be disaggregated into elements that flow from the presence of the University in Polk County, including operations, construction, and student spending, and elements that are statewide in nature. Statewide impacts are driven by the additional income that can be expected to flow to graduates of Florida Poly due to the valuable job market skills they possess. These are broken out in the Tables below.

Table 4: Top 10 Local Sectors for Total Impact of Annual University Operations, Construction, and Student Spending, by Number of Jobs

Description	Jobs	Labor Income	Local GDP	Total Output
Colleges and Universities	526	\$22,955,549	\$25,376,617	\$44,177,796
Construction of new educ/voc structures	167	\$6,997,594	\$11,557,309	\$29,468,331
Real estate	63	\$844,416	\$5,395,189	\$9,137,521
All other food and drinking places	63	\$1,694,076	\$1,669,787	\$2,810,755
Transit and ground passenger transp.	27	\$439,745	\$557,629	\$1,384,837
Retail - Food and beverage stores	22	\$584,964	\$904,520	\$1,419,456
Retail - General merchandise stores	18	\$505,374	\$795,349	\$1,239,448
Full-service restaurants	17	\$354,691	\$399,078	\$794,941
Limited service restaurants	15	\$260,094	\$678,574	\$1,225,896
Employment services	14	\$446,783	\$690,463	\$975,473
Other sectors	195	\$8,665,629	\$14,514,781	\$23,942,079
Total Impact =	1,127	\$43,748,915	\$62,539,296	\$116,576,532

Source: IMPLAN and author's calculations

Table 5: Top 10 Statewide Sectors for Total Impact of Increased Household Income Attributable to Florida Poly Degree vs. High School Degree, by Number of Jobs

Description	Jobs	Labor Income	Statewide GDP	Total Output
Real estate	79	\$1,185,773	\$8,857,027	\$13,562,313
Full-service restaurants	60	\$1,554,809	\$1,712,249	\$3,148,203
Hospitals	58	\$4,029,100	\$4,903,507	\$8,724,026
Limited-service restaurants	55	\$1,152,963	\$2,920,674	\$4,958,949
Offices of physicians	37	\$3,450,815	\$3,427,300	\$5,162,181
Retail - General merchandise stores	36	\$1,032,719	\$1,619,014	\$2,512,143
Retail - Food and beverage stores	35	\$993,457	\$1,513,552	\$2,310,447
Wholesale trade	33	\$2,556,044	\$5,099,867	\$7,735,870
Other financial investment activities	29	\$499,089	\$709,648	\$4,384,711
All other food and drinking places	27	\$751,980	\$750,639	\$1,246,875
Other sectors	775	\$36,679,258	\$67,323,367	\$118,836,920
Total Impact =	1,223	\$53,886,009	\$98,836,845	\$172,582,638

Source: IMPLAN and author's calculations

### Return on Investment from the Student Perspective

It is clear that Florida taxpayers receive excellent value for the tax dollars expended in support of Florida Poly. The figures presented above suggest that almost three dollars in new personal income stay in Florida for every dollar of general revenue appropriated to Florida Poly.

However, the fact that almost half of students in core STEM fields will leave the state at some point after finishing their degree<sup>48</sup> means that the above impacts are lower than they could be. If Florida companies created enough jobs in Florida Poly occupations, graduates would be able to work productively and meet their career expectations without having to leave the state. This would represent great progress towards Florida's high-wage economic development goals. On the cost side, some of the State of Florida revenue appropriated to Florida Poly has gone towards keeping the cost of attendance affordable, allowing the University to expand and meet its enrollment targets. Such subsidies have already diminished and will likely continue to diminish over time.

From the student perspective, the income gains that accrue from having obtained the scarce skills that are part of a quality core STEM education will follow them throughout a career, regardless of whether their paycheck comes from a Florida company or from elsewhere. Thus, when considering returns to individual Florida Poly students, there is no need to apply a discount to account for dollars earned as graduates migrate to pursue career opportunities. However, unlike the taxpayer, a student must also consider his or her opportunity cost of a rigorous academic program, especially the sacrifice of the income that could have been earned had they gone directly into the workforce instead of spending time in class and studying while enrolled at Florida Poly.

To perform these calculations, it makes sense to assume that the average graduate has a 35.4 year work-life expectancy at age 25,<sup>49</sup> gives up \$24,940 in income annually to attend Florida Poly, and has out-of-pocket school-related expenses of \$6,149 that would not have otherwise been incurred during his or her Florida Poly school career. If we use a real discount rate equal to the current yield on a 30-year Treasury inflation protected security (TIPS), then the present money value of the \$45,913 annual earnings differential over the work-life is \$1,635,446, which can be compared against an opportunity cost of about \$122,556.<sup>50</sup> This means that a graduate can expect to earn over \$13 in discounted additional personal income for every dollar of current outlay to pursue a degree. If we were to instead use the four percent after-inflation discount rate that the State of Florida uses in valuing future benefits from current outlays on transportation projects, then that ratio would fall to a multiple of 7.7 times cost.

These figures stand in contrast to the reported \$14,070 earnings differential in the 2016 UF-FSU report. Additionally, the growth rate in the differential was found to be different in that study, with inflation-adjusted earnings of Bachelor's degree graduates actually declining by 5.7 percent over a 5-year period at the same time as High School graduate earnings remained stable.<sup>51</sup> Assuming the same opportunity cost, and using the 30-year TIPS benchmark, the ratio of discounted additional personal income to cost is 4.1, even using a favorable (relative to the results found in the 2016 study) constant-over-time wage differential. Use of a four percent after-inflation discount rate shows a ratio of 2.4 dollars of additional personal income per dollar of cost. If we instead use the narrowing differential found in the 2016 study and a four percent after-inflation discount rate, the Bachelor's degree to High School diploma ratio drops to 1.9 dollars of income to every dollar of cost. Further, it is fair to conclude from the labor market experience of the recent past and from technical reports disentangling the reasons for the changes, that a Florida Poly education is becoming increasingly valuable over time, relative to both a High School diploma and an average SUS degree. All signs indicate that these trends will continue.

## Conclusion

Florida is a rapid-growth state relative to the rest of the nation, and there are both challenges and opportunities in terms of student population growth. Florida Poly is well-positioned to benefit from population growth trends. Demographic trends may present challenges, among them being the aging of the State, and the ongoing trend towards more leisure and hospitality activities. However, these trends are exactly why there is a pressing need for the core STEM programs offered at Florida Poly – they will enable the high wage economy that Florida aspires to.

About 61 percent of the economic impact of the University, as measured by the increment to state and local GDP, is driven by the skills, credentials, and increased earning capacity of the graduating students. It is straightforward to see that it is the rigorous teaching and credentialing that Florida Poly offers that will contribute most substantially to regional transformation via successive classes of students. The economic impact of a larger student body, and more faculty actively pursuing collaborative research with businesses across the region, will be profoundly larger than it is today. This will be seen in the breadth, depth, and variety of programs available, and in the population growth that would be associated with recruitment of out-of-region and out-of-state students, and the faculty to serve them. Major additions to the University's economic development contributions will come as research, development, and commercialization dollars generated by faculty and staff of Florida Poly grow along with University enrollments and increasing collaborations.

The fields of study offered by Florida Poly ensure that high wages are the norm. While other fields of study may merit consideration by families and students, it is clear that a wage penalty will likely be paid for more popular SUS degrees versus core STEM degrees. A growing and converging body of work offers explanations that point to continuations of these wage trend differentials.

The legislature showed foresight in committing resources to establish Florida Poly and encourage its growth. Its merit can be seen in the large economic impact per student that is driven primarily by excellent wage differentials versus competing programs. While there are challenges in finding enough qualified students, the basic demographic trends are favorable for steady expansion. If that occurs, the State and Florida Poly students and families will be repaid many times over by high wages and bright career prospects.

## Appendix A: The IMPLAN Model

We use models constructed in the IMPLAN economic impact modeling software environment ([www.implan.com](http://www.implan.com)) to identify Polk County and Florida-specific multipliers for the spending described above. IMPLAN is a member of the class of tools known as input-output models. Such models allow identification of the indirect and induced spending, or “multiplier effects,” also known as “ripple effects,” that are generated by direct spending elements such as those described in the body of the text above. These models use data on inter-industry linkages that are derived from data collected by the U.S. statistical agencies in their periodic surveys of businesses such as the annual Survey of Manufactures, and the Economic Census that is conducted every five years. The data from these and other surveys allows analysts to see from which sectors where businesses buy their inputs and to whom they sell their outputs. This process allows analysts to identify linkages between economic sectors and subsectors and construct a matrix that relates input-output (IO) relationships. The IMPLAN IO model consists of 536 sectors that correspond to the various types of businesses throughout the economy, as well as to personal spending by households at 10 different income levels, and by government entities, and the model specifies the spending linkages that on average exist between them. The model used in this analysis is calibrated to reflect the differences in relationships, as compared to the national average relationships for each sector, between sectors in Florida and each of its 67 counties.

Here we use the Polk County model to calculate impacts for those types of spending that occur in Polk County that would likely not occur in the County but for the presence of Florida Poly. These include the impacts of University operations, the non-tuition spending of Florida Poly students, and the average annual construction spending being done by Florida Poly in the ongoing construction and buildout of its campus. A statewide model is used in calculating the spending impact that is due to the earnings differential between occupations that correspond to Florida Poly areas of study and occupations that typically only require a High School Diploma. While about 16 percent of enrolled students listed their home as Polk County, it cannot yet be known where they will start their careers. However, Florida Poly sources suggest that a substantial number of students stay in Polk County after graduation. Clearly some non-trivial share of the statewide impact of the present money value of the income differential will be felt in Polk, in addition to the Polk-specific effects described above.

## Appendix B: Model Inputs and Assumptions

Increased economic activity in the community and in the State of Florida due to the presence of Florida Poly flow from several sources. These include the operations expenditures of the university, the average annual capital outlays of the University, the student spending done in the community, and, most importantly, from the increased future earnings of Florida Poly graduates relative to their peers. Here we use an estimated payroll figure of \$29.3 million per year (this counts salaried and OPS workers for the 2018-19 fiscal year) as an input into the college and university production sector for Polk County. This payroll value captures not only the estimated direct employment at the University but also, via the models multiplier linkages, supply chain of local businesses.<sup>52</sup> Operations expenditures consist of payroll, other operating expenses, and capital outlays associated with keeping the doors open. These values tend to be higher than spending done by a similar number of employees elsewhere in state and local government because of the higher wages commanded in the marketplace by workers with the educational attainment of university faculty and staff.

Because capital outlays tend to be unevenly distributed over time, with construction spending going from very low to very high as a new building is begun, and then back to a minimal level upon completion, here we use an estimated annual average for construction spending. We use \$6.25 million per year as an estimate of the average cost of construction to be done on campus.

It would be reasonable to expect that Florida Poly students might have had similar living expenses had they simply joined the workforce after high school or attended a different Florida school. However, spending done in the local community by out-of-area students who choose to attend Florida Poly would likely not have occurred elsewhere in Florida and is thus net new spending to the local economy. The same is true of local students (about one out of six students are from Polk County) who would likely have gone out of the area to attend college if Florida Poly were not to exist in Polk County. Here we follow the BOG measures of cost of attendance for students at the various SUS member institutions, appropriated adjusted to reflect the share of gross retail spending that stays in the local economy.

While the above sources are important, the present money value of the increased lifetime wages associated with market demand for the scarce skills provided by a Florida Poly education are far and away the largest component of economic impact for any college or university.<sup>53</sup> Here we use a four percent after-inflation discount rate applied to 30 years of wage differential between a Florida Poly grad and a high school graduated. Because students come from across the state to attend Florida Poly, and will likely work in areas around the state and outside the state once they graduate, we use a statewide model to calculate the indirect and induced effects of earnings. Wage values are taken from the EMSI Q3 2019 database, with differentials calculated based on U.S. Bureau of Labor Statistics assumptions about the average academic qualification for entry into a particular occupation.

We use reported 2018-19 expenditures taken from Florida Poly budget documents in assessing economic impact, including data on current expenditures for university operations, payroll for faculty and staff, and capital outlays.

Statewide, the differential between median wages for occupations for which a bachelor's degree is the normal entry credential versus high school degree occupations (at \$68,031 and \$36,612, respectively) is currently calculated to be 86 percent. The gap between high school degrees and those with jobs in Florida Poly majors is even larger, as the 2018 median annual earnings across Florida for the 18 occupations most closely associated with core STEM instructional programs were \$82,524.<sup>54</sup> The greater Florida Poly wage differential is due to its highly focused core STEM curriculum that produces well-trained, in-demand graduates.

Spending by students was taken from BOG tables that break out student expenditures for fall/spring attendance into tuition and fees, books and supplies, room and board, transportation, and other expenses. In order to avoid double counting, we subtract tuition and fees from costs to students, as they are captured in the revenue and expenditure data for the university. However, we do include room and board for all students, as student dorms for Florida Poly are operated by private entities under a public-private partnership agreement and thus do not appear on the University's income and expenditure statements.

Information on the likely earnings of Florida Poly graduates is taken from EMSI data for workers in occupations corresponding to Florida Poly fields of study. These data are then used to compare to likely earnings for high school graduates in Florida working in occupations typically requiring a high school degree, as reported by EMSI. Likelihood of labor market participation for engineering and computer science graduates is taken from NCES data as presented in Choy, Bradburn, and Carroll.<sup>55</sup> Probabilities of graduates staying in state during their working career are taken from a report on that topic by OPPAGA.<sup>56</sup> We then calculate the net present value of the differential over a 30-year worklife expectancy.

In keeping with normal practice in identifying economic impacts and impacts associated with a particular economic sector,<sup>57</sup> all direct spending is counted when calculating the economic impact of Florida Poly, and multipliers are applied to those components of spending that would not have otherwise been present in the Florida economy absent the operations of Florida Poly. This latter category includes the earnings differential between a Florida Poly graduate and a high school graduate, as well as the spending done by out of state students, whether on tuition or living expenses.



## Endnotes

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<sup>1</sup> A polytechnic education emphasizes the applications of technology and develops skills in reasoning and problem-solving, innovation, and interdisciplinary thinking.

[https://www.flbog.edu/documents\\_meetings/0128\\_0555\\_4478\\_2.pdf](https://www.flbog.edu/documents_meetings/0128_0555_4478_2.pdf)

<sup>2</sup> Florida House of Representatives Staff Analysis of SB 1994. Page 2.

<http://flsenate.gov/Session/Bill/2012/1994/Analyses/s1994z1.HEAS.PDF>.

<sup>3</sup> Florida House of Representatives Staff Analysis of SB 1994. Page 2.

<http://flsenate.gov/Session/Bill/2012/1994/Analyses/s1994z1.HEAS.PDF>.

<sup>4</sup> Per Dr. Randy K. Avent, founding president of Florida Poly <https://floridapoly.edu/staff/randy-avent/>.

<sup>5</sup> Florida Chamber Foundation, “Florida 2030: The Blueprint to Secure Florida’s Future. Key Targets & Strategies,”

[https://www.flchamber.com/wp-content/uploads/2018/09/ES\\_FLChamber2030\\_TargetsandStrategies\\_Sep12.pdf](https://www.flchamber.com/wp-content/uploads/2018/09/ES_FLChamber2030_TargetsandStrategies_Sep12.pdf)

September 2018, page 4.

<sup>6</sup> Using the Q3 2019 employment data from Economic Modeling Specialists International (EMSI), with wage averages weighted by the number of workers in each occupation ([www.economicmodeling.com](http://www.economicmodeling.com))

<sup>7</sup> <https://www.frbsf.org/economic-research/publications/economic-letter/2015/january/wages-education-college-labor-earnings-income/>

<sup>8</sup> J Dewey and D Denslow, “Baby Boom Retirees and Florida’s Job Structure,” *Business and Economics Journal*, 2012, write “Absent urgent and aggressive policy intervention, Florida’s workers that retire over the next 20 years are likely to be replaced by less educated and less skilled workers less suited to the knowledge economy, and the gap between Florida’s average job skill and the national average is likely to widen substantially.”

<sup>9</sup> See NSB <https://www.nsf.gov/statistics/state-indicators/indicator/seh-doctorate-holders-in-workforce/chart>, 2015, in which Florida scores above only Nevada. “This indicator measures the concentration of science, engineering, and health (SEH) doctorate holders among a state’s workforce and represents a state’s ability to attract and retain highly trained scientists and engineers. These individuals often conduct R&D, manage R&D activities, or are otherwise engaged in knowledge-intensive activities. A high value for this indicator in a state suggests employment opportunities for individuals with highly advanced training in SEH [science, engineering, and health] fields. States in the top quartile for this indicator tend to contain major research laboratories, research universities, or research-intensive industries.”

<sup>10</sup> “2019 Accountability Plan, Florida Polytechnic University,” March 2019, page 2.

<sup>11</sup> President Avent noted in his May 2019 report to the Board of Governors that the SUS has the next to lowest tuition and fees in the nation, and that Florida Poly has the lowest tuition and fees in the SUS.

<sup>12</sup> See Appendix for explanation of key terms and a description of the IMPLAN model. This study calculates the impact of university spending at the County level, and of income differential to Florida Poly grads at the State level. We adopt the standard convention of measuring impact from those dollars that would not be spent elsewhere in the County (for university spending) or the State (for the earnings differential). Had we instead used a state-wide model to examine the Polk impacts, we would have restricted ourselves to reporting direct spending, rather than direct, indirect, and induced. See Watson, et al, “Determining economic contributions and impacts: what is the difference and why do we care?” *Journal of Regional Analysis and Policy* 37(2): pps140-146, 2007.

<sup>13</sup> Hodges, Harrington, et al, “Economic Impacts of the State University System of Florida in 2014-15,” UF-IFAS and FSU-CEFA, April 15, 2016. That study reports (page 4) that “About two-thirds of the output and value-added impact and over half (54%) of employment impacts were attributed to the SUS graduates earning differential.” Some 25 percent of SUS degrees awarded, and earnings differential relative to High School calculated, were Master, Professional, and Doctoral degrees. The higher degrees show an earnings differential relative to high school graduates of from \$31,913 to \$58,088, versus the calculated 2013-14 SUS Bachelors differential of \$14,070. The Florida Poly wage impact is remarkable given that 25 percent of SUS degrees awarded and analyzed in the Hodges et al SUS-wide 2016 study were post-graduate, and showed higher wage than SUS Bachelor’s degrees, while all Florida Poly degrees considered in the present report are Bachelor’s degrees.

<sup>14</sup> Wage ratios calculated using EMSI median wages by occupation and geography. See fn 6.

<sup>15</sup> The six counties are Polk, Hillsborough, Broward, Palm Beach, Orange, and Pasco, as measured by share of student body population.

<sup>16</sup> Data from EMSI, see fn 6.

<sup>17</sup> President Avent’s statement to the Board of Governors noted that 72 percent of respondents to a post-graduation survey reported being employed. While we do not have information on survey response rates, this is in contrast to

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the SUS average of 66 percent reported as employed and 50 percent reported as employed full-time, as reported in the 2019 Economic Security Report.

<sup>18</sup> Florida BOG, “CostAttendance2019\_2020\_FINAL.xlsx”

<sup>19</sup> For 2018-19 tuition and fees, see <https://www.flbog.edu/wp-content/uploads/2018-19-SUS-Tuition-and-Fee-for-New-Students-by-level.pdf>

<sup>20</sup> The University substantially discounted expense to enrolling students during its first several years. That discount has decreased over time from 125 percent to 65 percent. Florida Poly students graduate with well below the national average level of student debt. In terms of economic impact to the local region, the spending of Florida Poly students is particularly important, as this spending likely would not have occurred elsewhere in Polk County had a student not attended Florida Poly.

<sup>21</sup> Hodges, Harrington, et al, “Economic Impacts of the State University System of Florida in 2014-15,” UF-IFAS and FSU-CEFA, April 15, 2016. Because Florida Poly is so new, the FY2104/15 expenditure data used in that study will have changed more in intervening years than for other SUS institutions.

<sup>22</sup> “The Second Fifty Years: Initial Assessment of the Impact on the University of West Florida of Adopting Florida’s Emerging Preeminence Standards as a Primary Driver of the University’s Strategic Planning Process,” UWF Center for Research and Economic Opportunity, June 2016

<sup>23</sup> As was pointed out almost a century ago by John Maynard Keynes who noted “The increase of technical efficiency has been taking place faster than we can deal with the problem of labour absorption,” in “The Economic Problems of our Grandchildren,” 1930.

<sup>24</sup> Ned Ludd in 1779 allegedly led hosiery workers to destroy mechanical looms that threatened their livelihood. Navickas, Katrina, “The search for ‘General Ludd’: the mythology of Luddism,” *Social History* 30(3), August 2005. More generally, Luddites battle against labor-saving innovation.

<sup>25</sup> See e.g., David Autor, “Work of the Past, Work of the Future,” NBER working paper 25588, February 2019.

<sup>26</sup> This has been a feature of the mainstream economics literature for a least a half-century. See, e.g., Jan Tinbergen, “Substitution of Graduate Labor by Other,” *Kyklos* 27(2), 217 – 226, 1974.

<sup>27</sup> See e.g., Autor, Levy, and Murnane, “The skill content of recent technological change: an empirical exploration,” NBER working paper 8337, June 2001.

<sup>28</sup> Beaudry, Green, and Sand, “The Great Reversal in the Demand for Skill and Cognitive Tasks,” *Journal of Labor Economics* 34, no. S1 (Part 2, January 2016): S199-S247.

<sup>29</sup> Robert Valletta, “Recent flattening in the higher education wage premium: polarization, skill downgrading, or both?” NBER working paper 22935, December 2016.

<sup>30</sup> David Autor, “Work of the Past, Work of the Future,” NBER working paper 25588, February 2019.

<sup>31</sup> Not all of this effect can be attributed to what was learned at university. At least some of this premium is earned by university graduates who might otherwise have been better earners as mere high school graduates than the average high school graduate – i.e., there may be self-selection bias inherent in the calculations of wage differential. Skilled and motivated people tend to get degrees. MIT economist Josh Angrist finds that most of the difference in earnings for graduates can be predicted before they actually enroll in college. That is, the higher earnings for MIT grads are mostly attributable to their ability to be accepted for enrollment at MIT rather than to value added by their MIT academic experience. It thus isn’t completely clear whether higher education makes people successful, or whether people bent on success acquire higher education, it is certainly clear that people with better levels of education are higher earners.

<sup>32</sup> Payscale.com The reported data are simply the median wage for graduates of a given college or university and the share of total degrees awarded that are STEM degrees.

<sup>33</sup> “Measuring the Economic Success of Florida’s Graduates: Economic Security Report 2018,” American Institutes for Research, December 2018, pages 4, 5. <http://www.floridajobs.org/docs/default-source/office-of-workforce-services/state-program-reports/2019-state-program-reports/florida-economic-security-report-final-01-10-2019.pdf?sfvrsn=0> accessed June 3, 2019.

<sup>34</sup> The 2016 assessment showed the SUS in FY2014/15 to have had an economic impact of 768,856 jobs and \$49.2 billion in additional gross domestic product at the state level, when direct, indirect, and induced impacts are considered. Florida Poly had opened its doors and was considered in the analysis but had not yet enrolled a full complement of students at that time. For example, in 2014/15, New College enrolled a total of 834 students and had a reported GDP impact of \$88 million, while Florida Poly enrolled 540 undergraduate students and had a GDP impact of \$22 million. However, in 2018 Florida Poly had 1,428 undergraduates enrolled, while New College had 838.

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<sup>35</sup> See, e.g., Lagakos, Moll, et al, “Life-Cycle Wage Growth Across Countries,” *Journal of Political Economy*, Vol 16, Number 2, April 2018, for a discussion of how more educated workers have steeper experience-wage profiles than the less educated; this accounts for around one-third of cross-country differences in aggregate experience-wage profiles.

<sup>36</sup> J Dewey and D Denslow, “Baby Boom Retirees and Florida’s Job Structure,” *Business and Economics Journal*, 2012.

<sup>37</sup> President Avent noted in a recent BOG presentation that the Florida SUS has the second lowest tuition in the nation, and that Florida Poly has the lowest net tuition (after financial awards to students) in the SUS.

<sup>38</sup> “2019 Accountability Plan, Florida Polytechnic University,” March 2019, page 2.

<sup>39</sup> “2018-2019 Academic Catalog,” retrieved at <http://catalog.floridapoly.edu/> on July 15, 2019.

<sup>40</sup> The CIP-SOC tools can be accessed here: [https://www.flbog.edu/board/office/asa/new\\_program\\_proposal.php](https://www.flbog.edu/board/office/asa/new_program_proposal.php)

<sup>41</sup> Data are from Economic Modeling Specialists International, version 2019.3 – QCEW Employees, Non-QCEW Employees, and Self-Employed, for Broward, Hillsborough, Orange, Palm Beach, Pasco, and Polk counties.

<sup>42</sup> Several non-STEM occupations also map from the Florida Poly CIP codes, including Chief Executives and General and Operations Managers, however these may be mid-level to senior-level occupations that arise over the course of a work career. Here we focus on positions that are less likely to be at the executive level.

<sup>43</sup> Here we use the U.S. Bureau of Labor Statistics (BLS) definition of typical entry level education expectation for each occupation, which can sometimes differ from the Florida Department of Economic Opportunity (DEO) classification. For example, Florida DEO assumes an Associate’s Degree is the typical credential for a registered nurse, while BLS assumes it requires a Bachelor’s Degree.

<sup>44</sup> This is likely to be a conservative estimate given that earnings in Florida Poly occupations have been increasing more rapidly than earnings in other occupations.

<sup>45</sup> Average cost of attendance is available at <https://www.flbog.edu/board/office/budget/tuition.php>. It includes tuition and fees, books and supplies, room and board, transportation, and other expenses. It does not include the opportunity cost of foregone earnings while in school.

<sup>46</sup> Florida Chamber Foundation, “Florida 2030: The Blueprint to Secure Florida’s Future. Key Targets & Strategies,” [https://www.flchamber.com/wp-content/uploads/2018/09/ES\\_FLChamber2030\\_TargetsandStrategies\\_Sep12.pdf](https://www.flchamber.com/wp-content/uploads/2018/09/ES_FLChamber2030_TargetsandStrategies_Sep12.pdf) September 2018, page 6, accessed 9-28-2019.

<sup>47</sup> Hodges, Harrington, et al, “Economic Impacts of the State University System of Florida in 2014-15,” UF-IFAS and FSU-CEFA, April 15, 2016.

<sup>48</sup> Office of Program Policy Analysis and Government Accountability (OPPAGA) of the Florida Legislature. Florida’s University Graduates Tend to Stay in the State Workforce After Completing Their Degrees. Report 05-59, 11 pages, Dec. 2005. See discussion in the Appendix regarding assumptions embodied in the impact calculations.

<sup>49</sup> See, e.g., Skoog, Cieka, and Krueger, “The Markov Process Model of Labor Force Activity: Extended Tables of Central Tendency, Shape, Percentile Points, and Bootstrap Standard Errors,” *Journal of Forensic Economics* 22(2), 2011, pp.165-229.

<sup>50</sup> This assumes that inflation-adjusted wages, other costs, and Florida Poly tuition and supplies costs are effectively flat in the near term.

<sup>51</sup> The phenomenon of de-skilling in middle income jobs typically held by college graduates is discussed in detail in Autor (“Work of the Past, Work of the Future,” NBER working paper 25588, February 2019) who finds that more highly skilled workers have moved up in the income distribution, while middle skill workers have moved down, so that skill-intensive core STEM degrees are increasingly differentiated from less technical Bachelor’s degrees.

<sup>52</sup> Purchases from outside the local area are effectively eliminated from calculations of impact by use of a local purchase coefficient that accounts for that fraction of purchases likely to originate from outside the local area.

<sup>53</sup> On top of this, Bachelor’s degree graduates are likely to stay in the workforce longer than workers with less educational attainment. See, e.g., Kurt Krueger and Frank Slesnick, “Total Worklife Expectancy,” *Journal of Forensic Economics* 25(1), 2014, pp. 51 – 70.

<sup>54</sup> Data are from EMSI. Without adjusting for inflation, differential growth rates, and before discounting, the gap between median earnings for the average Florida Poly grad versus the average SUS grad would total more than \$579,000 over a 40-year career.

<sup>55</sup> “Ten Years After College: Comparing the Employment Experiences of 1992-93 Bachelor’s Degree Recipients With Academic and Career-Oriented Majors,” NCES Report 2008-155, p28. This report finds that at least 74 percent and as many as 91 percent of Engineering and Computer Science graduates were employed full-time during any given sampling period in the ten years following graduation. This contrasts sharply with the employment figures for SUS bachelor’s degree graduates more generally, as presented in the most recent Economic Security Report.

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<sup>56</sup> Office of Program Policy Analysis and Government Accountability (OPPAGA) of the Florida Legislature. Florida's University Graduates Tend to Stay in the State Workforce After Completing Their Degrees. Report 05-59, 11 pages, Dec. 2005. In this table we use a value of 53 percent to represent the share of Florida Poly graduates working in Florida over their worklife. The OPPAGA report notes that FETPIP data found Bachelor's Degree graduates in Engineering and Computer Science working in Florida eight years after graduation at rates of 53 percent and 56 percent respectively. This is lower than for graduates in health professions (67 percent) and education (70 percent), and the report notes that "workforce demand data shows that Florida has a relatively low demand for graduates in fields such as engineering," (page 5). Dewey and Denslow (op cit) discuss the negative economic development implications of this ongoing trend.

<sup>57</sup> Watson, et al, "Determining economic contributions and impacts: what is the difference and why do we care?" Journal of Regional Analysis and Policy 37(2): pps140-146, 2007.