

Benefits of Michigan Apprenticeship Programs

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Executive Summary

- Registered apprenticeship programs are an important tool for developing a skilled workforce. Apprenticeship programs consist of a combination of on-the-job training and classroom instruction. Workers earn a full-time wage with benefits while they are participating in the programs.
- Registered apprenticeship programs generally last four years, but can run from one to six years. Graduates of registered apprenticeship programs receive a stackable and portable credential that demonstrates their skill level to employers. A stackable credential is a recognized degree or certificate that is part of a sequence of credentials that can be accumulated over time and move an individual along a career pathway (Social Policy Research 2014). Portability means that the credential is recognized and valued by a large number of employers.
- Registered apprenticeship programs compare very favorably with community colleges:
 - Community colleges receive approximately \$11,000 in taxes and tuition per full-time equivalent (FTE) student, while apprenticeship programs do not require funding from taxpayers or students.
 - The completion rate for registered apprenticeship programs is greater than the graduation rate of all but two of Michigan's public community colleges.
 - Completing an apprenticeship program significantly raises a worker's wage. The wage a worker earns upon completing a program is higher on average than the wage of those with an associate's degree who are younger than 40.
- Both union and nonunion employers participate in registered apprenticeship programs. Union programs tend to be more successful:
 - Union programs train 80 percent of apprentices.
 - Union programs train a disproportionate share of women (90 percent) and minorities (87 percent).
 - Apprentices are more likely to complete union programs (42 percent compared to 22 percent).
 - Apprentices earn more after completing union programs (\$22.21 per hour compared to \$14.55 per hour).
- Veterans are well represented in both union and nonunion apprenticeship programs. Veterans make up approximately 6 percent of Michigan apprenticeships, yet only approximately 3 percent of Michigan residents under the age of 55.

Overview of Apprenticeship Programs

A skilled workforce is critical for Michigan's economic future. Skilled workers attract employers to the state, and highly skilled workers earn higher wages. The right skills can help workers and their families achieve the American dream of prosperity through hard work. For much of the 20th Century, most workers could gain the skills needed to support a middle-class lifestyle in high school. However, as the economy has evolved, it has become increasingly important for workers to have training beyond high school to be competitive in the workforce. Some level of postsecondary training is now necessary for most workers to be successful.

Two- and four-year colleges come to mind when most people think of postsecondary training. However, apprenticeship programs represent an important alternative to the college path. Apprenticeship programs consist of a combination of on-the-job training and formal classroom instruction. Both the on-the-job training and classroom instruction takes place under the supervision of a journey-level craftsperson or trade professional. Two important aspects of apprenticeship programs make them an especially appealing way for workers to gain skills. First, workers receive practical hands-on training at actual worksites doing real work with a highly skilled supervisor. Second, apprentices earn wages during their training, as opposed to college where workers pay to be trained. Earning a paycheck while being trained makes apprenticeship programs more accessible for many workers, particularly those from low-income families, and those who

are already supporting a family. In a time of rapidly growing student debt, apprenticeship programs can be a very important alternative to the college path.

Apprenticeship programs have their origins in the practice of European craft workers. As America was settled, Europeans brought with them the practice of indenture and the system of master-apprenticeship relations. The term “indenture” comes from the English practice of tearing indentations, or notches, in duplicate copies of apprenticeship forms (Washington State Department of Labor and Industries 2016). The term “journeyperson” (previously “journeyman”) dates back to medieval times when skilled craftspeople had to travel from place to place, or journey, to practice their craft.

Originally, indenture agreements bound apprentices to a master for a number of years in exchange for learning a trade. People still enter apprenticeships through indenturing, although these are now employment contracts, and not the agreement to limited servitude that they were in the past. Indenturing takes the form of a written agreement to train for a craft as an apprentice. The apprenticeship agreement is generally an agreement between the apprentice and a joint apprenticeship committee for the full term of the apprenticeship program. Joint apprenticeship committees are generally collaborative efforts between unions and contractors’ associations. The agreements can also be made with individual employers. The agreements lay out the terms of employment and the training progression.

A typical career progression for those participating in apprenticeship programs would be: high-school graduate, apprentice, journeyperson, foreperson, superintendent, then general superintendent. Upon completing an apprenticeship program, the worker becomes a journeyperson. A foreperson supervises all journeypersons of a particular trade working on a project. Superintendents and general superintendents manage projects to ensure that they meet established schedules, specifications, methods, and procedures (Greater Michigan Plumbing and Mechanical Contractors Association Inc. 2015).

The U.S. Department of Labor (DOL) has identified more than 250 occupations with registered apprentices (DOL 2013). Many apprenticeships provide the equivalent of a two- or four-year degree; as mentioned, programs can run from one to six years. Upon completing a registered program, apprentices are awarded a nationally recognized credential that is portable and stackable—allowing them to document their skills to future employers. The DOL estimates that completing a registered apprenticeship program can increase lifetime earnings by more than \$300,000 (DOL 2014).

Nationally, there were 447,929 apprenticeships in 2015 (DOL 2016). Most apprenticeship programs require 2,000 hours of training on the job and 144 hours of technical instruction each year. The programs are generally full-time. In some programs, apprentices go to class one or two days per week, while in others they go for a week or two at a time at several points each year (DOL 2013). Nationally, the top ten occupations for apprenticeships were all in the construction trades, with electrician, carpenter, and plumber representing the top three occupations. Exhibit 1 shows the program length and class schedule for a number of Michigan apprenticeship programs.

EXHIBIT 1. Apprenticeship Program Requirements

Occupation	Program Length	Class Schedule
Bricklayer	Three years	One evening class per week
Carpenter	Four years	Classes one day every two weeks
Electrician	Five years	Classes one day every two weeks
Millwright	Four years	One day class every other week
Plumber	Five years	246 hours of classroom instruction per year

SOURCE: Greater Michigan Plumbing and Mechanical Contractors Association, Inc.

Union Apprenticeship Programs Compared to Nonunion Apprenticeship Programs

This paper presents Michigan data for registered apprenticeships for union and nonunion programs. Many aspects of the construction industry are often divided based on the labor employment policies of employers. Basically, employers are classified on whether they are union and nonunion employers, and there are differences in apprenticeship programs that fall along union and nonunion lines. Union and nonunion programs are set up differently, and this difference merits a brief discussion. Union apprenticeship programs are sponsored jointly by unions and the employers with which they collectively bargain. Nonunion apprenticeship programs are generally set up by individual employers—although employers can collaborate and provide programs jointly.

Economic theory suggests that collective bargaining may be an advantageous way to establish apprenticeship programs and other worker training. Economists distinguish between general training that increases a worker's productivity to many firms, and specific training that increases a worker's productivity only at the firm at which he or she is currently employed (Ehrenberg and Smith 1988). When workers receive general training that increases their productivity to a wide range of firms, they can then command higher wages. Therefore, it can be difficult for individual firms to earn a rate of return on investments in general training, since once workers have completed the training, they can command a higher wage in the labor market—and are likelier to change employers to gain better wages. As a result, firms that invest in general training may find that they are training the workers of their competitors, who are earning the return on their investment. This can create a Catch-22 situation. Firms may find an insufficient number of skilled workers in the labor force, but they do not have an incentive to provide the training that would increase worker skills to meet the demand for skilled workers.

Under collective bargaining, a group of employers and employees collectively provide training. Firms and workers share the cost of training and the benefits of increased worker productivity. Since all of the employers bear the cost of the investment in training, no single firm is advantaged or disadvantaged. The data collected by the DOL on registered apprenticeship programs distinguishes between union and nonunion programs, allowing this report to statistically distinguish between these programs. As will be seen, union programs in Michigan appear to be significantly more successful than nonunion programs. Union programs train the vast majority of registered apprentices in Michigan, union apprentices are more likely to complete an apprenticeship program, and they earn a significantly higher wage upon program completion.

The data used for this report are for registered apprenticeships. All union apprenticeships in Michigan are registered, and many nonunion programs are registered as well. However, nonunion employers may offer apprenticeship programs that are unregistered. Given this, the data used in this report may not fully reflect the efficacy of nonunion apprenticeships. There are reasons for employers and employees to prefer registered apprenticeships. First, upon completing a registered apprenticeship program, apprentices earn a nationally recognized credential that is portable and stackable, which is beneficial to both the employee and the employer.¹ The DOL and state agencies will help market registered apprenticeship programs and provide technical assistance (DOL 2016b). The Davis-Bacon and Related Acts, which apply to contractors working on federally funded construction projects, require apprentices to be registered if contractors are going to employ them on this type of work (DOL 2016c). Toward the end of this report, we discuss the limited availability of data on unregistered apprenticeship programs, which suggests a relatively small scope for these programs in Michigan.

¹ As will be discussed later in this report, nonunion employers have established a group called the National Center for Construction and Education Research to attempt to provide portable, stackable credentials for nonunion training programs.

RAPIDS Data

The DOL administers registered apprenticeship programs in conjunction with state agencies. In Michigan, apprenticeship programs are promoted by the Workforce Development Agency within the Department of Talent and Economic Development. The DOL compiles data on registered apprenticeships, and these data are available through the Registered Apprenticeship Partners Information Data System (RAPIDS). This report analyzes RAPIDS data for Michigan, which covers registered apprenticeships for 2000 to 2014. Cihan Bilginsoy, a professor of economics at the University of Utah, provided these data.

Analysis of Michigan Apprenticeship Programs

From 2000 to 2014, 31,703 individuals participated in registered apprenticeships in Michigan. During that period, an average of 2,114 new apprenticeships were started each year. The number of new registered apprenticeships dropped during the Great Recession, with just 1,512 apprenticeships started in 2009 and 1,780 in 2010. Since then, however, the number of new apprenticeships has rebounded, with 2,417 new apprenticeships in 2014, the highest number since 2000.

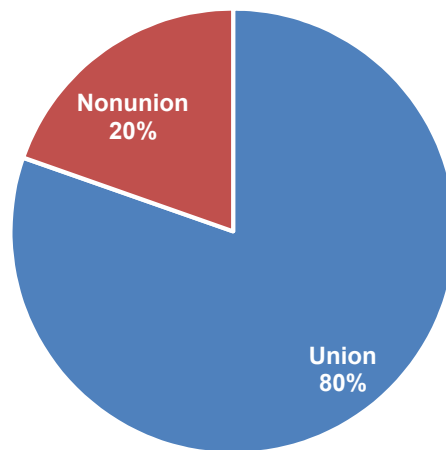
EXHIBIT 2. Michigan Apprenticeships by Start Year

Start Year	Union	Nonunion	Total	% Union
2000	1,976	495	2,471	80%
2001	2,085	504	2,589	81%
2002	1,971	381	2,352	84%
2003	991	363	1,354	73%
2004	1,172	373	1,545	76%
2005	1,903	350	2,253	84%
2006	2,001	342	2,343	85%
2007	2,172	247	2,419	90%
2008	1,939	271	2,210	88%
2009	1,293	219	1,512	86%
2010	1,206	574	1,780	68%
2011	1,707	621	2,328	73%
2012	1,607	481	2,088	77%
2013	1,543	499	2,042	76%
2014	1,913	504	2,417	79%
Avg.	1,699	415	2,114	80%
Total	25,479	6,224	31,703	80%

SOURCE: PSC calculations using RAPIDS data.

Of the apprenticeships, 80 percent (25,457) were union programs, while the remainder (6,224) were nonunion. As noted, union apprenticeships are collectively bargained and are funded by union employers and unions, while nonunion apprenticeships are organized and funded by nonunion employers exclusively.

EXHIBIT 3. Union Share of Registered Apprenticeships



SOURCE: PSC calculations using RAPIDS data.

The top five apprenticeship occupations represent approximately two-thirds of Michigan apprenticeships. These occupations are electrician (22 percent), construction craft laborer (17 percent), carpenter (12 percent), roofer (7 percent), and pipe fitter (7 percent). In all, the RAPIDS database shows apprenticeships for 58 different occupations in Michigan, as seen in Exhibit 4. **Michigan boilermaker apprenticeship data was unavailable since these apprenticeships are reported for the Great Lakes region as a whole. Statistics on boilermaker apprenticeships for the Great Lakes region are reported in Appendix B.**

EXHIBIT 4. Michigan Registered Apprenticeship by Occupation

Occupation	Total	% of Total	Union	Nonunion	% Union
Electrician ²	7,006	22.1%	3,040	3,966	43%
Construction Craft Laborer	5,488	17.3%	5,452	36	99%
Carpenter	3,908	12.3%	3,641	267	93%
Roofer	2,231	7.0%	2,156	75	97%
Pipe Fitter (Construction)	2,214	7.0%	2,007	207	91%
Sheet Metal Worker	1,310	4.1%	1,082	228	83%
Plumber	1,064	3.4%	554	510	52%
Millwright	886	2.8%	876	10	99%
Structural Steel/Ironworker	821	2.6%	818	3	100%

²The Electrical Administrative Act (MCL 338.883e) requires that any individual employed as an apprentice register within 30 days of employment with the State Electrical Administrative Board. The Michigan Department of Licensing and Regulatory Affairs shall issue a certificate of registration upon receiving proof of the individual's participation in a board-approved program. The board approves any bona fide apprenticeship program that has one registered electrical journeyman to no more than three apprentices and that meets or exceeds the requirements of those imposed by the Office of Apprenticeship in the U.S. Department of Labor.

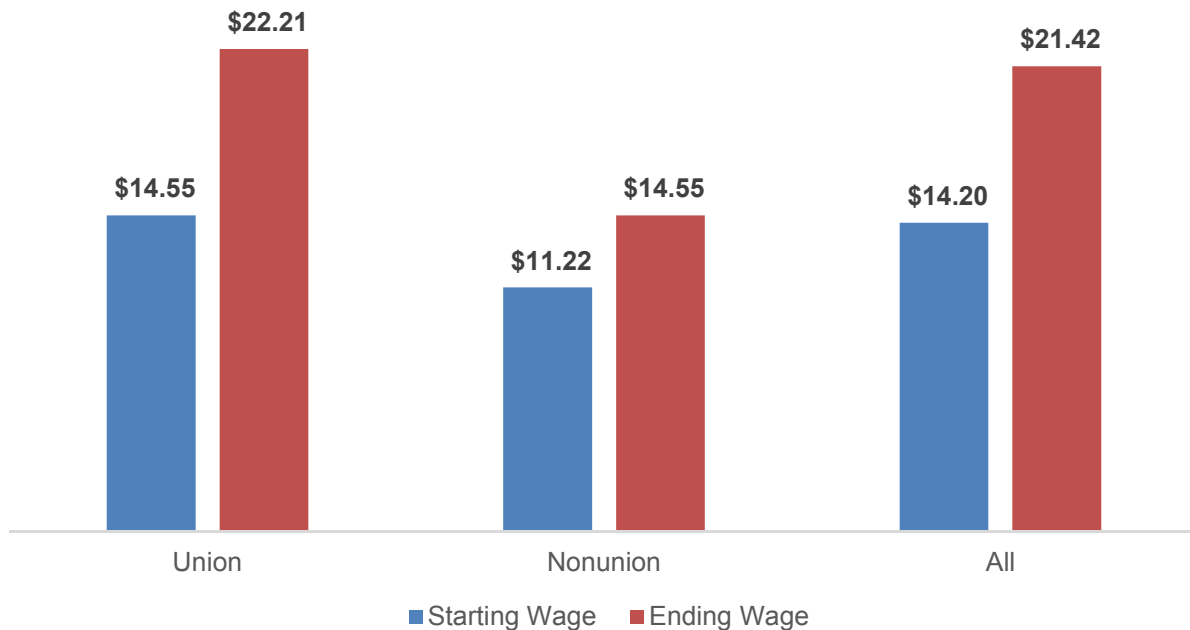
Occupation	Total	% of Total	Union	Nonunion	% Union
Painter (Construction)	609	1.9%	604	5	99%
Bricklayer (Construction)	558	1.8%	532	26	95%
Pipe Fitter—Sprinkler Fitter	480	1.5%	213	267	44%
Operating Engineer	467	1.5%	466	1	100%
Floor Layer	458	1.4%	399	59	87%
Residential Electrician	443	1.4%	436	7	98%
Elevator Constructor Mechanic	413	1.3%	405	8	98%
Line Erector	402	1.3%	402	-	100%
Tree Trimmer (Line Clear)	359	1.1%	359	-	100%
Heating and Air-Cond. Inst-Serv	300	0.9%	193	107	64%
Insulation Worker	280	0.9%	133	147	48%
Cement Mason	249	0.8%	243	6	98%
Ornamental Ironworker	220	0.7%	220	-	100%
Glazier	216	0.7%	215	1	100%
Pipe Coverer and Insulator	136	0.4%	136	-	100%
Tuckpointer, Cleaner, Caulker	129	0.4%	118	11	91%
Tile Finisher	119	0.4%	79	40	66%
Drywall Applicator	114	0.4%	87	27	76%
Reinforcing Metal Worker	103	0.3%	103	-	100%
Tile Setter	86	0.3%	53	33	62%
Rigger	85	0.3%	85	-	100%
Stationary Engineer	77	0.2%	77	-	100%
Assembler, Metal Building	74	0.2%	74	-	100%
Painter-Decorator (Painter Construction) (Hy)	67	0.2%	67	-	100%
Plasterer	63	0.2%	16	47	25%
Residential Carpenter	54	0.2%	-	54	0%
Painter, Industrial Coating, and Lining Application Specialist (Hy)	51	0.2%	51	-	100%
Electrician (Hy)	28	0.1%	28	-	100%
Residential Carpenter Specialist (Hy)	25	0.1%	-	25	0%
Pavement Striper	20	0.1%	-	20	0%
Refrigeration Mechanic (Equip.)	14	0.0%	-	14	0%
Taper	9	0.0%	9	-	100%
HVACR	8	0.0%	8	-	100%
Electrician, Maintenance	7	0.0%	-	7	0%
Fence Erector	7	0.0%	7	-	100%
Terrazzo Finisher	7	0.0%	7	-	100%
Truck Driver, Heavy	7	0.0%	-	7	0%
Refrigeration Mechanic (Any Ind.)	6	0.0%	3	3	50%

Occupation	Total	% of Total	Union	Nonunion	% Union
Fitter I (Any Ind.)	5	0.0%	5	-	100%
Elevator Repairer	4	0.0%	4	-	100%
Glazier (Hy)	4	0.0%	4	-	100%
Drywall Finisher (Taper) (Hy)	3	0.0%	3	-	100%
Operating Engineer (Hy)	2	0.0%	2	-	100%
Reinforcing Metal Worker (Hy)	2	0.0%	2	-	100%
Lather	1	0.0%	1	-	100%
Marble Setter	1	0.0%	1	-	100%
Painter, Hand (Any Ind.)	1	0.0%	1	-	100%
Marble Finisher	1	0.0%	1	-	100%
Carpenter, Piledriver	1	0.0%	1	-	100%
Totals	31,703		25,479	6,224	80%

SOURCE: PSC calculations using RAPIDS data. Hy after the occupation title indicates that the program uses a hybrid approach that requires a minimum number of on-the-job-learning hours and related technical instruction to demonstrate competency in the defined subject areas.

Completing an apprenticeship program leads to a substantial increase in an employee's wages. Beginning apprentices often earn 45 to 50 percent of journey person wages. The wages they earn go up each year that they participate in the program. In addition to their wages, workers also earn fringe benefits including insurance, vacation time, and pension benefits (Plumbing and Mechanical Contractors Association Inc. 2015). On average, workers completing an apprenticeship program saw their wages increase by 51 percent, from \$14.20 per hour to \$21.42 per hour. For union apprentices, the increase was 53 percent, with wages rising from \$14.55 to \$22.21 per hour, while for nonunion apprentices, the increase was 30 percent, from \$11.22 per hour to \$14.55 per hour. Apprentices completing union programs earned approximately 50 percent more upon program completion than apprentices completing nonunion programs.

EXHIBIT 5. Starting and Ending Wages for Registered Apprenticeships



SOURCE: PSC calculations using RAPIDS data.

The highest ending wages for those completing apprenticeship programs were for elevator construction mechanics at \$24.45 per hour. The lowest ending wage was residential electricians, with an ending wage of \$13.33 per hour. Starting and ending wages for apprenticeship programs with at least 40 people completing the program are contained in Exhibit 6.

EXHIBIT 6. Starting and Ending Wage for Apprenticeship Programs with at Least 40 Successful Completers

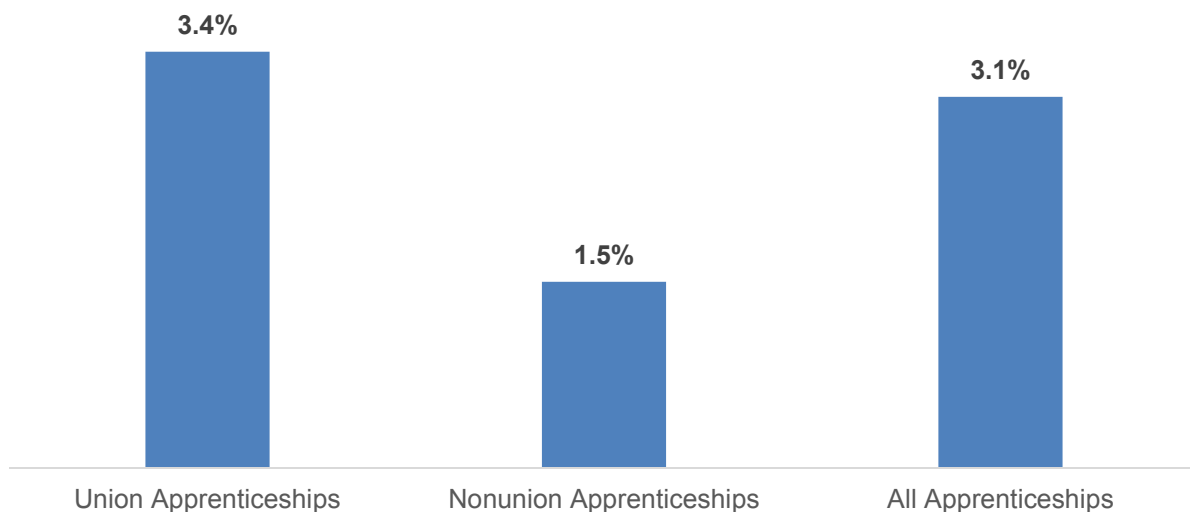
Occupation	Number Completers	Starting Wage	Ending Wage	% Change
Elevator Constructor Mechanic	200	\$18.50	\$24.45	32.2%
Pipe Fitter (Construction)	1,159	\$15.81	\$23.82	50.6%
Plumber	377	\$14.84	\$23.63	59.2%
Operating Engineer	178	\$18.72	\$23.25	24.2%
Heating and Air-Cond Inst-Serv	115	\$16.17	\$23.10	42.8%
Tree Trimmer (Line Clear)	152	\$15.01	\$22.98	53.1%
Millwright	475	\$15.85	\$22.07	39.3%
Roofer	369	\$15.29	\$22.01	44.0%
Line Erector	244	\$15.45	\$21.76	40.9%
Sheet Metal Worker	587	\$13.52	\$21.69	60.4%
Glazier	138	\$14.71	\$21.48	45.9%
Electrician	2,226	\$13.05	\$21.30	63.2%

Pipe Fitter—Sprinkler Fitter	148	\$12.33	\$21.21	72.0%
Construction Craft Laborer	165	\$16.23	\$20.80	28.1%
Pipe Coverer & Insulator	90	\$14.91	\$20.65	38.5%
Structural Steel/Ironworker	366	\$14.01	\$20.60	47.0%
Carpenter	1,014	\$12.19	\$19.73	61.8%
Cement Mason	51	\$16.50	\$19.63	19.0%
Painter (Construction)	159	\$13.17	\$19.23	46.1%
Bricklayer (Construction)	195	\$14.08	\$19.04	35.2%
Insulation Worker	70	\$12.93	\$18.78	45.2%
Floor Layer	93	\$12.30	\$18.48	50.2%
Ornamental Iron Worker	96	\$14.02	\$18.10	29.1%
Assembler, Metal Building	45	\$12.79	\$15.01	17.4%
Drywall Applicator	40	\$11.43	\$13.54	18.4%
Residential Electrician	79	\$9.64	\$13.33	38.2%

SOURCE: PSC calculations using RAPIDS data.

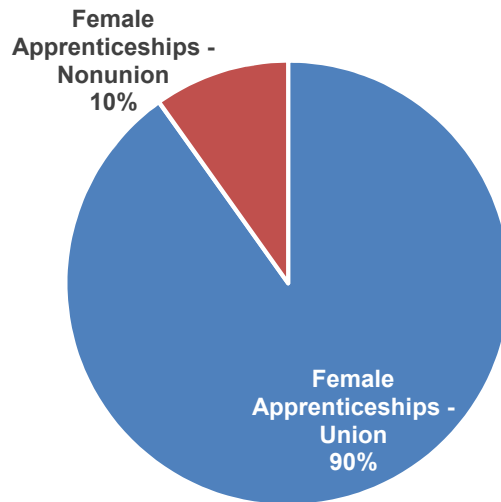
Male workers account for the vast majority of registered apprentices in Michigan, at 97 percent. Michigan apprenticeships are primarily in the construction trades, a traditionally male-dominated industry. The gender imbalance was slightly better for union apprenticeships than for nonunion apprenticeships, with women comprising 3.4 percent of union apprenticeships compared to 1.5 percent of nonunion apprenticeships. As a result, 90 percent of female apprenticeships were in union programs, despite unions representing just 80 percent of total apprenticeships.

EXHIBIT 7. Percent of Registered Apprenticeships Held by Women



SOURCE: PSC calculations using RAPIDS data.

EXHIBIT 8. Union Status of Female Registered Apprenticeships

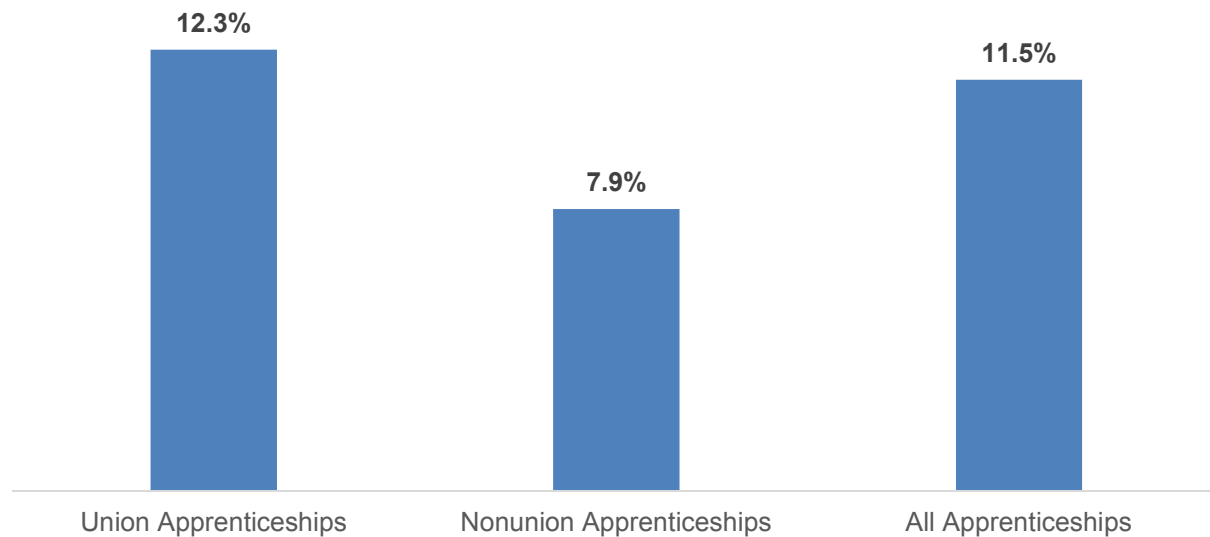


SOURCE: PSC calculations using RAPIDS data.

Approximately 11 percent of registered apprenticeships were held by minorities, while 89 percent were held by individuals classified as white in the RAPIDS data.³ Approximately 80 percent of Michigan's population is white according to the U.S. Census Bureau (2016), so registered apprenticeships were somewhat less diverse than the state's population as a whole. Union apprentices were a more diverse population than nonunion apprentices, with 12.3 percent of union apprenticeships going to minorities compared to 7.9 percent of nonunion apprenticeships. Unions provided 87 percent of the total apprenticeships going to minorities, despite representing just 80 percent of total apprenticeships.

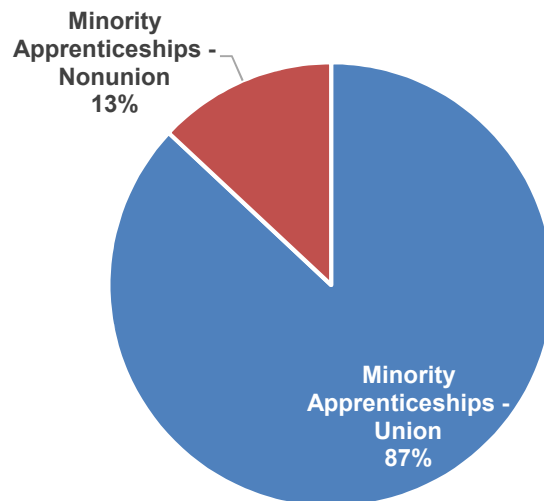
³ Only 83 percent of registered apprenticeships had a code indicating minority status. The RAPIDS data classified apprentices as white, black, Asian, native Hawaiian or Pacific Islander, and American Indian or Alaskan Native.

EXHIBIT 9. Percent of Registered Apprenticeships Held by Minorities



SOURCE: PSC calculations using RAPIDS data.

EXHIBIT 10. Union Status of Minority Registered Apprenticeships



SOURCE: PSC calculations using RAPIDS data.

Veterans hold 6.0 percent of registered apprenticeships in Michigan, and veterans make up 8.8 percent of Michigan's adult population. However, veterans tend to be older, while apprentices tend to be younger. Approximately, 70 percent of Michigan veterans are over age of 55, while just 152 of the more than 30,000 apprentices in the RAPIDS data were over 55 (Bureau of Labor Market Initiatives 2013). Based on the age distribution of Michigan's population and the overall veteran population, we estimate that roughly 3 percent of the adult population is a veteran and under the age of 55. Therefore, veterans are actually overrepresented

in apprenticeships, with the veterans' share of apprenticeships being approximately twice the veterans' share of the overall population under the age of 55.

Union and nonunion apprenticeships have similar shares of veterans, with veterans making up 6.1 percent of union apprenticeships and 5.7 percent of nonunion apprenticeships.

Registered apprentices tend to be young, with roughly half aged 25 and younger, and 84 percent below the age of 36. Nonunion apprentices tend to be younger than union apprentices, with 56 percent of nonunion apprentices aged 25 and younger compared to 49 percent of union apprentices. The relative youth of apprentices is not surprising, since in many ways apprenticeship programs are similar to college. While some college students are older, the vast majority are younger, and this pattern holds true for apprenticeships as well.

EXHIBIT 11. Age at Beginning of Registered Apprenticeship

Age	Percent in Age Bracket		
	Union	Nonunion	Total
25 and under	48.5%	56.0%	49.9%
26 to 35	34.6%	29.3%	33.5%
36 to 45	12.8%	10.3%	12.3%
46 to 55	3.7%	3.8%	3.7%
Over 55	0.5%	0.6%	0.5%

SOURCE: PSC calculations using RAPIDS data.

Of the 31,703 registered apprentices in our data set, 51 percent had either successfully completed the program or were still in training. However, a number of those who did not successfully complete their program exited for involuntary reasons, such as death or illness. We estimated the success rate for apprenticeships by first removing the 7,046 apprentices in our data set who were still in a training program. We then removed those who exited for involuntary reasons. As noted, these included those who did not finish due to involuntary reasons, and also included those whose programs were cancelled prior to completion. Our data set included 1,010 apprenticeships that ended for involuntary reasons.

Based on those adjustments, our data set had 23,647 apprentices who were no longer in an apprenticeship program (see Exhibit 12). Of those, 9,029 (38 percent) had successfully completed the program. The success rate for union apprenticeships (42 percent) was significantly higher than for nonunion apprentices (22 percent). **The completion rates for apprenticeship programs by occupation is included in Appendix A (see Exhibit A1).**

EXHIBIT 12. Registered Apprenticeship Program Success Rate

Category	Total No Longer in Program	Completers	% Success
Union	19,399	8,085	42%
Nonunion	4,248	944	22%
Total	23,647	9,029	38%

SOURCE: PSC calculations using RAPIDS data.

NOTE: Success calculation excludes apprentices still in training programs and those who exited for involuntary reasons.

EXHIBIT 13. State of Michigan Prosperity Regions



Our data set included the city that apprentices indicated when filling in their home address. Using this city name, we determined the corresponding county and prosperity region. We were able to determine the prosperity region for about 85 percent of the registered apprentices. Of course, the home address on the registration form does not necessarily correspond to the county where the apprentices actually works, but it should provide a rough approximation of how registered apprentices are distributed across Michigan. Not surprisingly, the most populous region (Region 10, the Detroit Metro Prosperity Region) is home to the largest number of apprentices, with 31 percent of the total. Region 10 has 39 percent of Michigan's population, however, so the number of apprentices is actually lower than might be expected. The second largest region, the West Michigan Prosperity Region, is slightly overrepresented, with 15 percent of the population and 18 percent of the apprentices.

Apprentices from Regions 2, 3, and 4 are less likely be unionized, with just over half of apprentices from Region 4 in unions and approximately two-thirds of apprentices from Regions 2 and 3 in unions. Approximately eight in ten apprentices are in unions for Regions 7 and 8, and for the remaining regions closer to nine in ten are in unions. Since not all registered apprentices could be allocated to a prosperity region, these results should be interpreted with caution.

EXHIBIT 14. Prosperity Region of Registered Apprentices in Michigan

Region Number	Prosperity Region	Union	Nonunion	Total	Percent Union
1	Upper Peninsula Prosperity Alliance	1,345	144	1,489	90%
2	Northwest Prosperity Region	481	267	748	64%
3	Northeast Prosperity Region	275	159	434	63%
4	West Michigan Prosperity Alliance	2,355	2,295	4,650	51%
5	East Central Michigan Prosperity Region	1,938	323	2,261	86%
6	East Michigan Prosperity Region	2,633	289	2,922	90%
7	South Central Prosperity Region	1,319	324	1,643	80%
8	Southwest Prosperity Region	1,711	486	2,197	78%
9	Southeast Michigan Prosperity Region	1,901	224	2,125	89%
10	Detroit Metro Prosperity Region	7,365	866	8,231	89%
Total		21,323	5,377	26,700	80%

SOURCE: PSC calculations using RAPIDS data.

Economic Benefits of Apprenticeship Programs

Apprenticeship programs provide a large economic benefit to the state of Michigan. They provide postsecondary training to a large cohort of workers without requiring public funds.⁴ The Workforce Intelligence Network estimates that 37 percent of Michigan job growth over the next five years will be in “middle skills” occupations (2015). Middle-skills occupations require more than a high-school degree, but less than a four-year degree. Community colleges serve as the main provider of middle-skill training, but apprenticeship programs are an important alternative. And of course, classroom training at community colleges or an alternative training center is an important component of apprenticeship training.

⁴ Since the cost of apprenticeship programs is built into the cost of labor for construction projects, public money provides some indirect support for apprenticeship programs because some of the cost will be included in the cost of public construction projects that use employers and workers that participate in apprenticeship programs.

Importance to Employers

Employers need access to a skilled workforce. We administered a survey to Michigan employers to ask them how important apprenticeship programs were to their ability to access skilled labor. Our survey is not a random sample of employers, so the results should be interpreted with caution. The sample pool is almost exclusively union employers. However, despite the survey not being random, the responses still illustrate the importance of these programs to some employers.

The National Electrical Contractors Association and the Michigan Building and Construction Trades Council e-mailed the link to the six-question survey to their members; there were 102 responses. The survey results are summarized below:

Question 1: Are you currently participating in an apprenticeship program?

- Yes: 85.3 percent
- No: 11.8 percent
- Don't know: 2.9 percent

Question 2: How important are apprenticeship programs in meeting your need for skilled labor?

- Very important: 74.5 percent
- Somewhat important: 18.6 percent
- Not important: 5.9 percent
- Don't know: 1.0 percent

For the responding employers, apprenticeship programs were important, with three-quarters saying the programs were very important and more than nine in ten answering somewhat important or very important.

Question 3: How important are apprenticeship programs in recruiting and retaining skilled labor?

- Very important: 70.9 percent
- Somewhat important: 21.4 percent
- Not important: 5.8 percent
- Don't know: 1.9 percent

Employer answers were similar for this question, with nine in ten indicating that these programs were very or somewhat important to their recruiting and retaining skilled labor.

Question 4: How well trained are the graduates of apprenticeship programs in which you participate?

- Very well trained: 40.2 percent
- Somewhat well trained: 46.1 percent
- Not well trained: 2.9 percent
- Don't know: 10.8 percent

More than 80 percent of employers indicated that employees were very or somewhat well trained. However, the results were not as positive as for the previous two questions, with only four in ten selecting very well trained.

Question 5: How much of an issue for you are the costs of apprenticeship programs?

- Not an issue: 36.3 percent
- Minor issue: 43.1 percent
- Significant issue: 14.7 percent
- Don't know: 5.9 percent

In general, the cost of apprenticeship programs is a relatively minor issue for employers, with just 1 in 7 indicating that cost was a significant issue.

Question 6: Are the apprenticeship programs you are participating in union programs?

- Yes: 93.1 percent
- No: 1.0 percent
- Don't know: 5.9 percent

Only one of the 96 respondents who answered this question with yes or no was a nonunion employer. Therefore, these results almost exclusively represent the views of union employers, and should not be generalized to include the views of nonunion employers.

In summary, the union employers responding to this survey viewed apprenticeship programs as an important tool for helping them meet their demand for skilled workers, and for recruitment and retention. Employers found graduates somewhat or well trained, and the cost of these programs was only a significant issue for a small share of employers.

Comparison to Community Colleges

Community colleges are an important means for many workers to develop middle skills, so it is natural to compare community colleges to apprenticeship programs. Apprenticeship programs are a complement to community colleges, rather than a substitute for them. Community colleges serve an essential role in the training of Michigan workers, and their scope and reach is much greater than that of apprenticeship programs. In 2015, there were 133,895 FTE students enrolled at Michigan community colleges, a much greater number than were participating in apprenticeship programs; approximately 2,400 workers started an apprenticeship program in 2014. However, because both institutions provide postsecondary training and develop middle-skill workers, community college data can help illustrate the relative success and cost of apprenticeship programs.

EXHIBIT 15. Total and Per Student Community College Revenues for 2015

	State Appropriation	Property Taxes	Tuition	Total
Community Colleges Total	\$307,191,300	\$531,499,183	\$643,567,637	\$1,482,258,120
Average Per FYES	\$2,294	\$3,970	\$4,807	\$11,071

FYES stands for Fiscal Year Equated Student.

SOURCE: Michigan Workforce Development Agency, 2016

Exhibit 15 shows revenues for the three largest sources of funding for community colleges in Michigan—state appropriations, property taxes, and tuition. These three revenue sources represent 95 percent of community college revenues. On average for Michigan community colleges, the state appropriated \$2,294

per pupil, \$3,970 was raised through property taxes and \$4,807 was raised through tuition, for a total of \$11,071 per student (Michigan Workforce Development Agency 2016).

One of the relative benefits of apprenticeship programs is quite clear from these figures. Apprenticeship programs do not require direct public expenditures, while over \$6,000 in public funds per year is spent for every FTE community college student. In addition, students are paying on average \$4,807 per year to attend community college, while apprentices actually get paid to participate in their programs.

Exhibit 16 shows the graduation rate for Michigan's community colleges. This graduation rate is calculated by the U.S. Department of Education as part of their College Scorecard project (U.S. Department of Education 2016). For two-year colleges, the graduation rate represents the share of students who have completed a degree four years after enrollment. **It does takes some community college graduates longer than four years to graduate, and the data may not adequately reflect those students who transfer to four-year schools rather than graduate from their respective community college.** However, even with those exceptions, the graduation rate published by the U.S. Department of Education is a good metric for comparison purposes.

Recall from Exhibit 12 that the average success rate for registered apprenticeship programs in Michigan was 38 percent, with a success rate of 42 percent for union apprenticeships and 22 percent for nonunion apprenticeships. The union apprenticeship success rate is higher than the graduation rate of all but one of Michigan's community colleges. The completion rate for apprenticeship programs was calculated excluding those who exited for involuntary reasons, such as illness or death. Of course, these factors could also impact the graduation rate of community colleges, making the figures less comparable. However, adding those who did not complete apprenticeship programs for involuntary reasons back into the data to make the results more comparable does not have a significant impact on the apprenticeship completion rate. The completion rate for registered union apprenticeships falls to 41 percent, the nonunion rate to 20 percent, and the overall rate to 37 percent. Therefore, at least for union apprenticeship programs, the rate of success is very favorable when compared to community colleges and is more than double the rate of many schools.

EXHIBIT 16. Graduation Rate of Michigan Community Colleges

Community College	Undergraduates	Graduation Rate
Alpena Community College	1,418	40%
Bay de Noc Community College	2,024	25%
Bay Mills Community College	514	19%
Delta College	864	22%
Glen Oaks Community College	709	26%
Gogebic Community College	948	47%
Grand Rapids Community College	15,635	20%
Henry Ford Community College	12,421	12%
Jackson College	5,180	16%
Kalamazoo Valley Community College	9,139	16%
Kellogg Community College	4,986	20%
Kirtland Community College	1,547	28%
Lake Michigan College	3,252	20%
Lansing Community College	13,947	17%
Macomb Community College	6,807	21%
Mid Michigan Community College	3,098	19%

Community College	Undergraduates	Graduation Rate
Monroe County Community College	2,285	21%
Montcalm Community College	1,643	17%
Mott Community College	8,349	16%
Muskegon Community College	3,798	19%
North Central Michigan College	2,466	17%
Oakland Community College	15,304	17%
Schoolcraft College	9,535	25%
St. Clair County Community College	3,588	21%
Southwestern Michigan College	2,419	23%
Washtenaw Community College	10,172	21%
Wayne County Community College District	13,713	14%
West Shore Community College	1,167	22%

SOURCE: U.S. Department of Education. <https://collegescorecard.ed.gov/search/?state=MI&control=public&sort=name:asc>

Earnings for graduates of apprenticeship programs compare favorably with the earnings of graduates of community colleges. We estimated the average earnings for workers in Michigan who have an associate's degree using data from the five-year American Community Survey.⁵ We included only those individuals who had an associate's degree as their highest level of educational attainment, and who also were currently working. On average, these workers earned approximately \$39,000 per year.

EXHIBIT 17. Earnings of Michigan Workers with an Associate's Degree

Age	Avg. Earnings Workers with Associate's Degree
30 and under	\$23,573
31 to 40	\$37,739
41 to 50	\$45,295
51 to 65	\$45,070
Over 65	\$30,051
Total	\$38,752

SOURCE: PSC calculations using 5-Year American Community Survey Data (2010–2014).

Average wages for those completing apprenticeship programs were \$21.42 per hour, with those completing union apprenticeship programs earning \$22.21 on average and those completing nonunion programs earnings \$14.55 on average (see Exhibit 5). Assuming a 2,080-hour year (52 weeks at 40 hours per week), the average apprenticeship completer's annual earnings would be \$44,553 per year, excluding overtime. This is more than the average for workers with an associate's degree who are aged 40 or less, and it compares favorably with older workers, being just slightly below the average for workers aged 41 to 65. Recall that apprentices tend to be young, so the best comparisons are likely those aged 40 and lower. Successful completers also likely see their wages rise as they gain additional training and experience, so their wages may be significantly higher as they progress through their careers.

⁵ The five-year American Community Survey for 2010–2014 was used to estimate the average earnings for worker's with associate's degrees. These data were downloaded from IPUMS USA (<https://usa.ipums.org/usa/cite.shtml>).

It is possible that many of those who complete apprenticeship programs would not have received any postsecondary training if it were not for their apprenticeship opportunity—meaning that workers with an associate’s degree might not be the best comparison population. For these workers, high-school graduates are the best comparison population. In 2014, the average wage for workers with a high-school degree as the highest level of education attainment was \$28,565, so for this cohort apprenticeship programs lead to a substantial increase in earnings.

Taken in total, apprenticeship programs fare very well when compared with community colleges. The cost of community colleges, which is absorbed by taxpayers and students, averages just over \$11,000 per year per student, while the costs of apprenticeship programs are borne by private employers and employees (for union programs). Participants in apprenticeship programs are earning a full-time wage while they are being trained. The completion rate of apprenticeship programs exceeds the average for most community colleges. Finally, the exit wage for apprentices is significantly higher than for younger workers with an associate’s degree and for those workers with just a high school diploma.

Mathematica Study

In 2012, Mathematica Policy Research, a highly respected research and evaluation firm, completed an in-depth study of registered apprenticeship programs in ten states for the U.S. Department of Labor (Reed, et. al. 2012). The states were Florida, Georgia, Iowa, Kentucky, Maryland, Missouri, New Jersey, Ohio, Pennsylvania, and Texas. While Michigan was not included in the study, many of the results are likely applicable in a general sense. The study addressed four questions, the first two of which apply to this report:⁶

1. Are registered apprenticeships effective in raising the annual earnings of employment of participants?
2. Do the total societal benefits of registered apprenticeships outweigh the costs?

The findings of the Mathematica study are consistent with the findings of this research. The study found that earnings of apprenticeship participants were significantly higher than the earnings of nonparticipants. This was true even when those who did not complete the program were included in the estimates. When the estimates were restricted to those who successfully completed the program, Mathematica found the estimated lifetime career earnings to be \$240,037 more than similar nonparticipants. Including benefits, increased this differential to \$301,533.

Mathematica also found a significant benefit of these programs to society as a whole. They found the net societal benefit of a worker participating in an apprenticeship program calculated over a 36-year career to be \$124,057 on average. These estimates include the societal benefits resulting from higher worker productivity and the reduced use of unemployment insurance and social welfare programs.

Nonregistered Apprenticeship Programs

This report has presented findings on registered apprenticeship programs. As noted earlier, all union apprenticeship programs are registered, and many nonunion programs are registered. It is difficult to know how many nonregistered apprenticeship programs are in Michigan, and the extent to which these programs represent a meaningful alternative to developing middle skills in the construction trades.

While little data on nonregistered apprenticeship programs exists, the evidence that does suggests these programs are limited. First, there are strong incentives to register an apprenticeship program. The DOL provides technical assistance and assists with the marketing of registered programs. As noted earlier,

⁶ The other two questions looked at the experiences of women and strategies to promote their success in programs, and the differences in how states administered programs.

registering an apprenticeship program makes those workers eligible to work on federal Davis-Bacon projects.

Many apprenticeship programs are financed out of trust funds. The Employee Retirement Security Act of 1974 (ERISA) has provisions covering these trust funds. Most collectively bargained trust funds are covered by ERISA because the Labor-Management Relations Act requires that the expenses of any joint labor/management apprenticeship committee be defrayed out of monies placed in a separate fund (DOL 2016). Nonunion multiemployer efforts may also use trust funds to manage funds used to provide training. Since these trust funds are nonprofit entities, they are required to file a 990 tax return with the Internal Revenue Service. Nonprofit tax returns are public information, so they provide a potential source of evidence for apprenticeship programs. An examination of 990 data for 2014 shows 44 Michigan union trust funds with revenues greater than zero, and these trust funds had total revenues of \$42.6 million.⁷ This compares to four nonunion trust funds with revenues of just \$2.6 million. Therefore, if there is a significant presence of nonregistered apprenticeships in Michigan, little of the activity is funded through trust funds.

Established in 1996, the National Center for Construction Education Research (NCCER) provides training for the construction industry. The nonprofit organization develops construction training curricula, accredits training programs, and develops assessments with portable credentials (NCCER 2016). The NCCER is a resource used by nonunion contracting firms to provide training. The NCCER's website lists ten organizations in Michigan accredited by the NCCER to provide training. Five of these organizations are in the Grand Rapids metropolitan area, while the remaining organizations are in Madison Heights, Midland, DeWitt, Rosebush, and Grayling. Three of the ten organizations also show up in the RAPIDS data, with 697 registered apprentices in total.

Given the limited data, it is difficult to make assessments about the overall scope of unregistered apprenticeship training in Michigan. The NCCER data does show some unregistered activity occurring, and a concentration, at least in terms of sponsors, occurring in West Michigan. However, the scope appears small. For perspective on the number of employers, there are ten NCCER training sponsors in Michigan and 569 training sponsors in the RAPIDS data. Of course, the relative size of the sponsors is unknown, but the small number combined with the limited 990 tax return data suggests that unregistered apprenticeship activity in Michigan is quite limited.

Conclusion

Registered apprenticeship programs help develop a skilled workforce in valuable ways. The completion rate for these programs is higher than those for most Michigan community colleges. Graduates of apprenticeship programs see a significant boost in earnings, and national estimates indicate lifetime earnings of graduates increase by over \$300,000.

Both union and nonunion employers sponsor apprenticeship programs, though economic theory suggests there are some disincentives to nonunionized employers investing in general training. An examination of apprenticeship data for Michigan suggests that union programs are more widespread and more successful. Union programs make up 80 percent of the 31,703 registered apprenticeships in the RAPIDS data. Apprentices are significantly more likely to complete a union program with a union completion rate of 41 percent compared to 20 percent for nonunion programs. Union programs train 90 percent of all female apprentices and 87 percent of all minority apprentices. Finally, union apprentices who successfully completed their program saw a larger increase in their wages (53 percent compared to 30 percent) and had higher overall wages upon completing the program (\$22.21 per hour compared to \$14.55).

⁷ The 990 data were provided by Dale Belman, a professor in the School of Labor and Industrial Relations and the Department of Economics at Michigan State University.

References

- Boilermakers National Apprenticeship Program (BNAP). n.d. "Great Lakes Area Apprenticeship Local Lodge Locations." *Boilermakers National Apprenticeship Program*. Accessed: November 4, 2016. <http://bnap.com/great-lakes-area/>
- Bureau of Labor Market Initiatives, Department of Technology, Management & Budget. September 2013. *Michigan Veterans: A Workforce Study*. State of Michigan, Department of Management and Budget. Accessed: April 12, 2016. https://www.michigan.gov/documents/wda/Veteran_Study_Final_432176_7.pdf
- Ehrenberg, Ronald G. and Robert S. Smith. 1988. *Modern Labor Economics: Theory and Public Policy*. Scott Foresman and Company.
- Greater Michigan Plumbing and Mechanical Contractors Association, Inc. 2015. *2015 Construction Career Manual*.
- Michigan Workforce Development Agency. 2016. *Activities Classification Structure Data Tables – 2014-2015*. Accessed: April 21, 2016. <http://www.michigancc.net/acs/dt2015/>
- National Center for Construction Education and Research. 2016. *About NCCER*. Accessed: April 29, 2016. <http://www.nccer.org/new-to-nccer>
- Reed, Debbie, Albert Yung-Hsu Liu, Rebecca Kleinman, Annalisa Mastri, Davin Reed, Samina Sattar, and Jessica Ziegler. July 25, 2012. *An Effectiveness Assessment and Cost-Benefit Analysis of Registered Apprenticeship Programs in 10 States*. Mathematica Policy Research.
- Ruggles, Steven, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. 2015. *Integrated Public Use Microdata Series: Version 6.0* [Machine-readable database]. Minneapolis: University of Minnesota.
- Social Policy Research. June 2014. *Stackable Credentials*. Accessed: April 27, 2016. <https://www.doleta.gov/regions/reg03/Pages/YouthForum2014/StackableCredentialsforYouth.pdf>
- U.S. Bureau of the Census. 2016. *Quick Facts: Michigan*. Accessed: April 12, 2016. <http://www.census.gov/quickfacts/table/PST045215/26>
- U.S. Department of Education. 2016. *College Scorecard*. Accessed: April 21, 2016. <https://collegescorecard.ed.gov/search/?state=MI&control=public&sort=name:asc>
- U.S. Department of Labor. Summer 2013. *Apprenticeship: Earn While You Learn*. Accessed: April 11, 2016. <http://www.bls.gov/careeroutlook/2013/summer/art01.pdf>
- U.S. Department of Labor. January 28, 2014. *Apprenticeship 101: Earn While You Learn*. Accessed: April 11, 2016. <http://blog.dol.gov/2014/01/28/apprenticeship-101-earn-while-you-learn/>
- U.S. Department of Labor. 2016. *Apprenticeship USA: Data and Statistics*. Accessed: April 24, 2016. https://doleta.gov/oa/data_statistics.cfm
- U.S. Department of Labor. 2016b. *Apprenticeships: Frequently Asked Questions*. Accessed: April 11, 2016. <https://www.dol.gov/featured/apprenticeship/faqs>

- U.S. Department of Labor. 2016c. *Wage and Hour Division: Davis-Bacon and Related Acts Frequently Asked Questions*. Accessed: April 24, 2016. <http://www.dol.gov/whd/programs/dbra/faqs/trainees.htm>
- U.S. Department of Labor. 2016d. *Apprenticeship and Training Plans*. Accessed: April 25, 2016. <http://www.dol.gov/ebsa/apprenticeshipplans.html>
- Washington State Department of Labor and Industries. 2016. *History of Apprenticeship*. Accessed: April 27, 2016. <http://www.lni.wa.gov/TradesLicensing/Apprenticeship/About/History/>
- Workforce Intelligence Network. 2015. *Middle-Skills Jobs: The Importance of Postsecondary Training to Economic Success*. Accessed: April 21, 2016. http://www.win-semich.org/wp-content/uploads/2015/04/Research-Brief_Middle-Skills-3.pdf

Appendix A: Completion Rate by Occupation

EXHIBIT A1. Completion Rate of Apprenticeship Programs by Occupation

	All Apprenticeships		Union Apprenticeships		Nonunion Apprenticeships	
Occupation	Total No Longer in Program	% Success	Total No Longer in Program	% Success	Total No Longer in Program	% Success
Electrician	4,901	45.4%	2,350	70.9%	2,551	22.0%
Construction Craft Laborer *	3,584	4.6%	3,563	4.4%	21	33.3%
Carpenter	3,337	30.4%	3,137	31.6%	200	11.5%
Roofer	1,827	20.2%	1,779	20.1%	48	25.0%
Pipe Fitter (Construction)	1,665	69.6%	1,521	72.7%	144	36.8%
Sheet Metal Worker	1,003	58.5%	830	64.8%	173	28.3%
Plumber	779	48.4%	411	75.2%	368	18.5%
Millwright	675	70.4%	667	70.6%	8	50.0%
Structural Steel/Ironworker	629	58.2%	626	58.5%	3	0.0%
Painter (Construction)	548	29.0%	543	28.9%	5	40.0%
Bricklayer (Construction)	476	41.0%	458	42.4%	18	5.6%
Floor Layer	398	23.4%	349	21.8%	49	34.7%
Pipe Fitter—Sprinkler Fitter	378	39.2%	172	55.2%	206	25.7%
Elevator Constructor Mechanic	316	63.3%	312	64.1%	4	0.0%
Line Erector	306	79.7%	306	79.7%	-	N/A
Operating Engineer	296	60.1%	296	60.1%	-	N/A
Residential Electrician	251	31.5%	246	31.7%	5	20.0%
Tree Trimmer (Line Clear)	236	64.4%	236	64.4%	-	N/A
Heating and Air-Cond. Inst-Serv	222	51.8%	135	73.3%	87	18.4%
Insulation Worker	220	31.8%	110	56.4%	110	7.3%

	All Apprenticeships		Union Apprenticeships		Nonunion Apprenticeships	
Ornamental Iron Worker	211	45.5%	211	45.5%	-	N/A
Cement Mason	209	24.4%	205	24.9%	4	0.0%
Glazier	194	71.1%	193	71.5%	1	0.0%
Pipe Coverer and Insulator	116	77.6%	116	77.6%	-	N/A
Drywall Applicator	111	36.0%	84	31.0%	27	51.9%
Tuckpointer, Cleaner, Caulker	91	30.8%	81	34.6%	10	0.0%
Reinforcing Metal Worker	89	28.1%	89	28.1%	-	N/A
Tile Finisher	84	8.3%	57	8.8%	27	7.4%
Stationary Engineer	77	36.4%	77	36.4%	-	N/A
Tile Setter	73	32.9%	43	23.3%	30	46.7%
Assembler, Metal Building	72	62.5%	72	62.5%	-	N/A
Plasterer	58	24.1%	14	14.3%	44	27.3%
Residential Carpenter	48	10.4%	-	N/A	48	10.4%
Rigger	47	55.3%	47	55.3%	-	N/A
All Other	120	34.2%	63	28.6%	57	40.4%
Total	23,647	38.2%	19,399	41.7%	4,248	22.2%

SOURCE: PSC calculations using RAPIDS data.

*Laborer apprentices often transfer into higher paying apprentice trade programs, so the completion rate for laborer apprentice programs is understated. Data provided by the union for 2011 to 2015 showed an average completion rate of approximately 9 percent.

Appendix B: Boilermakers

The analysis contained in the main body of the report used apprenticeship data for Michigan. These data do not include boilermakers because these apprenticeships are conducted through the Boilermakers National Apprenticeship Program (BNAP).⁸ BNAP provides apprenticeships for Michigan boilermakers through the Great Lakes Area Boilermakers Joint Apprenticeship Committee, which trains apprentices from Illinois, Indiana, Michigan, Minnesota, Missouri, North Dakota, Ohio, and Wisconsin (BNAP n.d.).

While Michigan-specific data were not available, over 3,000 apprenticeships provided by the Great Lakes Area Boilermakers Joint Apprenticeship Committee were identified in the national RAPIDS data, and these data likely include the Michigan boilermaker apprentices.⁹ The RAPIDS data had 3,270 boilermaker apprenticeships starting between 2000 and 2014. Since these all represent apprenticeships provided through the Great Lakes Area Boilermakers Joint Apprenticeship Committee, they are all union apprenticeships. The apprenticeships, organized by start year, are contained in Exhibit B1.

EXHIBIT B1. Great Lakes Boilermaker Apprenticeships by Start Year

Start Year	Union
2000	411
2001	215
2002	211
2003	161
2004	122
2005	292
2006	270
2007	361
2008	433
2009	101
2010	131
2011	116
2012	84
2013	183
2014	179
Avg.	218
Total	3,270

SOURCE: PSC calculations using RAPIDS data.

The successful completion rate for boilermakers was 62 percent, significantly higher than the average completion rate of 42 percent for all Michigan apprentices. BNAP apprentices in this dataset had an average starting wage of \$20.72 compared to an average starting wage of \$14.55 for all Michigan apprentices. The average ending wage for boilermakers who successfully completed the apprenticeship program was \$28.33,

⁸ Boilermakers assemble, install, and repair boilers, closed vats, and other large vessels or containers that hold liquids or gases.

⁹ The boilermaker data was extracted from the RAPIDS data by Cihan Bilginsoy, Professor of Economics at the University of Utah.

again well above the average ending wage of \$22.21 for all Michigan apprentices who successfully completed a Michigan apprenticeship program. The share of this wage differential due to the relative wage of boilermakers compared to the share of the differential due to overall wage variations between states cannot be determined from this dataset.