Problem Set I: *Quantitative Macroeconomics*

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1 Employment Rate

Compute (and plot) the time series of the monthly employment rate in the U.S. As source of data go to IPUMS and download the latest available CPS monthly data. Detrend and deseasonalize to show the effect of COVID19 in your estimates for year 2020.

In graph 1 we have the predicted employment rate versus the real employment rate. The predicted employment rate has been computed by doing a regression on monthly employment rate (2018-2019), using as independent variables monthly dummies, omitting the data that we have from 2020. Then with the estimated coefficients for each month we compute the predictions for 2020. We can see that there is a steep descend in employment in March reaching the lowest in April and then there has been a recovery, but the employment rate still faraway from the predictions for August.

Grahp 2 show the percentage of the employment rate, we can see the that in April there was a fall of the 8% while the recovery is being slower, with increments around 2% each month.

Redo by education group as <HS, HS, College and > College.

The 4 levels of education are computed are required (level 1 $< HS$, level 4 $> College$). The results for the employment rate by education level are provided in graph 3. As expected, we see that in general the employment rate is higher for higher levels of education for the whole period, also there is a noticeable difference in how big the fall is in April 2020, is reasonable to think that lower level of education, have jobs where telework is less likely and in more fragile sectors like hostelry and restoration, while high education population probably work in high tech sectors, where is easier to telework.

Redo by industry (for example, create two groups of industries according to their ability to telework).

For a better understanding of the results, I'm gonna explain a bit how I decided whether an industry is able to telework or not. I downloaded data from IPUMS time us, and use the variable (WRKHOMEABLE) that takes value 1 if the individual was able to telework and 0 if he wasn't able to telework. Firstly I computed the total amount of individuals that were able to telework by industry, then I computed the total amount of individuals by industry, finally I computed the proportion of individuals that teleworked by industry, my criteria for choosing whether an industry is able to telework or not, has been the following, if the proportions of individuals that teleworked is smaller than 0.5 then I decided that this industry is not able to telework(there are many other valid ways of deciding this).

We can see the results in graph 4, as happened with the education level, the employment rate is higher in industries that have more ability to telework, also the decrease in April has been much lower for the industries with higher ability to telework. The possible explanation for this persistent gap during the whole period can be link with the education level, probably the industries with more ability to telework are industries with higher technology, where the

employment rate is higher. Another remarkable thing is that the recovery is being faster in the industries with less ability to telework, as they were more affected by the lockdowns, they recover faster as the situation returns to "normal".

Redo by occupation. Hint: Find an interesting way to split occupations (2 or 3 groups) that you think is useful to learn the effects of COVID19

The division that I have made, is by worker type (type 1= self-employed, type2= private sector, type 3= government employee). The results are provided in graph 5. As expected the decrease in the private sector is higher, than in government employees and self-employees, the government employees have usually "safer" jobs, with more restrictions to be fired, self-employee may have difficulties to be able to close the business in case of need, the process for deciding is not immediate, the shock for self-employee might take longer to be appreciate in the employment rate.

2 Weekly Hours

Redo the previous item for average weekly hours. Discuss your results.

Graph 6 show the evolution of the average weekly hours versus the predicted average weekly hours, the way of computing the predictions is the same as before. We can see that the tendency is very similar as the employment rate, in April there a steep descend and then there a slower recovery.

We can see in graph 7 that the average weekly hours by education level also follows a similar path than the employment rate by education level, the individuals with less level of education work less hours always, the only difference with respect to the graph of employment rate, is that the percentage in which the hours worked decrease is similar across education levels, while in the employment rate, the higher level of education were less affected.

Now we look at the differences in weekly hours worked by ability to telework, in graph 8 we observe that during the whole period the industry with less ability to telework, work less hours, as expected they are more affected than the industries with high ability to telework, the percentage decrease in April is higher in industries with low ability to telework.

Where we observe clear differences with respect to the graphs of employment rate, is when we look at the evolution of the average weekly hours by worker type, while in employment rate the private sector was the most affected in terms of employment, in terms of average weekly hours does not change much, that is the individuals that still working, work more or less the same amount of hours. The same thing happened for government employees, but for self-employee, we see that the weekly hours worked decrease a lot, this might happen because, usually the self-employee work many hours, but during the lockdowns the there were many business that were forced to stop the activity for a while.

In the employment rate the self-employee were less affected, however they are the most af-

fected in terms of weekly hours worked, This reaffirms me in thinking that the self-employed are one of the most vulnerable sectors of the population in the situation that we have experienced.

3 Weekly Earnings

Redo for wages (or earnings).

Now I analyze the evolution of the average weekly earnings. Graph 10 shows the evolution of average weekly earning versus the predicted, we observe that the real average weekly earnings increase in April 2020, this might look weird, a possible explanation for this to happened is that, as we observe before, the individuals that were more affected in terms of employment rate were the ones with less education level, therefore the ones with lower wages, so the lower wages are being expelled from the labor market in April, while the higher wages stay, so that the average weekly earnings increase.

In graph 12 we control the earnings for the level of education, now we observe that there has not been much change, this reaffirms me in the explanation that I gave before for the increase in the average weekly hours without controlling for education level.

Graph 13 shows the evolution of the average weekly earnings by ability to telework, the tendency es very similar in both groups, the only remarkable thing of this graph is the persistent difference in the earnings during the whole period.

Finally in graph 14 we see the evolution of average weekly earnings controlling by worker type, this graph is not really comparable with the previous graphs controlling by worker type, since all the self-employee does not have a valid answer in the survey to this variable, we are only observing the evolution of government employees (worker type 3) which has significantly higher average earnings than the average in the private sector, but the tendency is similar in both groups.

4 Aggregate Hours

Is the behavior of aggregate hours driven by employment or by average weekly hours. Decompose using percentage deviations from the predicted value of these items. Discuss your results.

To answer this question look at graph[1] 15. In this graph we can clearly see that the behavior of aggregate hours is driven by employment. The average weekly hours decrease a bit in April, but not enough to explain the behavior of the aggregate hours, in fact the individuals that still working, work more or less the same hours as before. The percentage change of employment is very similar to the aggregate hours. So we can conclude that

[1] I took this graph borrowed from Joseph Emmens, it was my first time using Python and I didn't get to compile this graph properly.

most of the part of the decrease in the aggregate hours is caused by the decrease of the employment.

5 Spain

It was very hard to find data to try to replicate what I have done for USA, I'll explain a bit where I got the data for every section.

For the two graphs of employment rate, I download the data from Eurostat, the only available data that I found was quarterly not monthly, I used Eurostat and not INE because in Eurostat I found the employment rate by education level, which I couldn't find in INE. (By the way the employment rates of Eurostat and INE differ).

For the average hours, I downloaded data from INE also quarterly, and it is not weekly average, I just found the quarterly aggregate hours, to compute the average I downloaded also the total amount of occupied people also from INE and divided the hours by occupied. So what I have is average hours worked quarterly. It is not the same as USA that was average weekly hours and we have that information monthly.

Finally for earnings I downloaded from INE an average labor cost, also quarterly.

I couldn't find any dataset that allows me to compute the variables controlling by telework or not, or any kind of division by industry or occupation (I hope that these dataset exists but I couldn't find it).

5.1 Employment Rate

Graph 16 shows the evolution of the employment rate versus the predicted, now the predicted is computed doing the same regression as in USA but only with quarterly dummies, so this did not capture well the effect of every month in employment, therefore the predictions less accuracy than for USA. As for USA we observe that the predicted value is much higher than the real value of employment, in the first two quarterlies of 2020 the employment in decreasing a lot, we don't see signs of recovery yet in Spain.

In the next graph 17 we control by education level, the division is made by Eurostat level 1 (Less than primary, primary and lower secondary education), level 2 (Upper secondary and post-secondary non-tertiary education) level 3 (Tertiary education). In contrast with USA all the groups follow a similar tendency, it seems that all groups are affected in a similar way, however, obviously the higher is the education level the higher is the employment rate for the whole period.

5.2 Worked Hours

Now we study the evolution of the average worked hours quarterly, graph 18 shows the results, also versus the predicted. In this graph there is no signs of recovery either in Spain.

As in the graph of employment rate the predictions are much higher than the real value. The behavior of the hours before COVID seems pretty seasonal in Spain.

5.3 Average Labor Cost

I used as a proxy of wages or earnings the average labor cost because is the only that I found quarterly in INE. The results are shown in graph 19, again the graph shows the real versus the predicted, in USA we saw that the average earnings increased due to the different behavior in employment of low educated and high educated, in Spain we didn't' observed such difference in the employment rate, and now we don't observe that the average labor cost increase, in fact it sharply decrease in the two quarterlies of 2020. Also the behavior of the average labor cost seems very seeasonal in Spain.

Appendix: Graphs

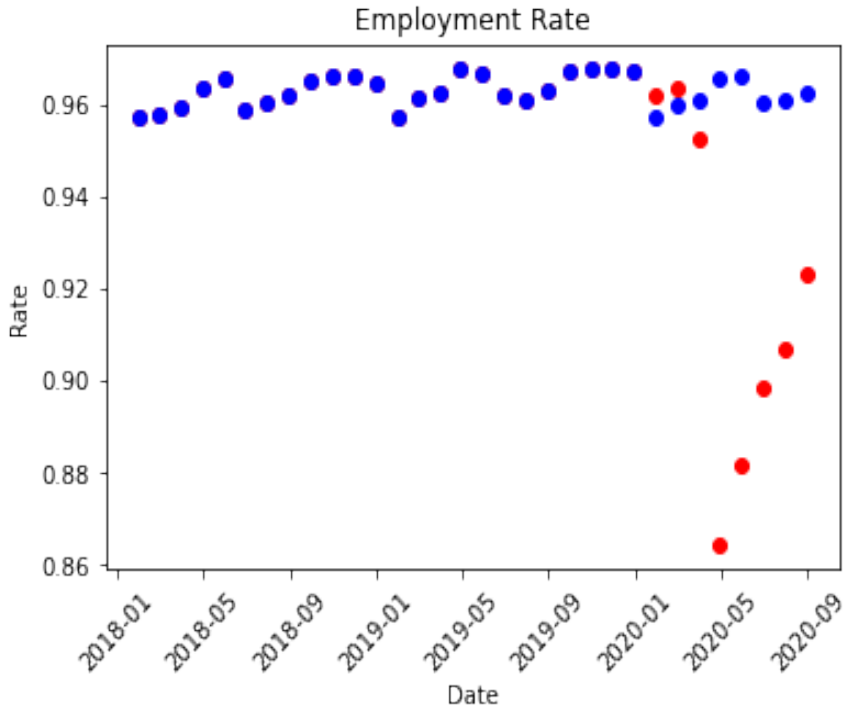

Figure 1: Employment Rate Real vs Predicted

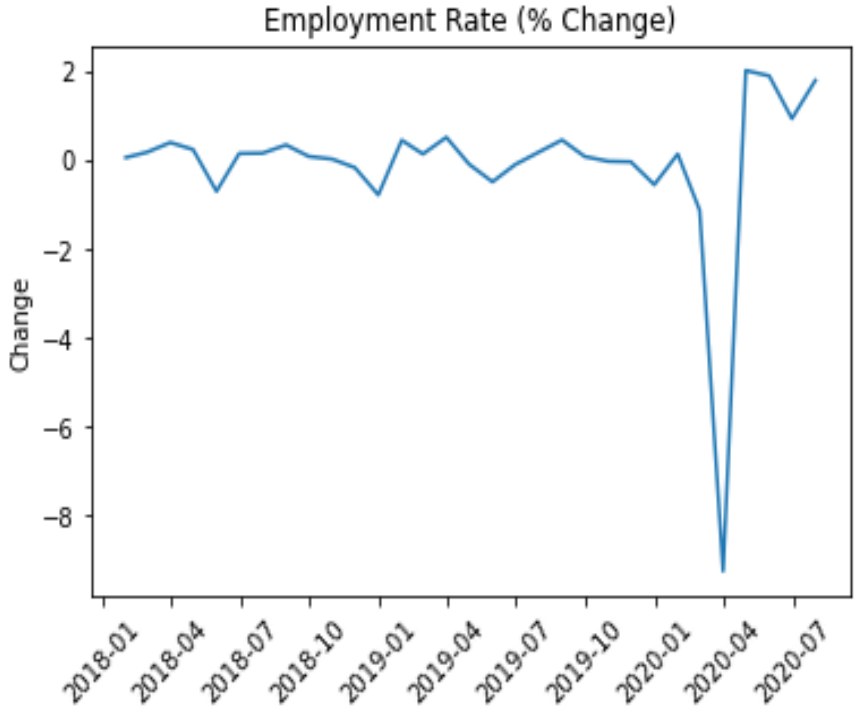

Figure 2: Percentage Change Employment Rate

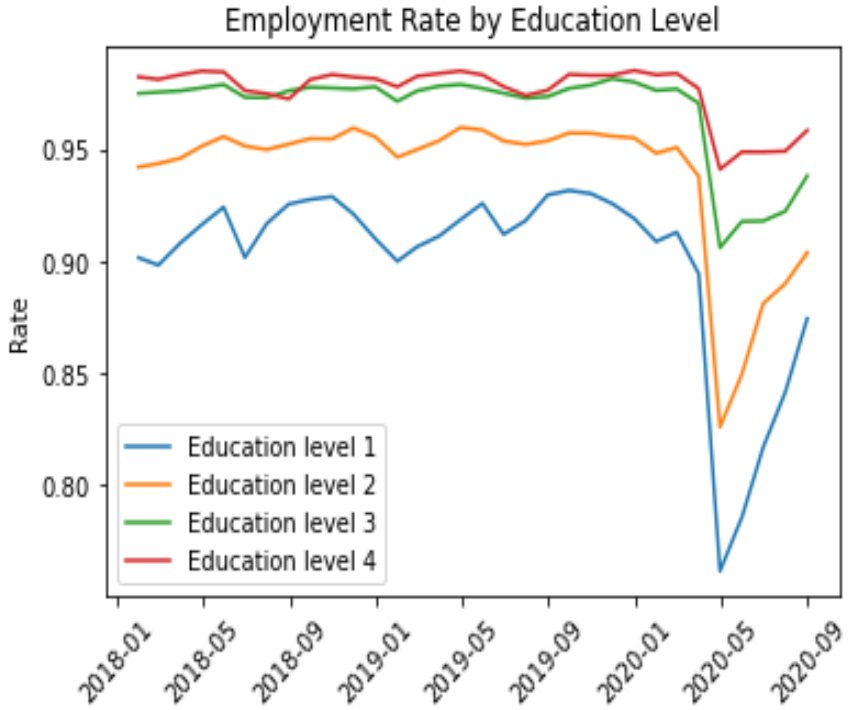

Figure 3: Emplyoment Rate by Education Level

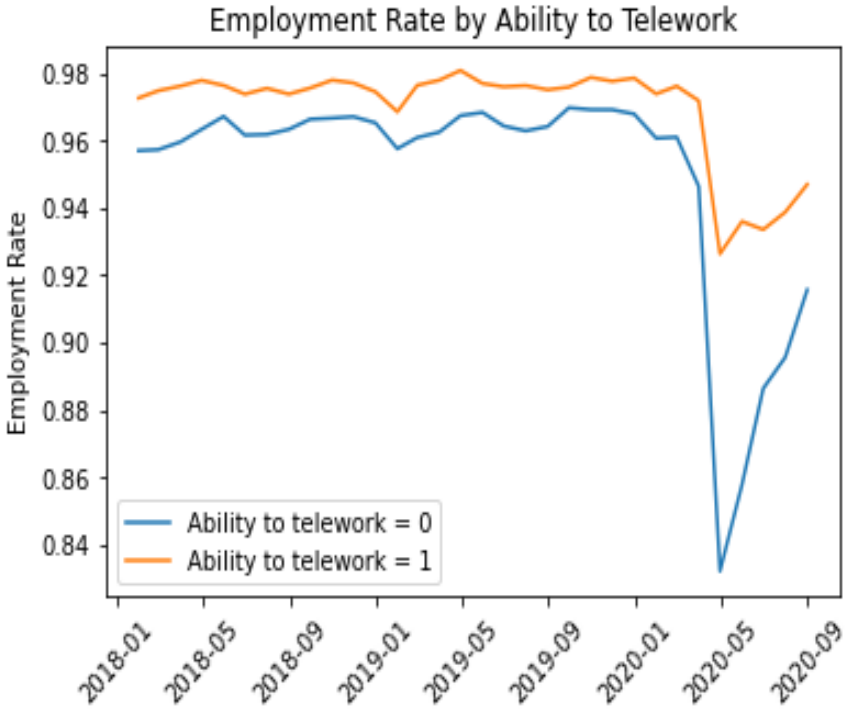

Figure 4: Emplyoment Rate by Telework Ability

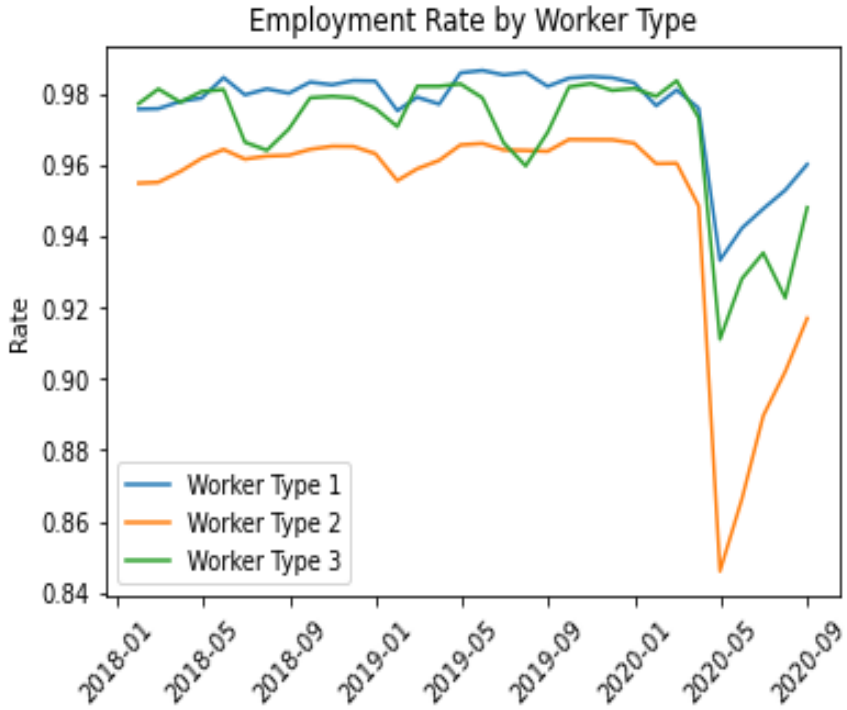

Figure 5: Emplyoment Rate by Worker Type

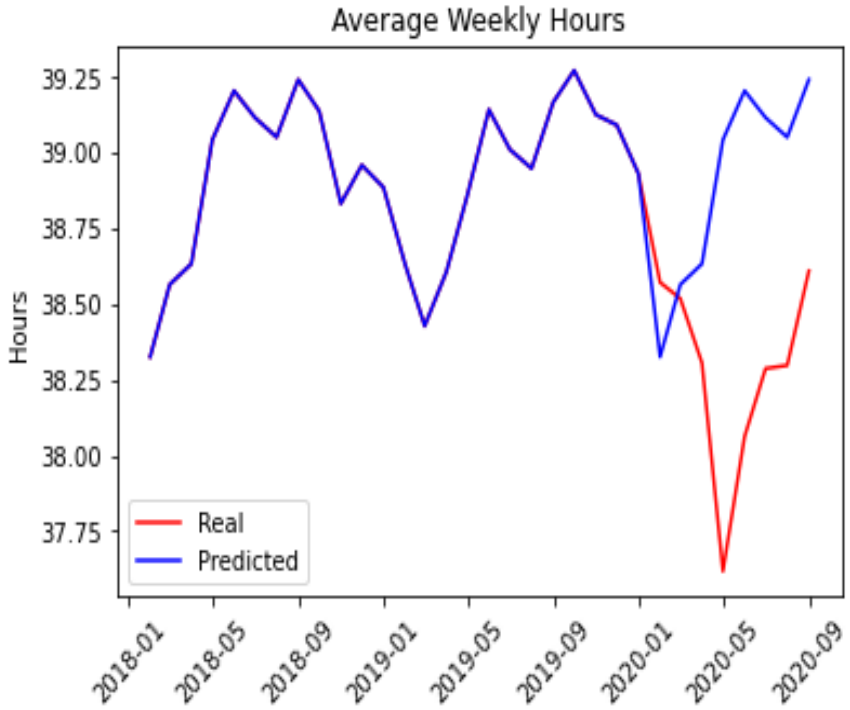

Figure 6: Average Weekly Hours vs Predicted

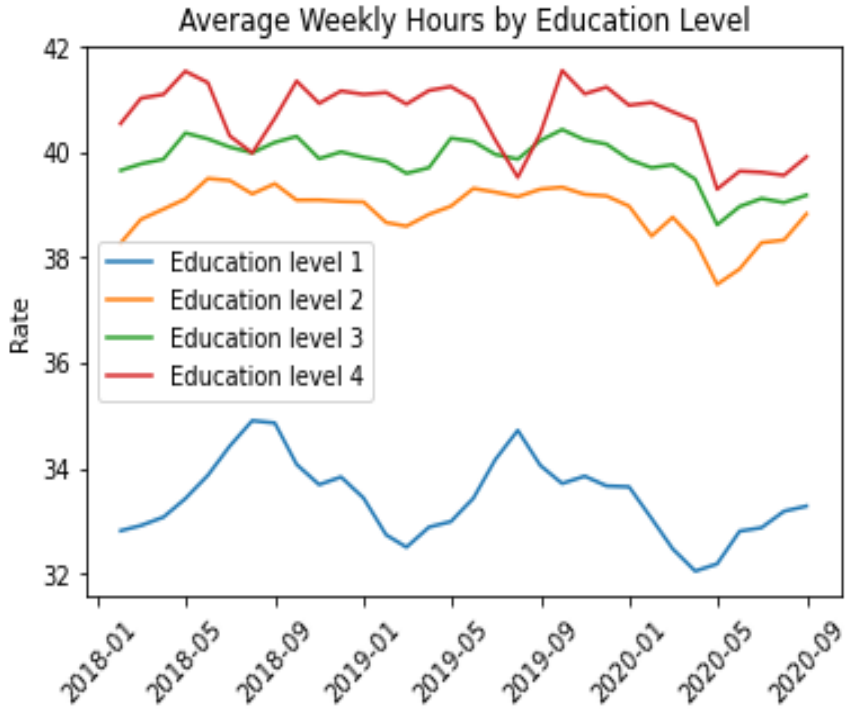

Figure 7: Average Weekly Hours by Education Level

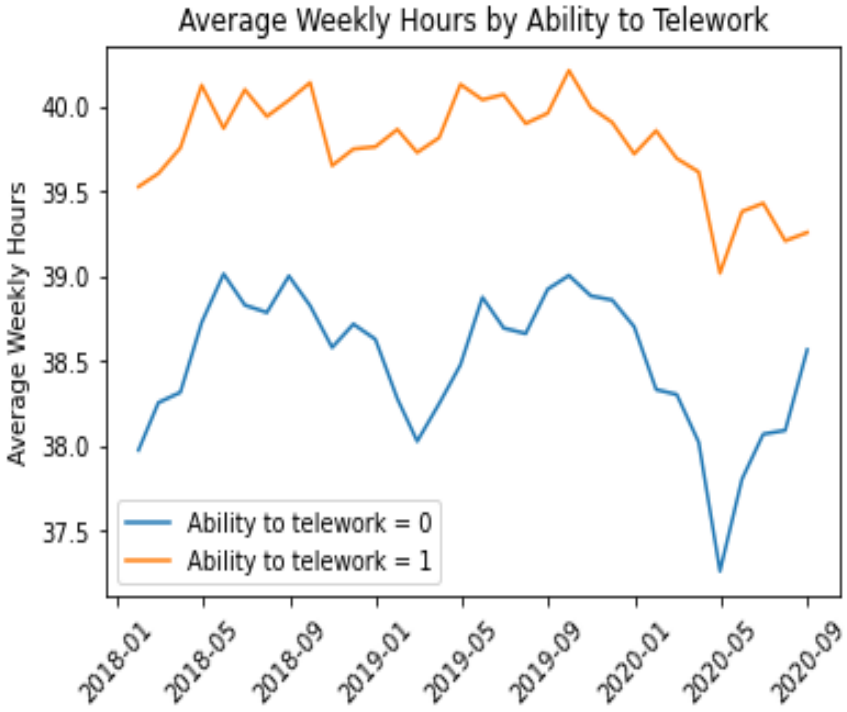

Figure 8: Average Weekly Hours by Ability to Telework

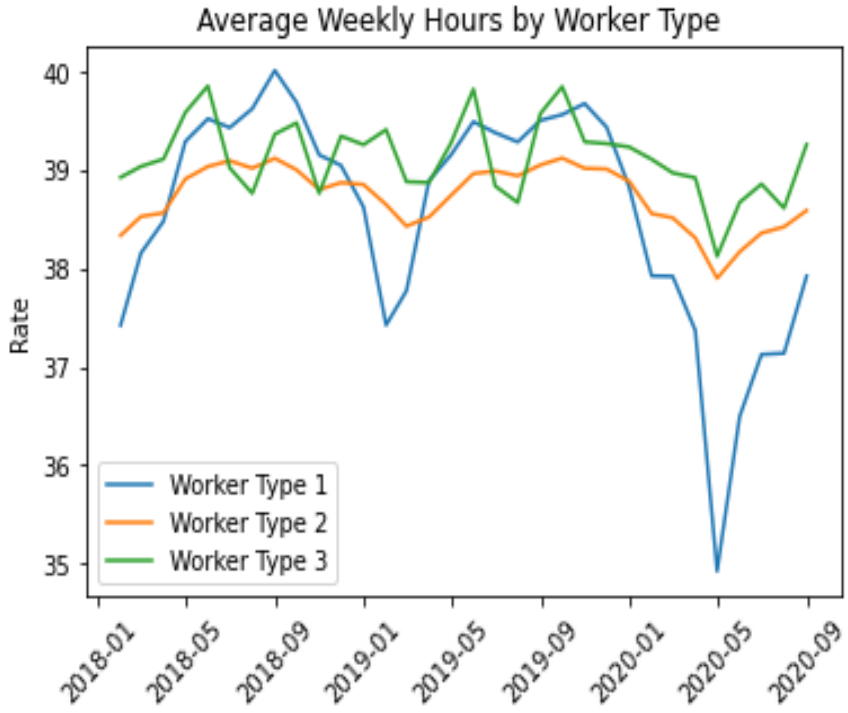

Figure 9: Average Weekly Hours by Worker Type

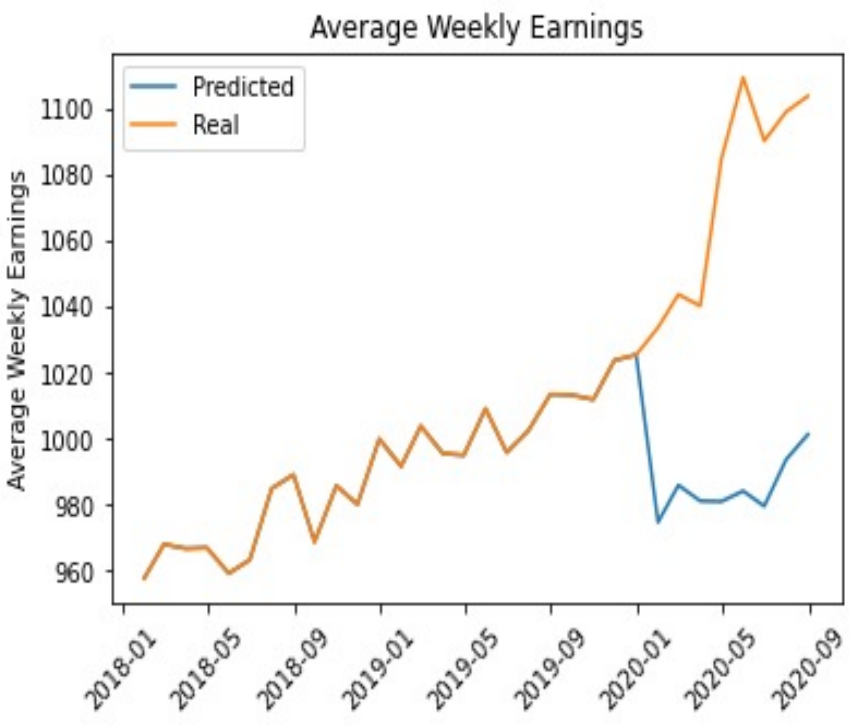

Figure 10: Average Weekly Earnings versus predicted

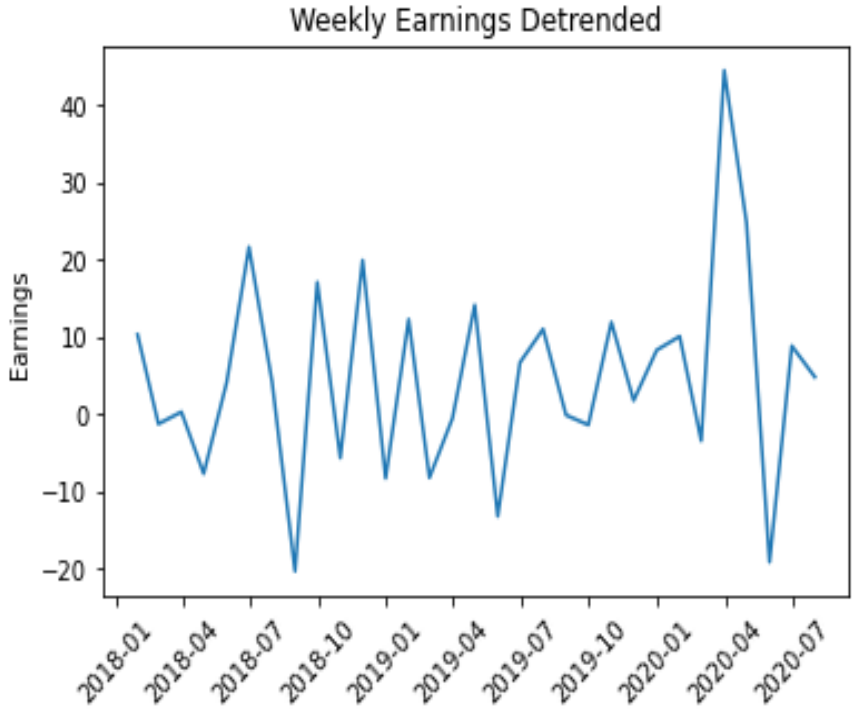

Figure 11: Average Weekly Earnings Detrended

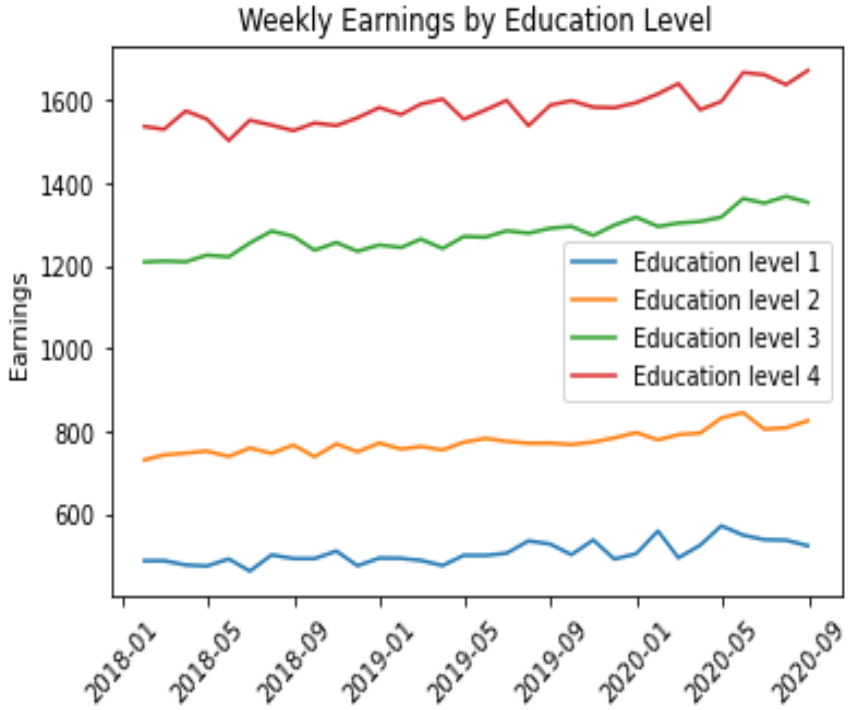

Figure 12: Average Weekly Earnings by Education Level

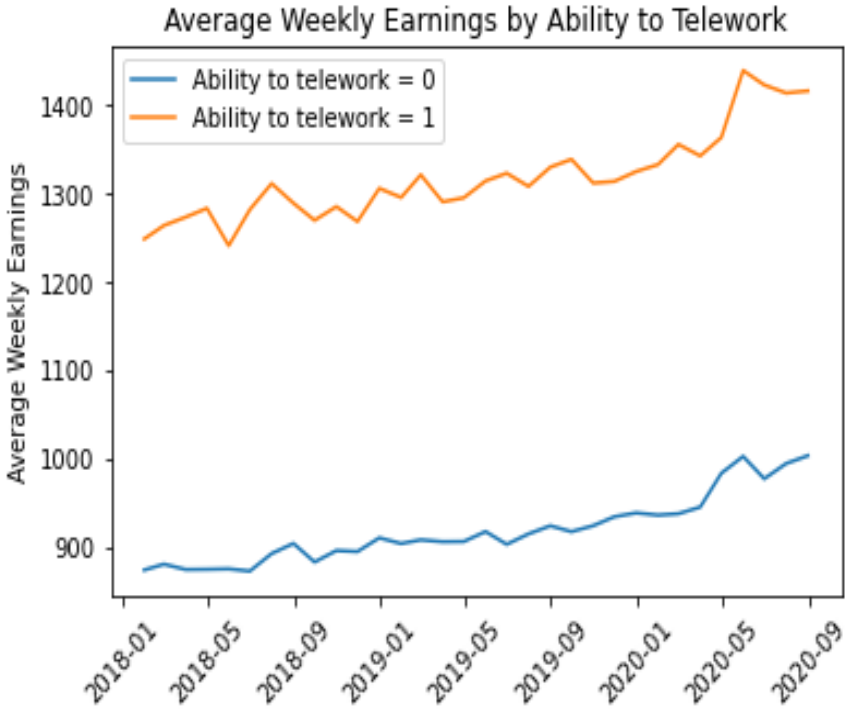

Figure 13: Average Weekly Earnings by Ability to Telework

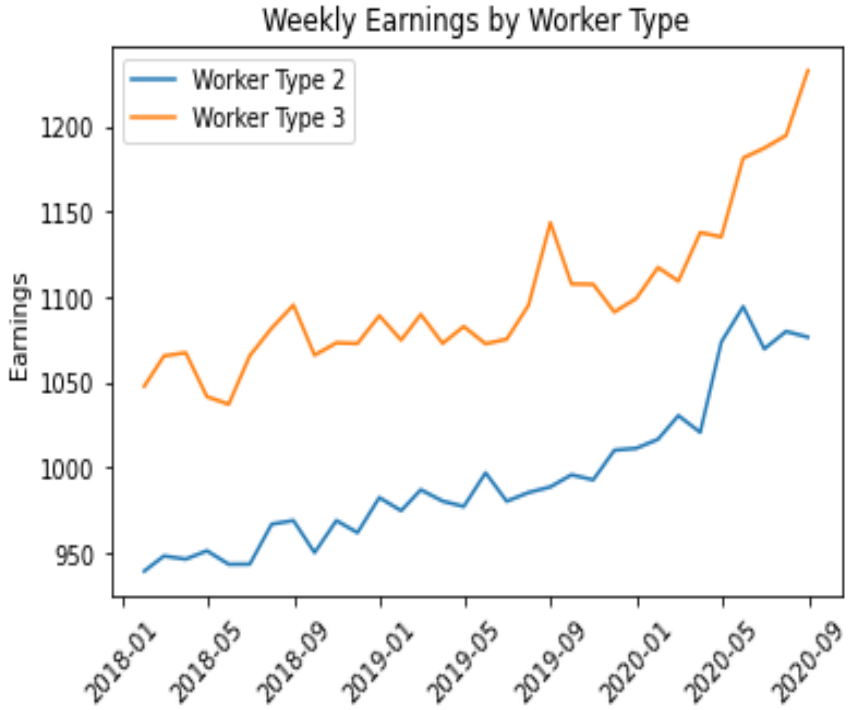

Figure 14: Average Weekly Earnings by Worker Type

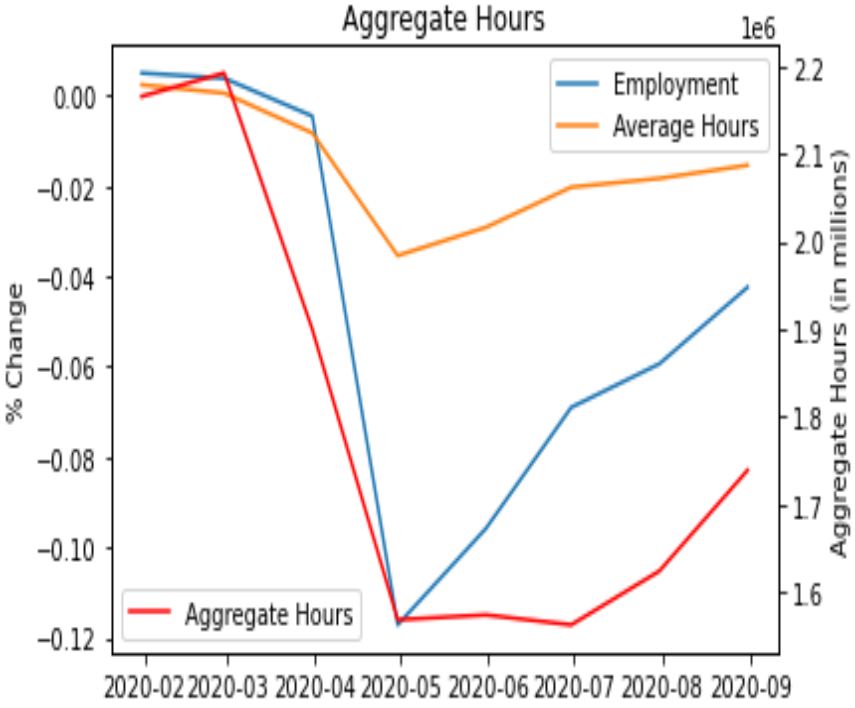

Figure 15: Aggregate Hours

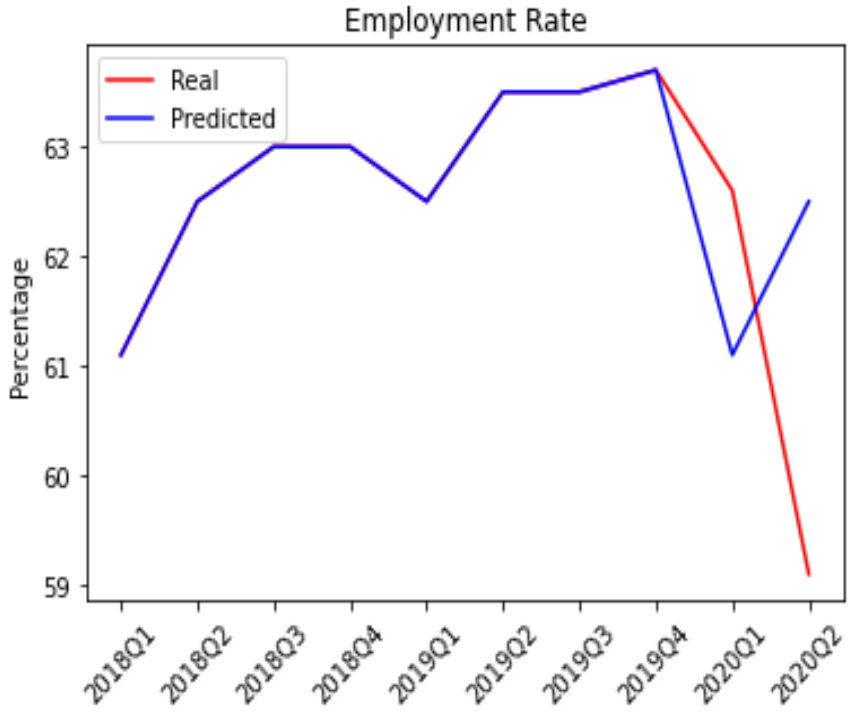

Figure 16: Employment Rate vs predicted

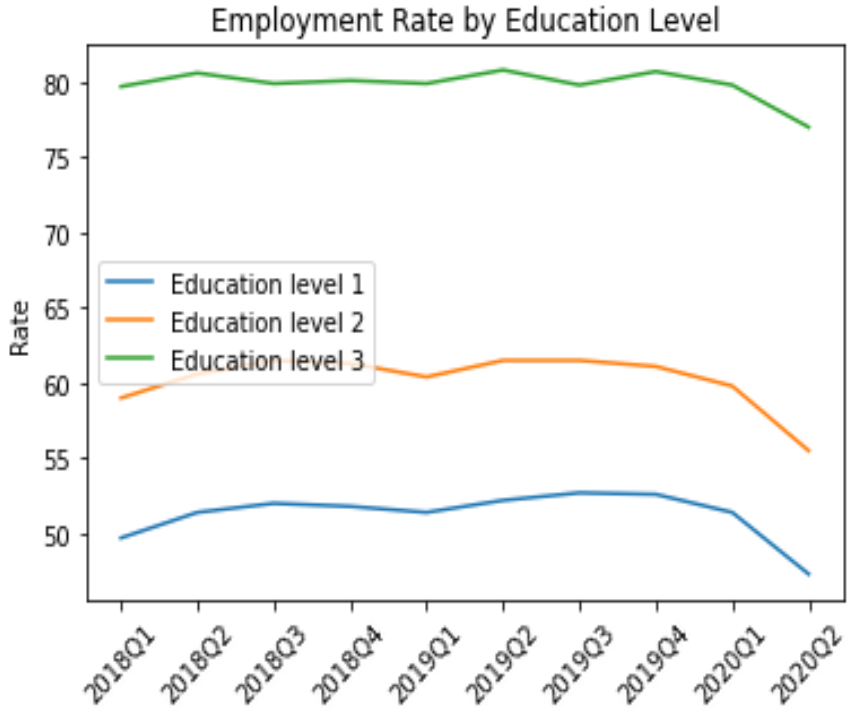

Figure 17: Employment Rate By Education Level

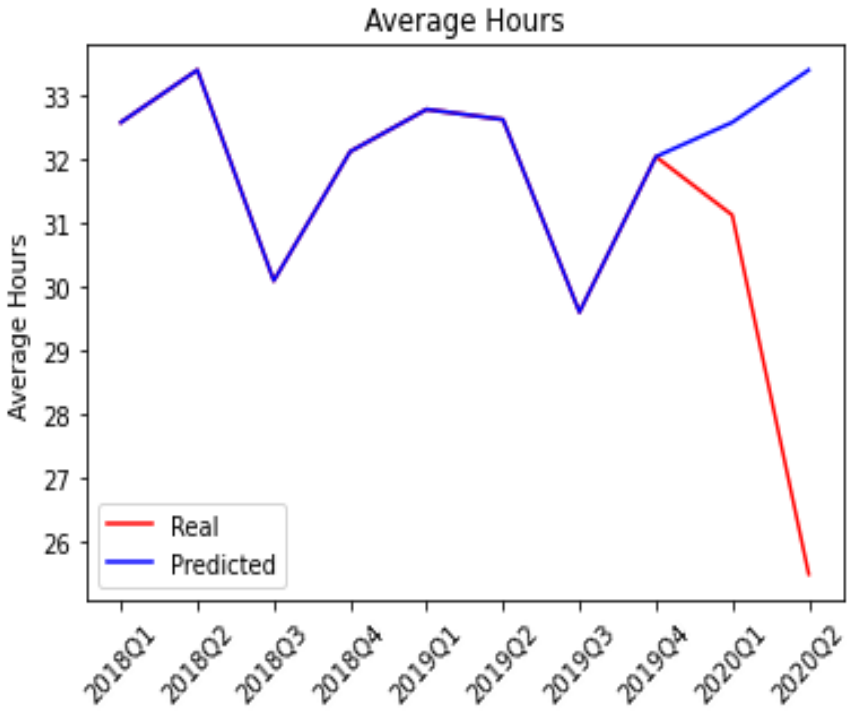

Figure 18: Average Hours versus predicted

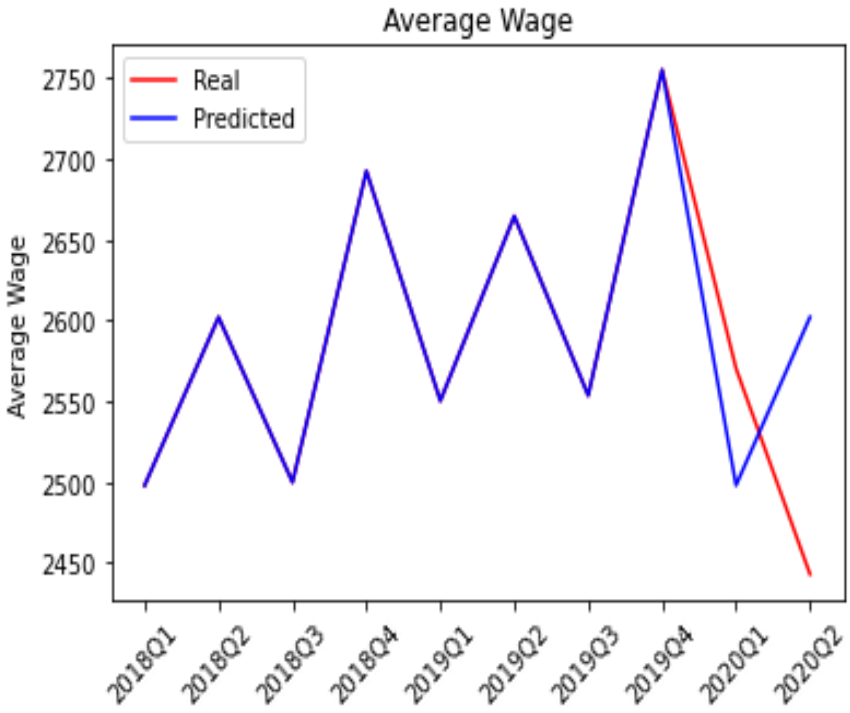

Figure 19: Average Wage versus predicted