Estimating Gender Discrimination in the Workplace

In this exercise we'll use data from the 2018 US Current Population Survey (CPS) to try and estimate the effect of being a woman on workplace compensation. Note that our focus will be only on differential compensation in the work place, and as a result it is important to bear in mind that our estimates are not estimates of all forms of gender discrimination. For example, these analyses will not account for things like gender discrimination in terms of getting jobs.

In [120…

```
import pandas as pd

# Load survey
df = pd.read_stata('./data/morg18.dta')
df.head()
```

Out[120…

	county	smsastat	age	sex	grade92	race	ethnic	marital	uhourse	earnhre	…	yrcoll	grprof
0	0	1.0	71	1	42	1	NaN	1	NaN	NaN	…	3.0	NaN
1	0	1.0	64	2	40	1	NaN	1	NaN	NaN	…	2.0	NaN
2	0	1.0	52	2	39	2	NaN	5	40.0	2084.0	…	NaN	NaN
3	0	1.0	19	2	39	2	NaN	7	40.0	1000.0	…	NaN	NaN
4	0	1.0	56	2	43	2	NaN	5	40.0	2500.0	…	NaN	NaN

5 rows × 25 columns

Exercise 2

Because our interest is only in-the-workplace wage discrimination among full-time workers, we need to start by subsetting our data for people currently employed at the time of this survey using the lfsr94 variable, who are employed full time (meaning that their usual hours per week – uhourse – is 35 or above).

As noted above, this analysis will miss many forms of gender discrimination. For example, in dropping anyone who isn't working, we immediately lose any women who couldn't get jobs, or who chose to lose the workforce because the wages they were offered (which were likely lower than those offered men) were lower than they were willing / could accept. And in focusing on

full time employees, we miss the fact women may not be offered full time jobs at the same rate as men.

In [121…
```
df = df[df.lfsr94 == 'Employed-At Work']
df = df[df.uhourse >= 35]

df.shape
```

Out[121… (133814, 25)

Exercise 3

Now let's estimate the basic wage gap for the United States!

Earnings per hour worked can be found in the earnhre variable. Two things are worth noting about this variable:

- It is coded in cents (1/100 of a dollar), not dollars, so make sure to divide by 100 to get dollars.
- Earnings are "top-coded" at 9999 (meaning any value above 99.99 dollars an hour is coded as 99.99 dollars an hour). Thankfully these are rare, so we'll just leave them in as-is for now. However, note that wage inequality is likely to be especially high for extremely high paid individuals (e.g. most CEOs are men), so this will bias us towards slightly conservative (low) estimates of the gender wage gap.

Using the variable sex (1=Male, 2=Female), estimate the gender wage gap in terms of wages per hour worked!

In [122…
```
import statsmodels.formula.api as smf
from scipy.stats import ttest_ind

# Adjust earnings per hour (in cents) into dollars,
df['earnhre_dollars'] = df['earnhre'] / 100
df['female'] = (df.sex == 2).astype('int')

# Compare
mean_female =  df.loc[df['sex'] == 2]["earnhre_dollars"].mean()
mean_male =  df.loc[df['sex'] == 1]["earnhre_dollars"].mean()

t_test = ttest_ind(df[df['sex'] == 2]["earnhre_dollars"],
                   df[df['sex'] == 1]["earnhre_dollars"],
                   nan_policy = "omit")

print("Female average per hour wage : {:.2f}".format(mean_female))
print("Male average per hour wage : {:.2f}".format(mean_male))
print("Difference between genders : {:.2f}".format(mean_male-mean_female))
print("P-value : {:.4f}".format(t_test[1]))
```

```
Female average per hour wage : 18.08
Male average per hour wage : 20.55
Difference between genders : 2.48
P-value : 0.0000
```

Answer: There is a significant (p-value < 0.0000) difference of per hour wage between males and females. The average per hour wage gap is 2.33 dollars.

Exercise 4

The variable uhourse is the number of hours that the respondent usually works per week. What is the wage gap not per hour, but per year? Is the difference statistically significant?

In [123…
```
df['annual_earnings'] = df['earnhre_dollars'] * df['uhourse'] * 52

# Compare
mean_female =  df[df['female']==1]["annual_earnings"].mean()
mean_male =  df[df['female']==0]["annual_earnings"].mean()

t_test = ttest_ind(df[df['female']==1]["annual_earnings"],
                   df[df['female']==0]["annual_earnings"],
                   nan_policy = "omit")

print("Female average annual wage : {:.2f}".format(mean_female))
print("Male average annual wage : {:.2f}".format(mean_male))
print("Difference between genders : {:.2f}".format(mean_male-mean_female))
print("P-value : {:.4f}".format(t_test[1]))
```

```
Female average annual wage : 37864.64
Male average annual wage : 45105.30
Difference between genders : 7240.67
P-value : 0.0000
```

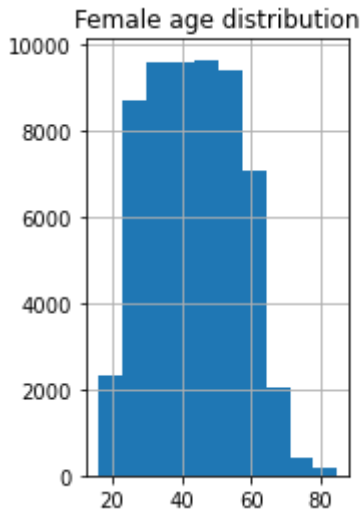
Answer: There is a significant (p-value < 0.0000) difference of annual wage between males and females. The average per hour wage gap is 7240.67 dollars.

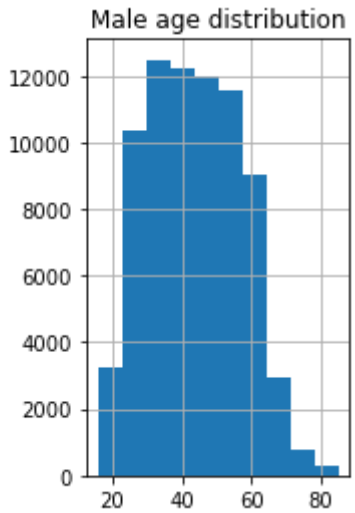
Exercise 5

We just compared all full-time working men to all full-time working women. For this to be an accurate causal estimate of the effect of being a woman in the work place, what must be true of these two groups? What is one reason that this may not be true?

In [124…
```
import matplotlib.pyplot as plt

plt.figure(figsize=(8,4))

plt.subplot(1,3,1)
df[df['female']==1]["age"].hist()
plt.title('Female age distribution')

plt.subplot(1,3,3)
df[df['female']==0]["age"].hist()
plt.title('Male age distribution')
```

Out[124…
```
Text(0.5, 1.0, 'Male age distribution')
```





Answer: Age is a potential factor may affect the comparison, because veterans tend to receive more salaries than a rookie. To get an accurate causal estimate, we must eliminate this difference from age. According to the charts, the two groups' age distribution is similar; however, advanced analysis is necessary.

Exercise 6

One answer to the second part of Exercise 5 is that working women are likely to be younger, since a larger portion of younger women are entering the workforce as compared to older generations.

Answer: To control for this difference, let's now regress annual earnings on gender and age. What is the implied average annual wage difference between women and men? Is it different from your raw estimate? Is the difference statistically significant?

In [125…
```
smf.ols('annual_earnings ~ female + age', df).fit().summary()
```

Out[125…

OLS Regression Results

Dep. Variable:	annual_earnings	**R-squared:**	0.057
Model:	OLS	**Adj. R-squared:**	0.057
Method:	Least Squares	**F-statistic:**	1974.
Date:	Mon, 22 Feb 2021	**Prob (F-statistic):**	0.00
Time:	16:08:41	**Log-Likelihood:**	-7.5225e+05
No. Observations:	65755	**AIC:**	1.504e+06
Df Residuals:	65752	**BIC:**	1.505e+06
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	3.265e+04	288.243	113.284	0.000	3.21e+04	3.32e+04
female	-7557.2936	176.107	-42.913	0.000	-7902.462	-7212.125
age	304.1829	6.406	47.485	0.000	291.627	316.738

Omnibus:	33771.778	**Durbin-Watson:**	1.868
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	307310.621
Skew:	2.305	**Prob(JB):**	0.00
Kurtosis:	12.535	**Cond. No.**	146.

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Answer: The implied average annual wage difference between women and men is 7557 dollars. Since the p-value is less than 0.001, the result is statistically significant. The difference is larger than the raw estimate of 7240 dollars.

Exercise 7

In running this regression and interpreting the coefficient on female, what is the implicit comparison you are making? In other words, when we run this regression and interpreting the coefficient on female, we're basically pretending we are comparing two groups and assuming they are counter-factuals for one another. What are these two groups?

Answer: We are interpreting the implicit comparison of women versus men with the same age in the model. Strictly speaking, it should be female and non-female. Still, in this dataset, the sex item only has two alternatives: men and women.

Exercise 8

Now let's add to our regression an indicator variable for whether the respondent has at least graduated high school, and an indicator for whether the respondent at least has a BA.

In answering this question, use the following table of codes for the variable grade92.

Education is coded as follows:

 cps_educ_codes

In [52]:
```
df['high_school'] = (df.grade92 >= 39).astype('int')
df['ba'] = (df.grade92 >= 42).astype('int')

print("Number of high_school is {}, BA is {}.".
      format(sum(df['high_school']), sum(df['ba'])))
```

```
Number of high_school is 125640, BA is 62617.
```

In [53]:
```
smf.ols('annual_earnings ~ female + age + high_school + ba', df).fit().summary()
```

Out[53]:

OLS Regression Results

Dep. Variable:	annual_earnings	**R-squared:**	0.145
Model:	OLS	**Adj. R-squared:**	0.145
Method:	Least Squares	**F-statistic:**	2786.
Date:	Mon, 22 Feb 2021	**Prob (F-statistic):**	0.00
Time:	10:04:44	**Log-Likelihood:**	-7.4902e+05
No. Observations:	65755	**AIC:**	1.498e+06
Df Residuals:	65750	**BIC:**	1.498e+06
Df Model:	4		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	2.139e+04	381.994	56.003	0.000	2.06e+04	2.21e+04
female	-9432.7984	169.206	-55.747	0.000	-9764.443	-9101.154
age	306.2583	6.101	50.197	0.000	294.300	318.217
high_school	9121.8502	296.897	30.724	0.000	8539.932	9703.768

ba	1.312e+04	189.998	69.056	0.000	1.27e+04	1.35e+04

Omnibus:	31930.498	**Durbin-Watson:**	1.896
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	289837.885
Skew:	2.144	**Prob(JB):**	0.00
Kurtosis:	12.349	**Cond. No.**	234.

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Answer: This model shows that having at least a high_school degree would increase the salary by 9121 dollars. At least a bachelor's degree would increase the wage by 13120 dollars. The two effects are all statistically significant. However, females' annual salary is significantly lower than men by 9432 dollars.

Exercise 9

In running this regression and interpreting the coefficient on female, what is the implicit comparison you are making? In other words, when we run this regression and interpreting the coefficient on female, we are once more basically pretending we are comparing two groups and assuming they are counter-factuals for one another. What are these two groups?

Answer: We are comparing annual salary between male and female of the same age and education.

Exercise 10

Given how the coefficient on female has changed between Exercise 6 and Exercise 8, what can you infer about the educational attainment of the women in your survey data (as compared to the educational attainment of men)?

Answer: Since the salary gap becomes larger after adding education in the model, we can conclude that education has a larger positive impact on women's salaries than men's salaries.

Exercise 11

What does that tell you about the potential outcomes of men and women before you added education as a control?

Answer: Before we added the education as the control, the potential difference between men and women's salaries is smaller than what we got aftre controling education. Without controlling education, the difference between men and women's salaries is expected to be $7557.

Exercise 12

Finally, let’s include fixed effects for the type of job held by each respondent.

Fixed effects are a method used when we have a nested data structure in which respondents belong to groups, and those groups may all be subject to different pressures. In this context, for example, we can add fixed effects for the industry of each respondent – since wages often vary across industries, controlling for industry is likely to improve our estimates.

(Note that fixed effects are very similar in principle to hierarchical models. There are some differences you will read about for our next class, but they are designed to serve the same role, just with slightly different mechanics).

When we add fixed effects for groups like this, our interpretation of the other coefficients changes. Whereas in previous exercises we were trying to explain variation in men and women's wages across all respondents, we are now effectively comparing men and women's wages within each employment sector. Our coefficient on female, in other words, now tells us how much less (on average) we would expect a woman to be paid than a man within the same industry, not across all respondents.

(Note that running this regression will result in lots of coefficients popping up you don't care about. We'll introduce some more efficient methods for adding fixed effects that aren't so messy in a later class – for now, you can ignore those coefficients!)

In [55]:
```
#from linearmodels import PanelOLS
#
#df_multiindex = df.set_index(['ind02', df.index])
#
#mod = PanelOLS.from_formula('annual_earnings ~ female + age + high_school + ba + En
#                            data=df_multiindex)
#mod.fit(cov_type='clustered', cluster_entity=True)
```

In [56]:
```
df.reset_index(drop=True, inplace=True)
smf.ols('annual_earnings ~ female + age + high_school + ba + C(ind02)', df).fit().su
```

Out[56]:

OLS Regression Results

Dep. Variable:	annual_earnings	**R-squared:**	0.229
Model:	OLS	**Adj. R-squared:**	0.226
Method:	Least Squares	**F-statistic:**	76.79
Date:	Mon, 22 Feb 2021	**Prob (F-statistic):**	0.00
Time:	10:05:10	**Log-Likelihood:**	-7.4559e+05
No. Observations:	65755	**AIC:**	1.492e+06
Df Residuals:	65500	**BIC:**	1.494e+06
Df Model:	254		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	1.944e+04	718.430	27.060	0.000	1.8e+04	2.08e+04
C(ind02)[T. Alcoholic beverages, merchant wholesalers (*4248)]**	-3842.2119	3133.897	-1.226	0.220	-9984.651	2300.228
C(ind02)[T. Apparel, fabrics, and notions, merchant wholesalers (*4243)]**	-570.6959	3006.218	-0.190	0.849	-6462.885	5321.493

C(ind02)[T. Construction (23)]**	1.196e+04	680.641	17.567	0.000	1.06e+04	1.33e+04
C(ind02)[T. Drugs, sundries, and chemical and allied products, merchant (wholesalerss*4242, 4246)]**	5767.8298	2403.874	2.399	0.016	1056.235	1.05e+04
C(ind02)[T. Farm product raw materials, merchant wholesalers (*4245)]**	-1264.7498	2816.737	-0.449	0.653	-6785.554	4256.055
C(ind02)[T. Farm supplies, merchant wholesalers (*42491)]**	-580.5447	3900.320	-0.149	0.882	-8225.173	7064.083
C(ind02)[T. Furniture and home furnishing, merchant wholesalers (*4232)]**	903.5353	4204.933	0.215	0.830	-7338.135	9145.206
C(ind02)[T. Groceries and related products, merchant wholesalers (*4244)]**	738.1672	1174.009	0.629	0.530	-1562.890	3039.225
C(ind02)[T. Lumber and other construction materials, merchant wholesalers (*4233)]**	1417.0565	2247.477	0.631	0.528	-2987.999	5822.112
C(ind02)[T. Machinery, equipment, and supplies, merchant wholesalers (*4238)]**	5654.9112	1694.885	3.336	0.001	2332.937	8976.886
C(ind02)[T. Mail order houses (*454113)]**	668.3939	3452.451	0.194	0.846	-6098.410	7435.198
C(ind02)[T. Metals and minerals, except petroleum, merchant wholesalers (*4235)]**	-562.7904	4489.679	-0.125	0.900	-9362.562	8236.981
C(ind02)[T. Miscellaneous (nondurable goods, merchant wholesalerss*4249 exc. 42491)]**	753.1012	2464.733	0.306	0.760	-4077.777	5583.979
C(ind02)[T. Miscellaneous durable goods, merchant wholesalers (*4239 exc. 42393)]**	-35.4565	4043.820	-0.009	0.993	-7961.345	7890.432
C(ind02)[T. Motor vehicles, parts and supplies, merchant wholesalers (*4231)]**	1054.1987	2334.361	0.452	0.652	-3521.149	5629.546
C(ind02)[T. Paper and paper products, merchant wholesalers (*4241)]**	-3068.7866	4043.986	-0.759	0.448	-1.1e+04	4857.427
C(ind02)[T. Petroleum and petroleum products, merchant wholesalers (*4247)]**	1.145e+04	2513.505	4.557	0.000	6526.675	1.64e+04
C(ind02)[T. Professional and commercial equipment and supplies, merchant wholesalers (*4234)]**	3131.6396	2160.266	1.450	0.147	-1102.483	7365.762
C(ind02)[T. Recyclable material, merchant wholesalers (*42393)]**	-1141.6214	2641.450	-0.432	0.666	-6318.863	4035.620
C(ind02)[T. Services to buildings and dwellings (5617 exc. 56173)]**	-3594.4957	1055.460	-3.406	0.001	-5663.198	-1525.793
C(ind02)[T.* Electronic auctions (New industrys*454112)]**	1575.0019	6174.506	0.255	0.799	-1.05e+04	1.37e+04
C(ind02)[T.* Electronic shopping**	-1534.4517	1751.348	-0.876	0.381	-4967.094	1898.190

(New industry *454111)]						
C(ind02)[T.* Wholesale electronic markets, agents and brokers New industry (*4251)]**	-3562.1602	3600.848	-0.989	0.323	-1.06e+04	3495.503
C(ind02)[T.** Data processing, hosting, and related services (*5182)]**	707.2829	3711.984	0.191	0.849	-6568.206	7982.772
C(ind02)[T.**Department stores and discount stores (s45211)]**	-4334.3777	877.910	-4.937	0.000	-6055.082	-2613.673
C(ind02)[T. Newspaper publishers (51111)]**	970.5677	2481.262	0.391	0.696	-3892.706	5833.841
C(ind02)[T. Not specified wholesale trade (Part of 42)]**	-2726.7992	3900.349	-0.699	0.484	-1.04e+04	4917.885
C(ind02)[T. Publishing, except newspapers and software (5111 exc. 51111)]**	-905.1365	2867.792	-0.316	0.752	-6526.010	4715.737
C(ind02)[T.Accounting, tax preparation, bookkeeping, and payroll services (5412)]	8679.7622	1379.404	6.292	0.000	5976.131	1.14e+04
C(ind02)[T.Administration of economic programs and space research (926, 927)]	1.595e+04	1322.296	12.062	0.000	1.34e+04	1.85e+04
C(ind02)[T.Administration of environmental quality and housing programs (924, 925)]	1.194e+04	1651.418	7.233	0.000	8707.353	1.52e+04
C(ind02)[T.Administration of human resource programs (923)]	9927.4194	1119.627	8.867	0.000	7732.950	1.21e+04
C(ind02)[T.Advertising and related services (5418)]	2582.4766	2122.054	1.217	0.224	-1576.750	6741.704
C(ind02)[T.Aerospace products and parts manufacturing (336414, 336415, 336419)]	2.982e+04	4122.310	7.233	0.000	2.17e+04	3.79e+04
C(ind02)[T.Agricultural chemical manufacturing (3253)]	1.779e+04	4842.470	3.675	0.000	8303.106	2.73e+04
C(ind02)[T.Agricultural implement manufacturing (33311)]	7268.6674	2308.301	3.149	0.002	2744.397	1.18e+04
C(ind02)[T.Air transportation (481)]	1.207e+04	1382.228	8.730	0.000	9357.324	1.48e+04
C(ind02)[T.Aircraft and parts manufacturing (336411 to 336413)]	1.58e+04	1215.801	12.999	0.000	1.34e+04	1.82e+04
C(ind02)[T.Aluminum production and processing (3313)]	8428.9125	3100.708	2.718	0.007	2351.525	1.45e+04
C(ind02)[T.Animal food, grain and oilseed milling (3111, 3112)]	2310.9439	2074.375	1.114	0.265	-1754.832	6376.720
C(ind02)[T.Animal production (112)]	1277.5506	1442.104	0.886	0.376	-1548.973	4104.075
C(ind02)[T.Animal slaughtering and processing (3116)]	508.0230	1089.651	0.466	0.641	-1627.694	2643.739
C(ind02)[T.Apparel accessories and other apparel manufacturing (3159)]	1718.7401	6820.705	0.252	0.801	-1.16e+04	1.51e+04
C(ind02)[T.Architectural, engineering,	1.825e+04	1070.304	17.054	0.000	1.62e+04	2.04e+04

and related services (5413)]						
C(ind02)[T.Auto parts, accessories, and tire stores (4413)]	-2664.5944	1332.546	-2.000	0.046	-5276.385	-52.804
C(ind02)[T.Automobile dealers (4411)]	1003.6945	1030.567	0.974	0.330	-1016.217	3023.606
C(ind02)[T.Automotive equipment rental and leasing (5321)]	-70.0433	2347.920	-0.030	0.976	-4671.967	4531.881
C(ind02)[T.Automotive repair and maintenance (8111 exc. 811192)]	5259.2288	1002.149	5.248	0.000	3295.016	7223.442
C(ind02)[T.Bakeries, except retail (3118 exc. 311811)]	1326.5007	1885.854	0.703	0.482	-2369.773	5022.774
C(ind02)[T.Banking and related activities (521, 52211,52219)]	3940.9626	933.892	4.220	0.000	2110.533	5771.392
C(ind02)[T.Barber shops (812111)]	-3051.1109	6472.618	-0.471	0.637	-1.57e+04	9635.221
C(ind02)[T.Beauty salons (812112)]	-2481.0332	1633.989	-1.518	0.129	-5683.651	721.585
C(ind02)[T.Beer, wine, and liquor stores (4453)]	-1960.7750	3406.685	-0.576	0.565	-8637.878	4716.328
C(ind02)[T.Beverage manufacturing (3121)]	5159.3441	1722.141	2.996	0.003	1783.947	8534.741
C(ind02)[T.Book stores and news dealers (45121)]	-5757.2962	3834.919	-1.501	0.133	-1.33e+04	1759.146
C(ind02)[T.Bowling centers (71395)]	-8373.1958	4489.185	-1.865	0.062	-1.72e+04	425.607
C(ind02)[T.Building material and supplies dealers (4441 exc. 44413)]	-1389.6050	1048.426	-1.325	0.185	-3444.520	665.310
C(ind02)[T.Bus service and urban transit (4851, 4852, 4854, 4855, 4859)]	2022.1170	1370.785	1.475	0.140	-664.621	4708.855
C(ind02)[T.Business support services (5614)]	-1868.2389	1271.653	-1.469	0.142	-4360.680	624.202
C(ind02)[T.Business, professional, political, and similar organizations (8139 exc. 81393)]	9875.2586	3101.837	3.184	0.001	3795.657	1.6e+04
C(ind02)[T.Business, technical, and trade schools and training (6114, 6115)]	7677.3639	4205.723	1.825	0.068	-565.854	1.59e+04
C(ind02)[T.Car washes (811192)]	-4945.1675	2530.943	-1.954	0.051	-9905.817	15.482
C(ind02)[T.Carpet and rug mills (31411)]	-579.1131	3133.934	-0.185	0.853	-6721.624	5563.398
C(ind02)[T.Cement, concrete, lime, and gypsum product manufacturing (3273, 3274)]	5508.6594	1819.863	3.027	0.002	1941.727	9075.591
C(ind02)[T.Child day care services (6244)]	-3584.9457	1058.087	-3.388	0.001	-5658.797	-1511.094
C(ind02)[T.Civic, social, advocacy organizations, and grantmaking and giving services (8132, 8133, 8134)]	3396.5214	1425.042	2.383	0.017	603.440	6189.603
C(ind02)[T.Clothing and accessories, except shoe, stores (448 exc. 44821, 4483)]	-2042.8904	1324.817	-1.542	0.123	-4639.532	553.751

C(ind02)[T.Coal mining (2121)]	2.418e+04	2075.009	11.651	0.000	2.01e+04	2.82e+04
C(ind02)[T.Coating, engraving, heat treating and allied activities (3328)]	1725.5210	2816.851	0.613	0.540	-3795.507	7246.549
C(ind02)[T.Colleges and universities, including junior colleges (6112, 6113)]	3765.0355	983.198	3.829	0.000	1837.967	5692.103
C(ind02)[T.Commercial and industrial machinery and equipment repair and maintenance (8113)]	1.065e+04	1607.969	6.624	0.000	7499.638	1.38e+04
C(ind02)[T.Commercial, industrial, and other intangible assets rental and leasing (5324, 533)]	7456.3597	2681.809	2.780	0.005	2200.013	1.27e+04
C(ind02)[T.Communications, audio, and video equipment manufacturing (3342, 3343)]	486.1752	2816.962	0.173	0.863	-5035.072	6007.422
C(ind02)[T.Community food and housing, and emergency services (6242)]	-24.8376	2642.139	-0.009	0.992	-5203.431	5153.756
C(ind02)[T.Computer systems design and related services (5415)]	1.625e+04	1074.706	15.122	0.000	1.41e+04	1.84e+04
C(ind02)[T.Construction, mining and oil field machinery manufacturing (33312, 33313)]	9138.3361	2057.014	4.443	0.000	5106.589	1.32e+04
C(ind02)[T.Couriers and messengers (492)]	8768.6571	1233.766	7.107	0.000	6350.476	1.12e+04
C(ind02)[T.Crop production (111)]	-355.8331	1181.243	-0.301	0.763	-2671.070	1959.404
C(ind02)[T.Cut and sew apparel manufacturing (3152)]	-1244.2785	2204.800	-0.564	0.573	-5565.687	3077.130
C(ind02)[T.Cutlery and hand tool manufacturing (3322)]	9877.0810	4597.885	2.148	0.032	865.226	1.89e+04
C(ind02)[T.Dairy product manufacturing (3115)]	4604.0986	1830.971	2.515	0.012	1015.394	8192.803
C(ind02)[T.Drinking places, alcoholic beverages (7224)]	-9896.9578	2283.856	-4.333	0.000	-1.44e+04	-5420.599
C(ind02)[T.Drycleaning and laundry services (8123)]	-3107.6167	1803.968	-1.723	0.085	-6643.394	428.160
C(ind02)[T.Electric and gas, and other combinations (Pts. 2211, 2212)]	1.932e+04	2841.593	6.800	0.000	1.38e+04	2.49e+04
C(ind02)[T.Electric power generation, transmission and distribution (Pt. 2211)]	2.155e+04	1152.307	18.703	0.000	1.93e+04	2.38e+04
C(ind02)[T.Electrical lighting, equipment, and supplies manufacturing, n.e.c. (3351, 3353, 3359)]	5187.8613	1589.617	3.264	0.001	2072.211	8303.512
C(ind02)[T.Electronic and precision equipment repair and maintenance (8112)]	4338.7347	2920.095	1.486	0.137	-1384.652	1.01e+04
C(ind02)[T.Electronic component and product manufacturing, n.e.c. (3344, 3346)]	7885.4744	1419.976	5.553	0.000	5102.321	1.07e+04

C(ind02)[T.Elementary and secondary schools (6111)]	2541.3408	770.199	3.300	0.001	1031.751	4050.930
C(ind02)[T.Employment services (5613)]	2873.1350	1129.754	2.543	0.011	658.816	5087.454
C(ind02)[T.Engines, turbines, and power transmission equipment manufacturing (3336)]	6877.3365	3970.007	1.732	0.083	-903.878	1.47e+04
C(ind02)[T.Executive offices and legislative bodies (92111, 92112, 92114, pt. 92115)]	7365.8811	1005.029	7.329	0.000	5396.025	9335.737
C(ind02)[T.Fabric mills, except knitting (3132 exc. 31324)]	-1548.1019	2867.385	-0.540	0.589	-7168.177	4071.973
C(ind02)[T.Fiber, yarn, and thread mills (3131)]	-5723.0886	1.02e+04	-0.561	0.575	-2.57e+04	1.43e+04
C(ind02)[T.Fishing, hunting, and trapping (114)]	-5488.3286	5131.333	-1.070	0.285	-1.55e+04	4569.085
C(ind02)[T.Footwear manufacturing (3162)]	-739.9731	5480.490	-0.135	0.893	-1.15e+04	1e+04
C(ind02)[T.Forestry except logging (1131, 1132)]	6441.4195	3363.969	1.915	0.056	-151.961	1.3e+04
C(ind02)[T.Foundries (3315)]	6867.8370	2841.659	2.417	0.016	1298.184	1.24e+04
C(ind02)[T.Fruit and vegetable preserving and specialty food manufacturing (3114)]	2464.5516	1954.083	1.261	0.207	-1365.451	6294.555
C(ind02)[T.Fuel dealers (45431)]	949.0905	2703.071	0.351	0.726	-4348.930	6247.111
C(ind02)[T.Funeral homes, cemeteries, and crematories (8122)]	-2722.7767	2894.202	-0.941	0.347	-8395.414	2949.861
C(ind02)[T.Furniture and home furnishings stores (442)]	-1361.1077	1491.259	-0.913	0.361	-4283.976	1561.761
C(ind02)[T.Gasoline stations (447)]	-5394.2659	1411.447	-3.822	0.000	-8160.703	-2627.829
C(ind02)[T.Gift, novelty, and souvenir shops (45322)]	-7690.8951	3243.444	-2.371	0.018	-1.4e+04	-1333.745
C(ind02)[T.Glass and glass product manufacturing (3272)]	-262.7486	2247.586	-0.117	0.907	-4668.017	4142.520
C(ind02)[T.Grocery stores (4451)]	-3238.8131	831.306	-3.896	0.000	-4868.174	-1609.452
C(ind02)[T.Hardware stores (44413)]	-5867.0819	2007.099	-2.923	0.003	-9800.996	-1933.168
C(ind02)[T.Health and personal care, except drug, stores (446 exc. 44611)]	1348.8135	1667.063	0.809	0.418	-1918.630	4616.257
C(ind02)[T.Home health care services (6216)]	-122.1201	1022.841	-0.119	0.905	-2126.888	1882.648
C(ind02)[T.Hospitals (622)]	1.364e+04	705.039	19.353	0.000	1.23e+04	1.5e+04
C(ind02)[T.Household appliance manufacturing (3352)]	4559.5669	3036.211	1.502	0.133	-1391.407	1.05e+04
C(ind02)[T.Household appliance stores (443111)]	-2290.6459	3654.823	-0.627	0.531	-9454.101	4872.809
C(ind02)[T.Independent artists, performing arts, spectator sports, and	6093.8094	1961.881	3.106	0.002	2248.522	9939.096

related industries (711)]						
C(ind02)[T.Individual and family services (6241)]	1205.3125	1001.901	1.203	0.229	-758.414	3169.039
C(ind02)[T.Industrial and miscellaneous chemicals (3251, 3259)]	1.436e+04	1478.119	9.714	0.000	1.15e+04	1.73e+04
C(ind02)[T.Insurance carriers and related activities (524)]	5321.7818	911.925	5.836	0.000	3534.409	7109.155
C(ind02)[T.Internet publishing and broadcasting and web search portals (51913)]	2.68e+04	4294.704	6.239	0.000	1.84e+04	3.52e+04
C(ind02)[T.Investigation and security services (5616)]	-1762.5457	1125.374	-1.566	0.117	-3968.280	443.188
C(ind02)[T.Iron and steel mills and steel product manufacturing (3311, 3312)]	1.004e+04	1569.891	6.393	0.000	6958.774	1.31e+04
C(ind02)[T.Jewelry, luggage, and leather goods stores (4483)]	-3923.6094	2793.589	-1.405	0.160	-9399.044	1551.825
C(ind02)[T.Justice, public order, and safety activities (922, pt. 92115)]	1.006e+04	805.027	12.492	0.000	8478.522	1.16e+04
C(ind02)[T.Knitting mills (31324, 3151)]	-3581.8509	5297.417	-0.676	0.499	-1.4e+04	6801.088
C(ind02)[T.Labor unions (81393)]	1.71e+04	4388.117	3.897	0.000	8499.579	2.57e+04
C(ind02)[T.Landscaping services (56173)]	-1408.1005	1070.448	-1.315	0.188	-3506.180	689.979
C(ind02)[T.Lawn and garden equipment and supplies stores (4442)]	-1323.9406	1791.860	-0.739	0.460	-4835.987	2188.105
C(ind02)[T.Leather tanning and products, except footwear manufacturing (3161, 3169)]	-5731.7491	6174.909	-0.928	0.353	-1.78e+04	6371.074
C(ind02)[T.Legal services (5411)]	1.117e+04	1241.704	8.994	0.000	8734.561	1.36e+04
C(ind02)[T.Libraries and archives (*51912)]	4830.3104	2483.620	1.945	0.052	-37.585	9698.206
C(ind02)[T.Logging (1133)]	5994.2576	2793.219	2.146	0.032	519.547	1.15e+04
C(ind02)[T.Machine shops; turned product; screw, nut and bolt manufacturing (3327)]	4888.8448	1494.520	3.271	0.001	1959.585	7818.104
C(ind02)[T.Machinery manufacturing, n.e.c. (3332, 3334, 3339)]	5917.8121	1191.748	4.966	0.000	3581.985	8253.639
C(ind02)[T.Management of companies and enterprises (551)]	2597.8954	2480.696	1.047	0.295	-2264.269	7460.060
C(ind02)[T.Management, scientific, and technical consulting services (5416)]	1.1e+04	1361.625	8.078	0.000	8330.722	1.37e+04
C(ind02)[T.Medical equipment and supplies manufacturing (3391)]	6211.0521	1336.685	4.647	0.000	3591.149	8830.955
C(ind02)[T.Metal forgings and stampings (3321)]	404.2700	3100.360	0.130	0.896	-5672.437	6480.977
C(ind02)[T.Metal ore mining (2122)]	3.801e+04	3281.329	11.582	0.000	3.16e+04	4.44e+04

C(ind02)[T.Metalworking machinery manufacturing (3335)]	8665.3363	2202.569	3.934	0.000	4348.301	1.3e+04
C(ind02)[T.Miscellaneous fabricated metal products manufacturing (3325, 3326, 3329 exc. 332992, 332993, 332994, 332995)]	3349.9454	1525.572	2.196	0.028	359.825	6340.066
C(ind02)[T.Miscellaneous general merchandise stores (4529)]	-3020.1074	1360.603	-2.220	0.026	-5686.889	-353.326
C(ind02)[T.Miscellaneous manufacturing, n.e.c. (3399 exc. 33992, 33993)]	3492.6771	1354.111	2.579	0.010	838.620	6146.734
C(ind02)[T.Miscellaneous nonmetallic mineral product manufacturing (3279)]	4370.6433	2702.914	1.617	0.106	-927.069	9668.355
C(ind02)[T.Miscellaneous paper and pulp products (32222,32223, 32229)]	5697.6106	3006.138	1.895	0.058	-194.421	1.16e+04
C(ind02)[T.Miscellaneous petroleum and coal products (32419)]	7129.0233	4597.902	1.550	0.121	-1882.865	1.61e+04
C(ind02)[T.Miscellaneous retail stores (4539)]	-642.7847	1771.376	-0.363	0.717	-4114.683	2829.113
C(ind02)[T.Motion pictures and video industries (5121)]	1.449e+04	2465.027	5.876	0.000	9653.925	1.93e+04
C(ind02)[T.Motor vehicles and motor vehicle equipment manufacturing (3361, 3362, 3363)]	5536.6185	915.080	6.050	0.000	3743.061	7330.176
C(ind02)[T.Museums, art galleries, historical sites, and similar institutions (712)]	537.5635	1781.961	0.302	0.763	-2955.080	4030.207
C(ind02)[T.Nail salons and other personal care services (812113, 81219)]	2010.7711	1956.077	1.028	0.304	-1823.139	5844.682
C(ind02)[T.National security and international affairs (928)]	1.599e+04	1090.799	14.662	0.000	1.39e+04	1.81e+04
C(ind02)[T.Natural gas distribution (Pt.s2212)]	1.536e+04	2283.549	6.728	0.000	1.09e+04	1.98e+04
C(ind02)[T.Navigational, measuring, electromedical, and control instruments manufacturing (3345)]	1.497e+04	2150.316	6.963	0.000	1.08e+04	1.92e+04
C(ind02)[T.Non-depository credit and related activities (5222, 5223)]	3817.5991	1319.683	2.893	0.004	1231.020	6404.179
C(ind02)[T.Nonferrous metal, except aluminum, production and processing (3314)]	5832.9113	3452.275	1.690	0.091	-933.549	1.26e+04
C(ind02)[T.Nonmetallic mineral mining and quarrying (2123)]	1.593e+04	1892.907	8.413	0.000	1.22e+04	1.96e+04
C(ind02)[T.Not specified food industries (Part of 311)]	638.5830	3168.771	0.202	0.840	-5572.208	6849.374
C(ind02)[T.Not specified manufacturing industries (Part of 31, 32, 33)]	1554.8828	1726.797	0.900	0.368	-1829.639	4939.404

C(ind02)[T.Not specified metal industries (Part of 331 and 332)]	3443.7465	5132.058	0.671	0.502	-6615.088	1.35e+04
C(ind02)[T.Not specified retail trade (Part of 44, 45)]	-2055.5478	1843.453	-1.115	0.265	-5668.717	1557.621
C(ind02)[T.Not specified utilities (Part of 22)]	1.217e+04	7725.716	1.575	0.115	-2975.455	2.73e+04
C(ind02)[T.Nursing care facilities (6231)]	1189.5407	882.342	1.348	0.178	-539.851	2918.932
C(ind02)[T.Office supplies and stationery stores (45321)]	-1590.7688	2602.599	-0.611	0.541	-6691.863	3510.326
C(ind02)[T.Offices of chiropractors (62131)]	6720.4364	3656.904	1.838	0.066	-447.096	1.39e+04
C(ind02)[T.Offices of dentists (6212)]	5942.6082	1225.728	4.848	0.000	3540.181	8345.035
C(ind02)[T.Offices of optometrists (62132)]	1115.5327	2274.040	0.491	0.624	-3341.585	5572.651
C(ind02)[T.Offices of other health practitioners (6213 exc. 62131, 62132)]	1.354e+04	2704.865	5.005	0.000	8236.247	1.88e+04
C(ind02)[T.Offices of physicians (6211)]	7559.9073	965.730	7.828	0.000	5667.077	9452.737
C(ind02)[T.Oil and gas extraction (211)]	2.461e+04	3321.416	7.410	0.000	1.81e+04	3.11e+04
C(ind02)[T.Ordnance (332992 to 332995)]	1.2e+04	3067.753	3.913	0.000	5990.015	1.8e+04
C(ind02)[T.Other administrative and other support services (5611, 5612, 5619)]	22.9230	1819.925	0.013	0.990	-3544.131	3589.977
C(ind02)[T.Other amusement, gambling, and recreation industries (713 exc. 71395)]	-3606.8801	937.391	-3.848	0.000	-5444.167	-1769.593
C(ind02)[T.Other consumer goods rental (53221, 53222, 53229, 5323)]	-264.7296	2892.976	-0.092	0.927	-5934.962	5405.503
C(ind02)[T.Other direct selling establishments (45439)]	-2811.8715	4043.704	-0.695	0.487	-1.07e+04	5113.790
C(ind02)[T.Other general government and support (92119)]	9517.2638	2548.097	3.735	0.000	4522.994	1.45e+04
C(ind02)[T.Other health care services (6215, 6219)]	8738.4788	969.684	9.012	0.000	6837.897	1.06e+04
C(ind02)[T.Other information services (*5191 exc. 51912)]	2.084e+04	7725.755	2.698	0.007	5697.825	3.6e+04
C(ind02)[T.Other motor vehicle dealers (4412)]	2773.6466	2321.342	1.195	0.232	-1776.185	7323.478
C(ind02)[T.Other personal services (8129)]	-3484.8979	1976.756	-1.763	0.078	-7359.340	389.544
C(ind02)[T.Other professional, scientific, and technical services (5419 exc. 54194)]	4794.6333	2322.088	2.065	0.039	243.340	9345.926
C(ind02)[T.Other schools, instruction,	6357.2790	1927.460	3.298	0.001	2579.457	1.01e+04

and educational services (6116, 6117)]						
C(ind02)[T.Other telecommunications services (*517 exc. 5171, 5175)]	7661.6946	1600.531	4.787	0.000	4524.653	1.08e+04
C(ind02)[T.Other transportation equipment manufacturing (3369)]	-434.0863	4388.150	-0.099	0.921	-9034.861	8166.689
C(ind02)[T.Outpatient care centers (6214)]	7072.7249	902.987	7.833	0.000	5302.871	8842.579
C(ind02)[T.Paint, coating, and adhesive manufacturing B46 (3255)]	7094.7241	3655.088	1.941	0.052	-69.249	1.43e+04
C(ind02)[T.Paperboard containers and boxes (32221)]	2293.6000	2661.242	0.862	0.389	-2922.435	7509.635
C(ind02)[T.Personal and household goods repair and maintenance (8114 exc. 81143)]	2962.1410	2724.316	1.087	0.277	-2377.519	8301.801
C(ind02)[T.Petroleum refining (32411)]	2.549e+04	2023.467	12.596	0.000	2.15e+04	2.95e+04
C(ind02)[T.Pharmaceutical and medicine manufacturing (3254)]	7154.5910	1682.833	4.252	0.000	3856.239	1.05e+04
C(ind02)[T.Pharmacies and drug stores (44611)]	6013.0821	1139.138	5.279	0.000	3780.372	8245.793
C(ind02)[T.Pipeline transportation (486)]	2.145e+04	2893.331	7.413	0.000	1.58e+04	2.71e+04
C(ind02)[T.Plastics product manufacturing (3261)]	2434.7848	1433.469	1.699	0.089	-374.815	5244.385
C(ind02)[T.Postal Service (491)]	6810.1587	1191.457	5.716	0.000	4474.904	9145.414
C(ind02)[T.Pottery, ceramics, and related products manufacturing (32711)]	-360.4404	5480.929	-0.066	0.948	-1.11e+04	1.04e+04
C(ind02)[T.Prefabricated wood buildings and mobile homes (321991, 321992)]	-169.0769	3712.947	-0.046	0.964	-7446.454	7108.301
C(ind02)[T.Printing and related support activities (3231)]	1858.1015	1361.813	1.364	0.172	-811.053	4527.256
C(ind02)[T.Private households (814)]	-2565.8402	1530.498	-1.676	0.094	-5565.617	433.937
C(ind02)[T.Public finance activities (92113)]	8551.4812	1739.214	4.917	0.000	5142.621	1.2e+04
C(ind02)[T.Pulp, paper, and paperboard mills (3221)]	1.233e+04	1771.349	6.958	0.000	8853.578	1.58e+04
C(ind02)[T.Radio and television broadcasting and cable (5151, 5152, 5175)]	8756.4072	1494.528	5.859	0.000	5827.132	1.17e+04
C(ind02)[T.Rail transportation (482)]	1.814e+04	1781.983	10.179	0.000	1.46e+04	2.16e+04
C(ind02)[T.Railroad rolling stock manufacturing (3365)]	1.036e+04	4715.606	2.198	0.028	1121.508	1.96e+04
C(ind02)[T.Real estate (531)]	3142.1872	1009.000	3.114	0.002	1164.548	5119.827
C(ind02)[T.Recreational vehicle parks and camps, and rooming and boarding houses (7212, 7213)]	-7276.4343	3363.097	-2.164	0.030	-1.39e+04	-684.764

C(ind02)[T.Religious organizations (8131)]	-390.3931	1700.563	-0.230	0.818	-3723.497	2942.711
C(ind02)[T.Residential care facilities, without nursing (6232, 6233, 6239)]	-704.1146	1082.679	-0.650	0.515	-2826.166	1417.937
C(ind02)[T.Resin, synthetic rubber and fibers, and filaments manufacturing (3252)]	4714.1697	2056.837	2.292	0.022	682.768	8745.571
C(ind02)[T.Restaurants and other food services (722 exc. 7224)]	-5656.4446	713.914	-7.923	0.000	-7055.717	-4257.172
C(ind02)[T.Retail bakeries (311811)]	-3102.9307	1992.947	-1.557	0.119	-7009.107	803.246
C(ind02)[T.Retail florists (4531)]	-4828.2914	4599.034	-1.050	0.294	-1.38e+04	4185.817
C(ind02)[T.Rubber products, except tires, manufacturing (32622, 32629)]	5622.2455	2565.599	2.191	0.028	593.671	1.07e+04
C(ind02)[T.Savings institutions, including credit unions (52212, 52213)]	3643.3479	1668.242	2.184	0.029	373.593	6913.103
C(ind02)[T.Sawmills and wood preservation (3211)]	4821.5766	1849.342	2.607	0.009	1196.866	8446.288
C(ind02)[T.Scenic and sightseeing transportation (487)]	-4307.9709	4715.534	-0.914	0.361	-1.36e+04	4934.477
C(ind02)[T.Scientific research and development services (5417)]	1.354e+04	1647.955	8.215	0.000	1.03e+04	1.68e+04
C(ind02)[T.Seafood and other miscellaneous foods, n.e.c. (3117, 3119)]	3528.6578	1854.869	1.902	0.057	-106.886	7164.201
C(ind02)[T.Securities, commodities, funds, trusts, and other financial investments (523, 525)]	8049.5454	1460.264	5.512	0.000	5187.428	1.09e+04
C(ind02)[T.Services incidental to transportation (488)]	6606.9728	1179.937	5.599	0.000	4294.296	8919.649
C(ind02)[T.Sewage treatment facilities (22132)]	8720.6424	2641.852	3.301	0.001	3542.611	1.39e+04
C(ind02)[T.Sewing, needlework, and piece goods stores (45113)]	-6846.9236	5685.446	-1.204	0.228	-1.8e+04	4296.552
C(ind02)[T.Ship and boat building (3366)]	7495.2431	1912.094	3.920	0.000	3747.539	1.12e+04
C(ind02)[T.Shoe stores (44821)]	-1045.7612	3100.876	-0.337	0.736	-7123.479	5031.957
C(ind02)[T.Soap, cleaning compound, and cosmetics manufacturing (3256)]	-67.1593	2867.051	-0.023	0.981	-5686.580	5552.261
C(ind02)[T.Software publishing (5112)]	2.425e+04	5915.016	4.100	0.000	1.27e+04	3.58e+04
C(ind02)[T.Sound recording industries (5122)]	1.329e+04	1.02e+04	1.302	0.193	-6716.245	3.33e+04
C(ind02)[T.Specialized design services (5414)]	9226.3935	2817.871	3.274	0.001	3703.366	1.47e+04
C(ind02)[T.Specialty food stores (4452)]	-2709.4567	2433.756	-1.113	0.266	-7479.619	2060.706
C(ind02)[T.Structural clay product manufacturing (32712)]	46.2289	4842.266	0.010	0.992	-9444.614	9537.072

C(ind02)[T.Structural metals, and tank and shipping container manufacturing (3323, 3324)]	5970.1941	1448.004	4.123	0.000	3132.106	8808.283
C(ind02)[T.Sugar and confectionery products (3113)]	1272.9177	2621.715	0.486	0.627	-3865.643	6411.479
C(ind02)[T.Support activities for agriculture and forestry (115)]	2204.0829	2514.585	0.877	0.381	-2724.505	7132.670
C(ind02)[T.Support activities for mining (213)]	2.666e+04	1200.673	22.206	0.000	2.43e+04	2.9e+04
C(ind02)[T.Taxi and limousine service (4853)]	-5690.3070	2048.593	-2.778	0.005	-9705.549	-1675.065
C(ind02)[T.Textile and fabric finishing and coating mills (3133)]	-1951.8643	8341.337	-0.234	0.815	-1.83e+04	1.44e+04
C(ind02)[T.Textile product mills, except carpets and rugs (314 exc. 31411)]	-2967.7456	2948.251	-1.007	0.314	-8746.319	2810.828
C(ind02)[T.Tire manufacturing (32621)]	1.314e+04	3363.120	3.908	0.000	6552.444	1.97e+04
C(ind02)[T.Tobacco manufacturing (3122)]	2.222e+04	8340.750	2.664	0.008	5874.080	3.86e+04
C(ind02)[T.Toys, amusement, and sporting goods manufacturing (33992, 33993)]	-2314.3848	2621.695	-0.883	0.377	-7452.907	2824.137
C(ind02)[T.Travel arrangements and reservation services (5615)]	402.6599	2214.753	0.182	0.856	-3938.256	4743.576
C(ind02)[T.Traveler accommodation (7211)]	-2427.4611	930.844	-2.608	0.009	-4251.916	-603.006
C(ind02)[T.Truck transportation (484)]	6380.9211	956.161	6.673	0.000	4506.845	8254.997
C(ind02)[T.Used merchandise stores (4533)]	-8148.6844	2404.518	-3.389	0.001	-1.29e+04	-3435.828
C(ind02)[T.Vending machine operators (4542)]	2012.0079	4489.230	0.448	0.654	-6786.884	1.08e+04
C(ind02)[T.Veneer, plywood, and engineered wood products (3212)]	5990.3678	3771.667	1.588	0.112	-1402.101	1.34e+04
C(ind02)[T.Veterinary services (54194)]	558.8103	1607.943	0.348	0.728	-2592.759	3710.380
C(ind02)[T.Video tape and disk rental (53223)]	2.585e+04	1.44e+04	1.793	0.073	-2408.754	5.41e+04
C(ind02)[T.Vocational rehabilitation services (6243)]	-4185.8301	3100.605	-1.350	0.177	-1.03e+04	1891.357
C(ind02)[T.Warehousing and storage (493)]	-1852.6714	1196.859	-1.548	0.122	-4198.516	493.173
C(ind02)[T.Waste management and remediation services (562)]	4610.8198	1306.341	3.530	0.000	2050.391	7171.248
C(ind02)[T.Water transportation (483)]	1.557e+04	3655.062	4.260	0.000	8407.372	2.27e+04
C(ind02)[T.Water, steam, air-conditioning, and irrigation systems (22131, 22133)]	8458.3618	1708.841	4.950	0.000	5109.033	1.18e+04

C(ind02)[T.Wired telecommunications carriers (*5171)]	1.422e+04	1457.609	9.755	0.000	1.14e+04	1.71e+04
female	-7329.5423	187.293	-39.134	0.000	-7696.637	-6962.448
age	266.1527	5.942	44.789	0.000	254.506	277.800
high_school	7233.1058	290.710	24.881	0.000	6663.314	7802.898
ba	1.1e+04	189.778	57.954	0.000	1.06e+04	1.14e+04

Omnibus:	32694.200	**Durbin-Watson:**	1.907
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	334911.860
Skew:	2.164	**Prob(JB):**	0.00
Kurtosis:	13.174	**Cond. No.**	7.93e+03

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 7.93e+03. This might indicate that there are
strong multicollinearity or other numerical problems.

Answer: According to the model, women will receive 7329 dollars less than men on average. The result is statistically significant.

Exercise 13

Now that we've added industry fixed effects, what groups are we implicitly treated as counter-factuals for one another now?

Answer: We are comparing annual salary between male and female of the same age, education and in the same industry.

Exercise 14

What happened to your estimate of the gender wage gap when you added industry fixed effects? What does that tell you about the industries chosen by women as opposed to men?

Answer: The wage gap is smaller after added industry fixed effects. The decrease show women are more concentrated in low salary industry. At the same time, men are more likely to stay in the high-salary industry. We can get the same conclusion from the following plot. There is an apparent trend that an industry's female rate goes down with the industry's salary.

In [104…

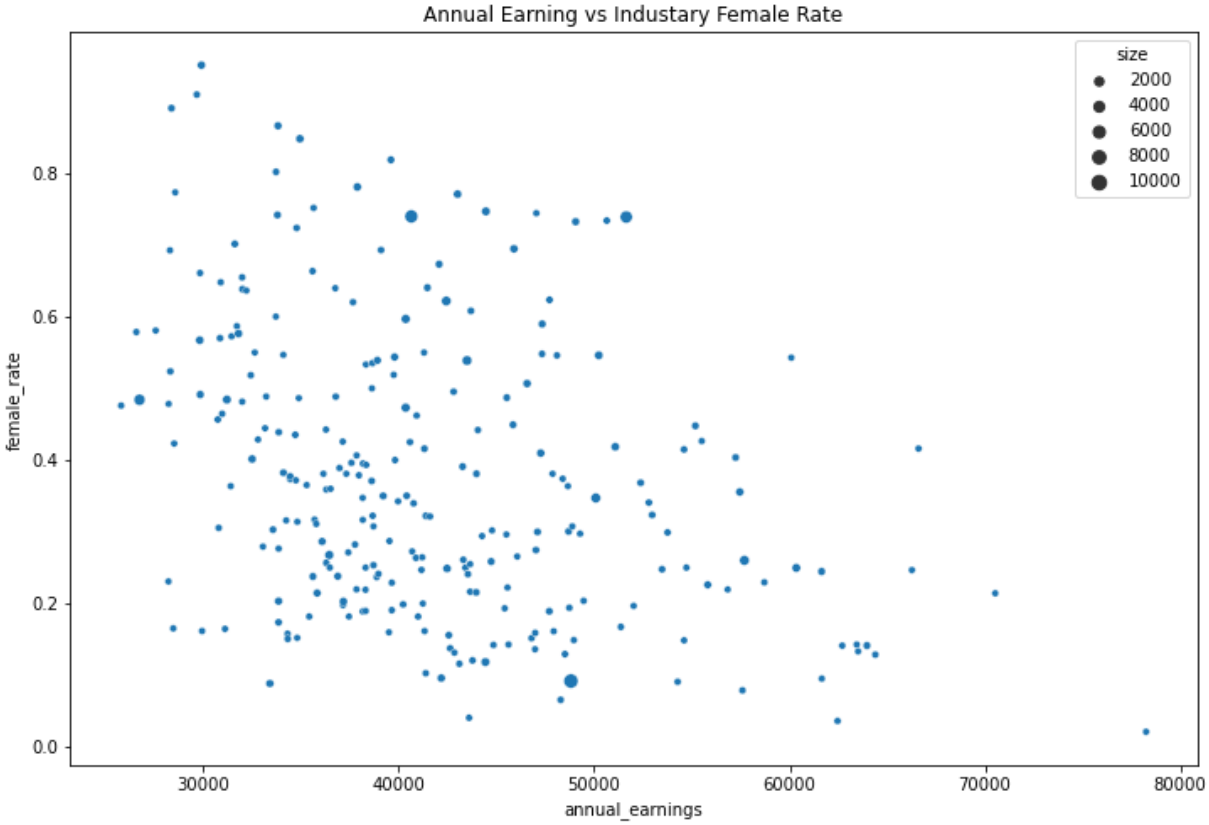
```
import seaborn as sns

ind_salary = df.groupby(["ind02"])["annual_earnings"].mean().reset_index()
ind_female_rate = df.groupby(["ind02"])["female"].sum() / df.groupby(["ind02"]).size
ind_size = df.groupby(["ind02"]).size()
df_res = ind_salary.merge(ind_female_rate.reset_index(), on="ind02").reindex()
df_res = df_res.merge(ind_size.reset_index(), on="ind02").reindex()
df_res = df_res.rename(columns={"0_x": "female_rate", "0_y": "size"})
df_res.sort_values(["annual_earnings"], inplace=True)
df_res.head()
```

Out[104…

	ind02	annual_earnings	female_rate	size
82	Drinking places, alcoholic beverages (7224)	25781.557674	0.475862	145
240	Used merchandise stores (4533)	26558.520519	0.578571	140
206	Restaurants and other food services (722 exc. ...	26721.339625	0.484069	5053
55	Book stores and news dealers (45121)	27548.273103	0.580645	62
56	Bowling centers (71395)	28203.314286	0.230769	26

In [107…
```
plt.figure(figsize=(12, 8))

sns.scatterplot(data=df_res, x="annual_earnings", y="female_rate", size="size")
plt.title('Annual Earning vs Industary Female Rate')
```

Out[107… `Text(0.5, 1.0, 'Annual Earning vs Industary Female Rate')`



In [ ]: