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An Analysis of the Gender Earnings Gap in the Tri-Cities

Introduction and Background

According to the National Committee on Pay Equity, Equal Pay Day was Tuesday, March 25, 2025. This date symbolizes how far into the year women must work to earn what men earned in the previous year. Because women typically earn less than men, they must work longer for the same amount of pay. This difference in pay is known as the gender earnings gap (earnings gap). For example, according to the Pew Research Center, in 2024, women working full-time year-round made 85 cents per dollar earned by men (representing an earnings gap of 15 percent[1]).

In the United States, women generally start their careers closer to wage parity; however, the earnings gap diverges with age. There are several explanations for the earnings gap: women are over-represented in lower-paying occupations, women are under-represented in leadership positions, household and parenting responsibilities are not shared equally, and gender discrimination, although the U.S. Department of Labor acknowledges this is difficult to statistically measure.

In this report, we examine the earnings of men and women of the Tri-Cities[2] and compare the size of the Tri-Cities earnings gap to the national earnings gap. Specifically, we consider differences in the earnings gap among selected industry groups and later by levels of education, both in the Tri-Cities and nationally. Finally, we conclude with a regression

[1] Fry, R., & Aragão, C. (2025, March 4). *Gender pay gap in U.S. has narrowed slightly over 2 decades*. Pew Research Center. https://www.pewresearch.org/short-reads/2025/03/04/gender-pay-gap-in-us-has-narrowed-slightly-over-2-decades/

[2] We use the revised definitions of the U.S. Census Bureau, which is the Combined Statistical Area (CSA) of Johnson City and Kingsport-Bristol, TN-VA.

analysis to report the relationship of education and industry choice on monthly earnings for men and women. To our knowledge, this is the first study of the earnings gap in the Tri-Cities. Our main finding is, after controlling for education and sector of employment on average, women in the Tri-Cities earn $1,961 less than men. To give this number context, nationally, the difference between women and men's earnings is $2,372.

Data Sources

The source data comes from the Quarterly Workforce Indicators[3] (QWI) database published online by the US Census Bureau. The QWI is reported with about a 1-year lag. The employment count in the QWI is a count of jobs, not the number of employed persons. Our dependent variable is Average Monthly Earnings with stable jobs (i.e., worked with the same firm throughout the quarter). Stable jobs better reflect the average earnings for employees in a particular industry compared to other measures such as beginning-of-quarter employment, which tends to be lower because the worker did not work the entire quarter.

Results

Earnings Gap by Economic Sectors

The North American Industry Classification System (NAICS) is the standard and used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.[4] As mentioned earlier, our data come from the QWI, a database developed by the U.S. Census Bureau. One limitation when analyzing data at the national level is that the QWI dataset only provides NAICS codes at the two-digit level. The two-digit designation is the broadest classification with only 20 sectors. For example, the two-digit code 72 represents Accommodation and Food Services. Businesses are then classified into more specific categories within a sector, represented by codes up to six digits (see Table 1). When a code has more digits, the business activity is more specific. The fifth and sixth digits represent industries at the international (United States, Canada, and Mexico) and national level.

In our data, we eliminated sectors with low levels of employment and added the aggregated sector "ALL NAICS Sectors" for a total of 14 categories. Columns 2 and 3 in Table 2 report the median monthly earnings for men and women in the Tri-Cities. Column 4 is the Tri-Cities earnings gap. The earnings gap is calculated by subtracting the average[5] earnings of women from the average earnings of men; dividing this difference by the average earnings of men;

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[3] The QWI database and links to descriptive information about the QWI may be found at https://lehd.did.census.gov/led/datatools/qwiapp.html.

[4] For a description of the NAICS sectors identified in Tables 4 and 5, please see the North American Industry Classification System at https://www.naics.com/search/.

[5] When analyzing income, the median is often preferred over the mean because it's less susceptible to skewed data (our data is skewed to the right).

and then multiply by 100 to express the gap as a percent. For example, the Accommodation and Food Services Sector's earnings gap is 15.7%[6] and implies that for every dollar a man earns, a woman takes home about 84 cents. The difference between men and women's earnings is often expressed in terms of how much less a woman makes compared to men. To calculate this gap, we use the earnings gap (explained above) and subtract it from 1. If wage parity existed, the earnings gap would equal 0. And when we subtract 0 from 1, we would find that men and women earned the same amount. In the Tri-Cities, the earnings gap ranges from 15.7% in the Accommodation and Food Services Sector to 42.7% in the Professional, Scientific, and Technical Sector. This is consistent with the **theory** that lower-skilled jobs have smaller earnings gaps, a subject we will discuss in more detail in the section "Earnings Gap by Educational Attainment."

Columns 5, 6 and 7 report the same information but at the national level. Also, Column 8 is the difference between the Tri-Cities' earnings gap and the national earnings gap. A positive (negative) number indicates the Tri-Cities earnings gap is larger (smaller). For example, in the Accommodation and Food Services Sector, the difference in the earnings gaps is -0.35%. This indicates that the Tri-Cities earnings gap (15.7% which we reported in the paragraph above) is 0.35% smaller compared to the earnings gap nationally. However, in other industry sectors there is a large variance between the earnings gap in the Tri-Cities and nationally. In some sectors like Health Care & Social Assistance and in Professional, Scientific, & Technical Services, the earnings gap is positive, implying that the earnings of men and women are more dissimilar in the Tri-Cities than nationally. Over half (8/14) of the categories reported in Column 8 have positive values.

Gender Earnings Gap by Industry Groups

One goal of this report is to compare the Tri-Cities earnings gap with the earnings gap at the national level (as we did in Column 8 of Table 2). As mentioned earlier, at the national level, our dataset is set at the two-digit sector. If we make the simplifying assumption that men and women in the Tri-Cities are distributed similarly within a sector as they are at the national level, then Column 8 paints a relatively accurate picture. However, the two-digit classification limits our ability to do a true apples-to-apples comparison of the size of the earnings gap. This is because (1), within each sector, there are many different types of jobs, and (2) we know men and women are not evenly distributed throughout each sector. That is, Columns 4 and 7 might be biased, but because we are looking at the difference in the earnings gap, the bias is likely corrected in Column 8.

[6] Step 1) $2,587 - $2,181 = $406.
Step 2) $406 / $2,587 ≈ 0.157
Step 3) 0.157 * 100 = 15.7%

Ideally, we would like to compare men's and women's earnings at the job level, but the narrowest level of specificity for metro data (like the Tri-Cities) is at the industry group (4-digit level). The 4-digit classification is a large improvement over the two-digit level. For example, in the 4-digit classification, there are eight industry groups (such as 7223 - Special Food Services, shown in Table 1) that make up sector 72 - Accommodation and Food Services. Also, many sectors have more than eight industry groups; for example, manufacturing (31-33) has the most with 54 industry groups. We ordered the 308 NAICS 4-digit industry groups by men's employment level and then separately for women's employment level. That is, we rank the industry groups by the number of men (and women) working in the Tri-Cities. We report 20 industry groups (10 for men and 10 for women). Figure 1 ranks the top-10 industry groups by men's employment in 2023. For example, there are more men working in "Restaurants and Other Eating Places" than any other industry group. The average size of the earnings gap in the 10 selected industries is 18.9%. Similarly, Figure 2 reports the top-10 industry group by women's employment. However, in Figure 2, we see a large difference between men and women's earnings. More women work in the "Offices of Physicians" than any other industry group. The median monthly earnings of a woman are $5,196, whereas men's monthly earnings are $16,007. The large disparity is likely driven by differences in jobs. Typically, physicians are the highest-paid employees in the office, and in the Tri-Cities (as in most places in the country), physicians are more likely to be men, and women make up a large proportion of the support staff. The average earnings gap over the 10 industry groups in Figure 2 is 30.9%. If we exclude the two outliers (Offices of Physicians and Offices of Dentists), the average earnings gap is 20.9% and remains materially larger than the 10 industry groups in Figure 1. That is, we find the largest earnings gaps in the industry groups that hire the most women.

Earnings Gap by Educational Attainment

> **"The more that you read, the more things you will know, the more that you learn, the more places you'll go." —Dr. Seuss**

When it comes to post-secondary education, women outperform men on many important statistics. For example, nationally, there are more women than men enrolled in college, women are more likely to graduate, and women are more likely to attend graduate school. Table 3 reports the enrollment rates of men and women at higher-ed institutions in the Tri-Cities. There are seven colleges and universities in our list[7], and all have higher enrollments for women compared to men. King University in Bristol, TN has the greatest share of female students at 66.2%. And while women have made significant gains, women's earnings are still lower relative to men.

[7] Tusculum University (located in Tusculum, TN) is in the geographic region but not in the Tri-Cities.

We begin by reporting the monthly median earnings of males and females by educational attainment. Figure 3 reports the monthly median earnings at the national level, and Figure 4 shows the same data for the Tri-Cities. Higher education leads to higher earnings in both the Tri-Cities and the United States. For example, in the United States, a female with a bachelor's degree[8] earns $2,759 more per month than a female with just a high school diploma.[9]

However, women are paid less than men at every education level. Table 4 reports the size of the earnings gap. The earnings gap in the Tri-Cities is smaller than the national earnings gap for all education levels. Accordingly, the average monthly earnings of men and women are slightly more similar in the Tri-Cities relative to the national level.

While incomes increase with education, so does the earnings gap. There are several theories explaining why the earnings gap is relatively small at lower levels of education and then diverges. Lower levels of education are correlated with lower-paying and lower-skilled jobs. Lower-paying jobs are benchmarked to the minimum wage which creates a wage floor. Also, lower-skilled jobs have more precise job descriptions, they tend to pay an hourly wage, and workers are paid more alike. The large earnings gap at high levels of education is due in large part to women choosing different majors. Women disproportionately gravitate to college majors that are still largely traditional, defined by interests and values as nurturing, caregiving and social interaction, which emphasize service to others. Women also dominate two of the lowest-paying majors: education and psychology. Even when women choose competitive majors, they often select careers with lower pay. For example, a woman who earns a mathematics degree is more likely to work as a high school math teacher, whereas a male with the same degree will pursue a higher-paying job such as an engineer. This trend is consistent with our earlier findings; namely that industries that require less education, such as Accommodation and Food Services (72) and Administrative and Support and Waste Management (56) have the smallest earnings gaps in the United States. Whereas higher skilled industries, such as Finance and Insurance (52) and Management of Companies & Enterprises (55) have the largest earnings gaps.

Interestingly, retail trade (Sector 44-45) is traditionally considered a lower-skilled sector; however, we find a large earnings gap. This is likely due to differences in the types of jobs women hold versus men. To get a more complete picture, we look at this from a national perspective using data from the Bureau of Labor Statistics (BLS)[10]. Because our report uses 2023 data, we will also report 2023 BLS data. Cashiers are the lowest paid job classification in the retail sector, and nationally 7 out of 10 cashiers were women. The BLS reports women's earnings as a percentage of men's by taking the median weekly earnings of women

[8] We use the term "bachelor's degree" as shorthand for the official measure, which is bachelor's degree or advanced degree. An advanced degree is any academic or professional degree above that of a baccalaureate – for example, a master's degree or doctorate.

[9] High school diploma or its equivalency (e.g., a GED).

[10] https://www.bls.gov/opub/reports/womens-earnings/2023/home.htm#table-2

and dividing it by men's median weekly earnings and multiplying by 100. The ratio of women's median to men for cashiers is 97.7%. In contrast, men comprise most of the industry's first-line supervisors. Women's earnings as a percentage of men's is only 82.6%[11] for first-line supervisors. However, as mentioned above the BLS ratio is simply the median earnings of women divided by men's median earnings. The BLS ratio does not take into account that cashiers are disproportionately women and first-line supervisors men. If we multiply the median earnings but also take into account the number of women and men in each occupation, then we can calculate a weighted average which will give us a more accurate earnings ratio. We find that when we consider the proportion of men and women in each occupation, the ratio is 77.3%[12]. While there are more than two jobs in the retail sector, this numerical example gives us an explanation as to why we see such a large earnings gap in this retail trade sector.

Regression Analysis of Monthly Earnings

Table 5 reports variations in monthly earnings using regression analysis. Regression analysis allows us to incorporate multiple variables into one model, and the regression results tell us which variables are statistically significant, their impact on earnings, and how much of the variation our models capture. To ensure reliable and meaningful results we increased our sample size. All the regressions in this final section of the report use 2022 and 2023 data. Model (1) applies a linear regression, and to control for heteroskedasticity,[13] the regression

[11] Median weekly earnings of female cashiers = $602. Median weekly earnings of male cashiers = $616. $602/$616= 97.7%. For first-line supervisors of retail sales workers, the earnings are $904 and $1,094, respectively (ratio = 82.6%).

[12] There were 801 female cashiers and 960 female first-line supervisors of retail sales workers. And 346 male cashiers and 1,274 male first-line supervisors of retail sales workers. We calculate the ratio of the two occupations with the following formula:

(1) $Weigted\ average\ female\ earnings\ \frac{(801*\$602)+\ (960*\$904)}{801+960} = \$766.63$

(2) $Weigted\ average\ male\ earnings\ \frac{(346*\$616)+\ (1{,}274*\$1{,}094)}{346+1{,}274} = \$991.91$

(3) $Ratio\ of\ weighted\ average\ earnings\ \frac{\$766.63}{\$991.91} \times 100 = 77.3\%$

[13] Heteroskedasticity is when the variability of a variable is unequal across the range of values of a second variable that predicts it. The classic example is the examination of income versus expenditure on meals. Because people prefer a variety of different foods, a rich person is likely to eat both inexpensive and expensive foods; whereas poor people are constrained by income and almost always eat inexpensive food. Therefore, people with higher incomes exhibit greater variability in expenditures on food. We run into a similar issue when we compare earnings with education. We have seen that the variation is much smaller at lower levels of education and increases with more education.

is run with robust standard errors. The dependent variable remains worker's monthly earnings with stable jobs. Model (1) has only two independent variables, both categorical, and represented as dummy variables (taking on values of 0 or 1). For example, the dummy variable "Female" will equal 1 if the observation is female and takes a 0 for men. The coefficients for each variable give us information on the linear equation that best fits our data:

$$\text{Monthly Earnings} = 7{,}484 + (-2{,}064 * \text{Female}) + (-1{,}504 * \text{Tri-Cities})$$

The coefficient on Female is negative, indicating that women earn $2,064 less than men. The stars indicate that the result is statistically significant at the 1% level. A worker in the Tri-Cities will on average earn $1,504 less relative to the average worker in the U.S. From the regression equation, a female in the Tri-Cities is predicted to earn the following:

$$\text{Monthly Earnings} = 7{,}484 + (-2{,}064 * 1) + (-1{,}504 * 1) = \$3{,}916$$

In Model (2), the R^2 increases from 0.18 to 0.33, indicating that including education explains more of the variation in monthly earnings. Not surprisingly, the coefficients are positive and statistically significant. A worker with a bachelor's degree (or advanced degree, see footnote 2) will earn $2,886 more a month than a person who did not graduate from high school.

Model (3) adds the economic sector to our model and explains almost 2/3 of the variation. Because of multicollinearity, one sector must be dropped.[14] We dropped Accommodation and Food Services because it was the sector with the lowest monthly earnings. That leaves 12 dummy variables, one for each sector, and their coefficients are all relative to Accommodation and Food Services. Because Accommodation and Food Services is the lowest-paying sector, the remaining coefficients are positive. For example, a worker in the "Management of Companies and Enterprises" sector will earn on average $5,240 more a month than a worker in Accommodation and Food Services. We add the constant to find the total monthly earnings of $8,990. If this worker is female, employed in the Tri-Cities, and holds a bachelor's degree, then we would add −2,064, −1,504, and 2,886, respectively, to bring the total monthly earnings to $8,308.

Model (3) showed us that even after we control for education and the economic sector a female earns less than a male. Model (3) also indicated that earnings in the Tri-Cities are lower than the national average. But the main question we want to answer is how the disparity in earnings compare in the Tri-Cities relative to the U.S. as aw hile. Model (4) answers this question by creating an interaction variable called FemaleTri-Cities. FemaleTri-Cities is a dummy variable equaling 1 whenever the observation is a female living in the Tri-Cities (Female * Tri-Cities). Four coefficients have changed: Female, TriCities, the constant, and our newest term FemaleTri-Cities. And we are now able to report one of our most important findings in the report; that is, we are able to report that the earnings gap in the

[14] Because ALNAICS is the sum of all the sectors, we drop it from the regression for the same reason.

Tri-Cities is smaller compared to the U.S.. Model (4) reports the following: Females in the U.S. earn $2,372 less than men, living in the Tri-Cities reduces earnings by an additional $1,710; however, for women living in the Tri-Cities instead of earning $2,372 less than men – the difference is only $1,961 (= $2,372 - $411). To summarize, as in the rest of the country, women in the Tri-Cities earn less than men; however, after controlling for education and the economic sector the difference between a male's earnings and female's earnings is smaller (more similar) in the Tri-Cities compared to the U.S..

Conclusion

In June of 1963, President John F. Kennedy passed the Equal Pay Act, a federal law prohibiting discrimination and addressing what he called the "unconscionable practice of paying female employees less wages than male employees for the same job." In this report, we analyze women's progress in the Tri-Cities over the last 60 years by comparing the earnings gap of the Tri-Cities to the national level. When we compare the earnings gap by level of education, the earnings gap in the Tri-Cities is comparable or smaller than at the national level for all education levels except for workers who hold a bachelor's degree/advanced degree. However, we find mixed results when we compare the earnings gap by the different sectors of the economy. On the one hand, some sectors such as Accommodation and Food Services, Construction, Finance and Insurance, Management of Companies & Enterprises, and arguably the most important the aggregated All NAICS sectors have smaller earnings gaps. However, on the other hand, sectors such as: Health Care and Social Assistance, Professional, Scientific, & Technical, Transportation & Warehousing have relatively large earnings gaps. Next, we do a deeper dive into earnings gaps by comparing industry groups rather than sectors. We find that the earnings gap is smaller in jobs with high levels of male employment, whereas industries with a lot of female employees (in particular, doctor offices) have very large gaps. Finally, we use regression analysis to control for education, gender, working in the Tri-Cities, and the role the particular economic sector has on monthly earnings. After controlling for these variables, we still find that a woman earns on average earns $2,372 per month less than a man. However, if there is a silver lining, it's that in the Tri-Cities women's earnings lags by $1,961 per month. While we had hoped to be able to report wage parity, our findings are consistent with a plethora of national studies showing women's earnings lagging men's compensation.

KIRES Report No. 24 was prepared by Dr. Alexander P. Brumlik, Associate Professor of Economics and Director of KIRES and King University business majors Deniz Crespo, Andrew Haber, Pedronel Herrera, and Madison Worley. Significant contributions were also made by Professor David Robinson, Dean of the School of Business, Economics, and Technology.

Tables and Charts

Table 1: North American Industry Classification Structure

NAICS Hierarchy	Number of Digits	Example
Sector	2	72 - Accommodation and Food Services
Subsector	3	722 - Food Services and Drinking Places
Industry Group	4	7223 - Special Food Services
International Industry	5	72232 - Caterers
U.S. National Industry	6	722320 - Caterers

Table 2: Differences in Male and Female Earnings by Sector

NAICS Sector (Code):	Median Earnings Female TRI	Median Earnings Male TRI	Earnings Gap TRI	Median Earnings Female U.S.	Median Earnings Male U.S.	Earnings Gap U.S.	Extra Earnings Gap of TRI
All NAICS Sectors (0)	3,861	5,506	29.9%	4,826	6,976	30.8%	-0.95%
Accommodation and Food Services (72)	2,181	2,587	15.7%	2,705	3,222	16.0%	-0.35%
Admin and Support & Waste Man (56)	3,198	4,081	21.6%	4,262	5,307	19.7%	1.93%
Construction (23)	4,322	5,524	21.8%	5,045	6,807	25.9%	-4.13%
Educational Services (61)	3,024	3,930	23.1%	4,494	5,821	22.8%	0.27%
Finance and Insurance (52)	4,809	7,427	35.2%	6,919	12,533	44.8%	-9.55%
Health Care and Social Assistance (62)	4,423	7,474	40.8%	4,632	6,767	31.6%	9.27%
Mgmt. of Companies & Enterprises (55)	5,276	7,814	32.5%	7,108	11,060	35.7%	-3.25%
Manufacturing (31-33)	4,698	6,002	21.7%	5,590	7,206	22.4%	-0.69%
Other Services Except Public Admin (81)	2,818	4,019	29.9%	3,673	5,105	28.0%	1.83%
Professional, Scientific, & Technical (54)	4,281	7,467	42.7%	7,225	10,530	31.4%	11.29%
Retail Trade (44-45)	2,758	4,131	33.2%	3,220	4,612	30.2%	3.05%
Transportation & Warehousing (48-49)	3,421	5,613	39.0%	4,243	6,075	30.2%	8.90%
Wholesale Trade (42)	5,403	6,817	20.7%	6,601	8,218	19.7%	1.06%

Table 3: Undergraduate Enrollment of Men and Women at Local Colleges and Universities

Names of Colleges and Universities	Men	Women
Emory and Henery College	43.7%	56.3%
East TN State University	38.0%	62.0%
King University	33.8%	66.2%
Milligan University	45.1%	54.9%
North East State Community College	43.7%	56.3%
Tusculum University	40.9%	59.1%
Virginia Highlands Community College	37.7%	62.3%

https://www.collegefactual.com/colleges/king-college/student-life/diversity/

Table 4: The Earnings Gap by Level of Education

Highest Level of Education	Earnings Gap in Tri-Cities	Earnings Gap in the U.S.
All Education Categories	29.3%	33.0%
Less than high school	23.6%	27.6%
High school or equivalent, no college	26.9%	29.7%
Some college or Associate degree	28.0%	31.1%
Bachelor's degree or advanced degree	36.8%	38.2%

Table 5: Linear Regression with Monthly Earnings as the Dependent Variable

Dependent Variable Monthly Earnings with Stable Jobs	(1)	(2)	(3)	(4)
Female	−2,064***	−2,064***	−2,064***	−2,372***
Tri-Cities	−1,504***	−1,504***	−1,504***	−1,710***
FemaleTri-Cities				411***
High school or equivalent, no college		249**	249***	249***
Some college or Associate degree		743***	743***	743***
Bachelor's degree / Adv. Degree		2,886***	2,886***	2,886***
Admin and Support & Waste Man			1,594***	1,594***
Construction			2,544***	2,544***
Educational Services			1,3336***	1,3336***
Finance and Insurance			4,992***	4,992***
Health Care and Social Assistance			3,803***	3,803***
Mgmt. of Companies & Enterprises			5,240***	5,240***
Manufacturing			3,544***	3,544***
Other Services Except Public Admin			1,133***	1,133***
Professional, Scientific, & Technical			4,047***	4,047***
Retail Trade			1,205***	1,205***
Transportation & Warehousing			2,407***	2,407***
Wholesale Trade			4,088***	4,088***
Constant	7,484***	6,514***	3,750***	3,904***
R^2	0.18	0.33	0.62	0.63
Observations	3,328	3,328	3,328	3,328

Notes: ***, **, * denote statistically significant effects at the 1%, 5%, and 10% level, respectively.

4Figure 1: Median Earnings of Men and Women in the Top-10 Industry Groups by Men's Employment Level

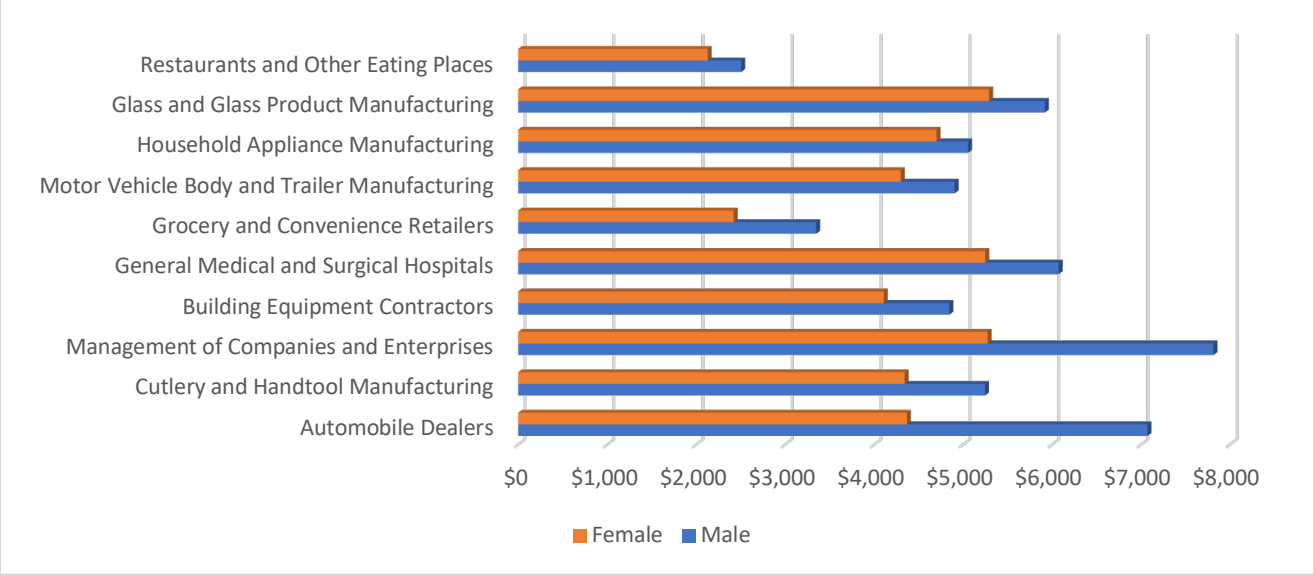

Figure 2: Median Earnings of Men and Women in the Top-10 Industry Groups by Women's Employment Level

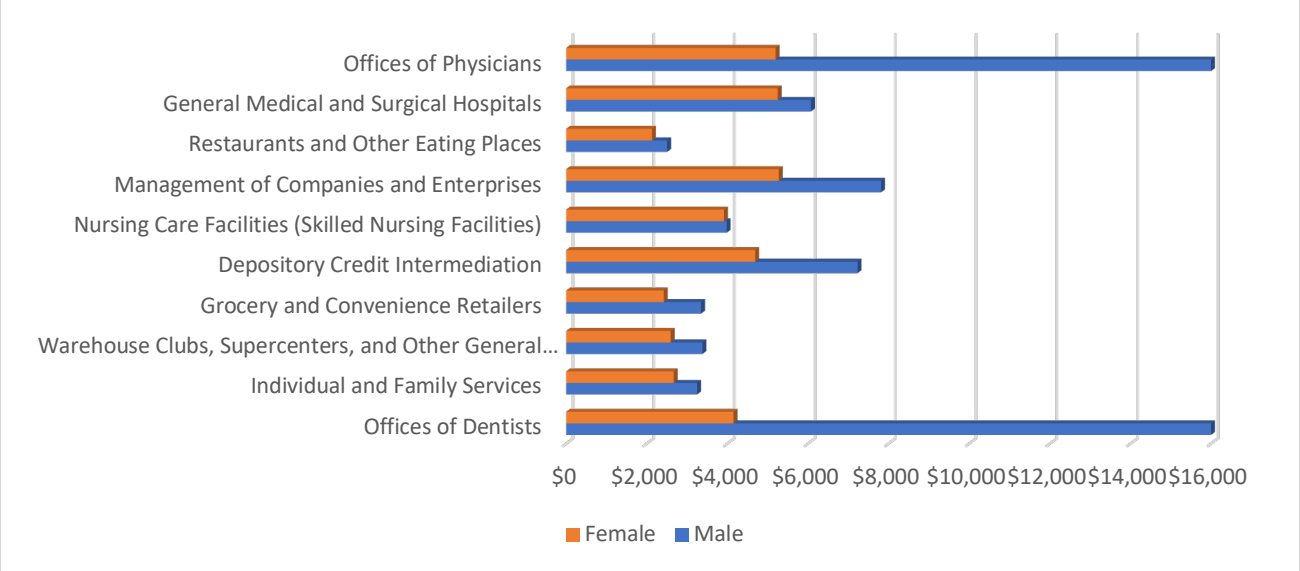

Figure 3: 2023 Median Earnings by Educational Attainment, U.S.

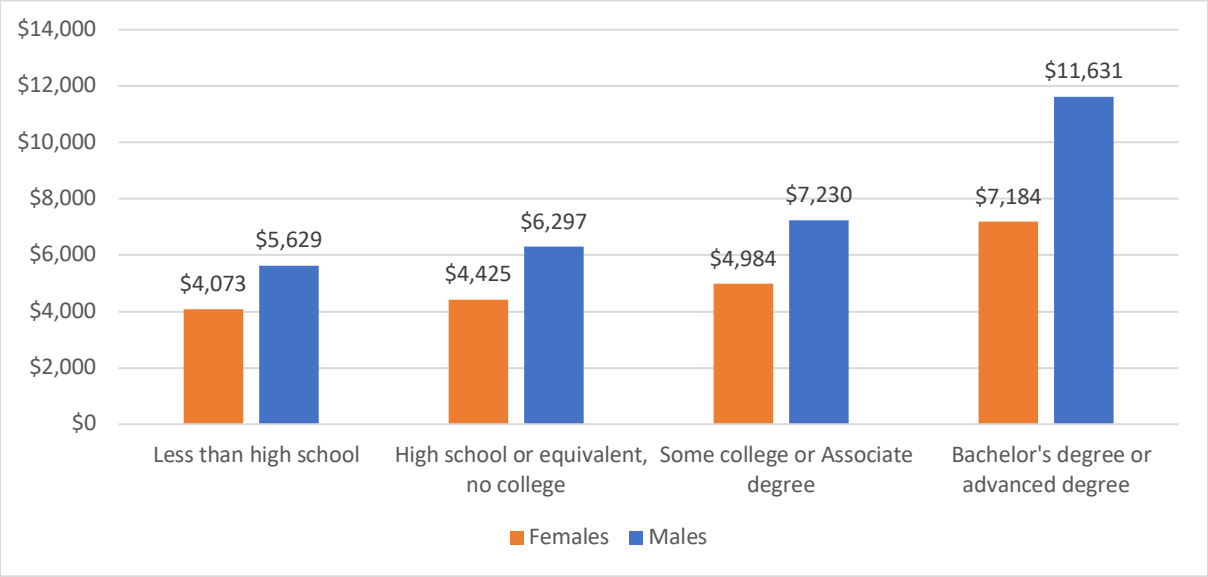

Figure 4: 2023 Median Earnings by Educational Attainment, Tri-Cities