

Problem Set 1 *Quantitative Macroeconomics*

1. 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.

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

I define the employment rate (employment-to-population ratio) as a ratio of the current employed population to the whole working age (15-64) population.

As <HS I classify individuals with educational attainment lower than “High school diploma or equivalent”.

As HS I classify only the individuals who have a “high school diploma or equivalent”

As college I classify all individuals who have educational attainment higher than “high school diploma or equivalent”, that is to say have a HS diploma or equivalent and have completed some college training or other academic or vocational programs.

As >college I classify the individuals with “professional school degree” or “doctorate degree”.

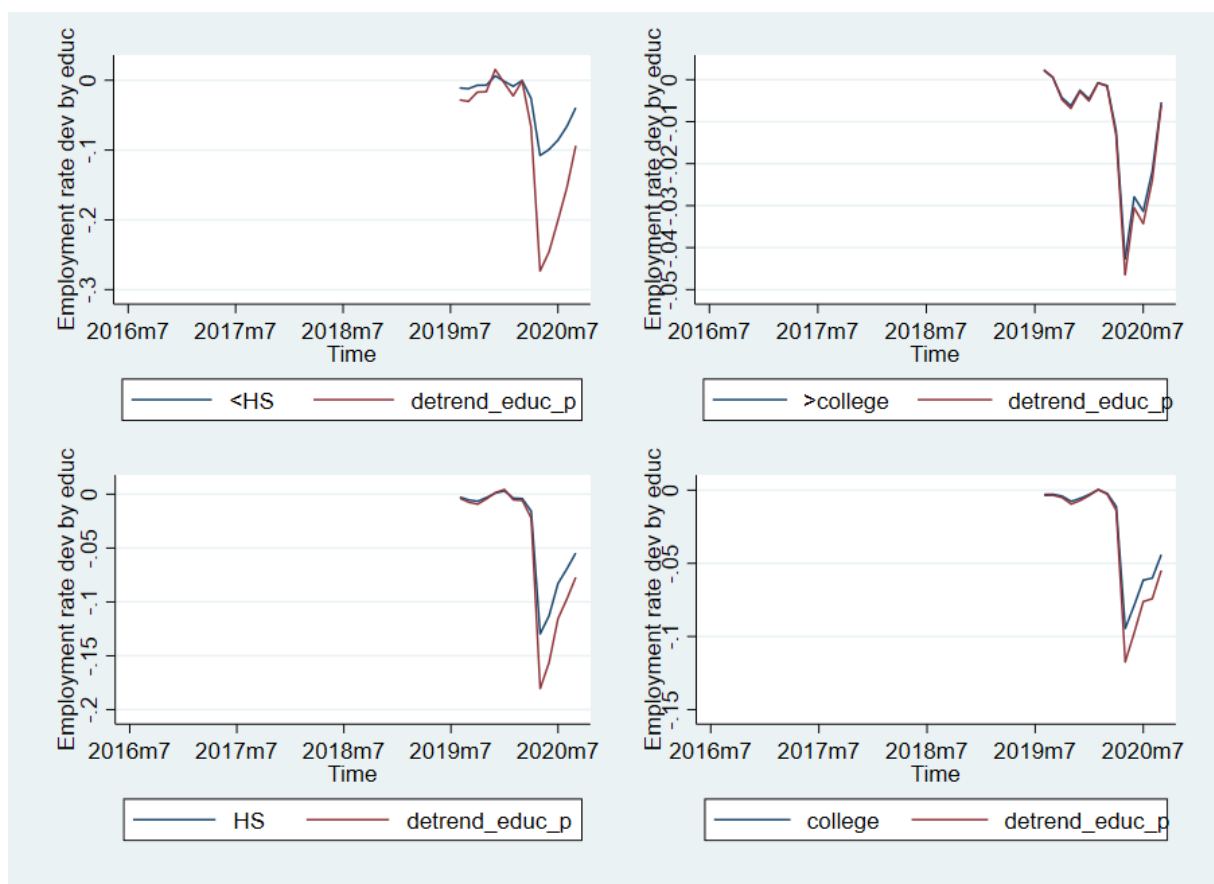


Before we move on to analyze the deviations from the predicted COVID-era employment rates, let us first remark that the level of employment is very strongly correlated

with the individual's educational attainment. Moreover, the higher the educational attainment the lower the variance of the employment rate already before the pandemic. Therefore it is to be expected that the higher educated individuals will lose the job less frequently than the less educated ones.

One more important remark concerns the lowest educated <HS group. It is the one which experiences the highest seasonality as low educated workers make up the host of seasonal field workers as well as temporary services staff in the summer. It is one of the examples why we should look at the detrended and deseasonalised data as provided on the next page.

The employment losses due to the COVID pandemic are unevenly spread across various educational attainments. The highest educated group (>college) has incurred the smallest loss of approximately 6 percentage points at the worst point of the recession, although the recovery has been rather slow as the employment loss still remains 4 percentage points below the long-run trend.



The group of college educated individuals and high-school graduates has fared relatively similar. Both groups have incurred approximately 10 percentage point losses in employment and have been recovering quite quickly so far. The employment losses in the <college group are slightly below those of the HS group.

The lowest educated group has performed relatively well in the absolute terms as the employment losses are smaller than both in the HS and <college group. However in relative terms these are definitely the worst of all groups. Already before the pandemic the employment rate in the lowest educated group of the population stood at the very low 32-34% level and at the worst point of the recession it dipped to 24%, which amounts to a 25% drop in employment.

Although the recovery has been particularly quick in this group, the employment level still remains at 30% level, over 10% below the pre-crisis level.

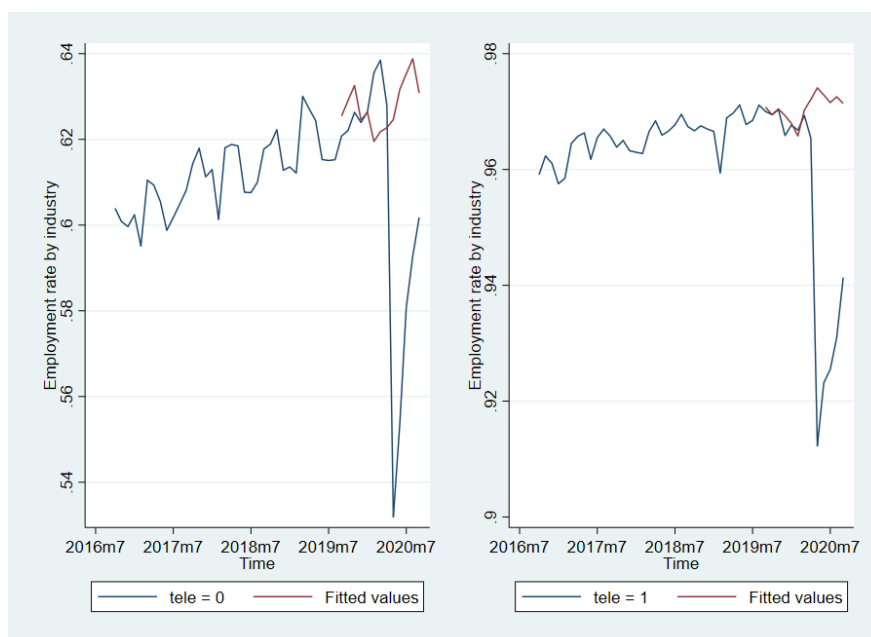
Unlike the previous US recessions which have had especially severe impact on the construction and manufacturing sector, where the less educated workforce is employed, the COVID lockdown has had the most detrimental impact on sectors where direct person-to-person contact is indispensable. This category involves workers of various education levels. Both HS educated shop assistants and waiters, as well as college educated teachers and medical practitioners.

One could argue that employment in the least educated group has been less affected, since the sectors of employment for these workers are usually utilities and basic services, which have to be exempted from the lockdown as they are civilisational necessities. The most educated group, on the other hand, is usually the one which finds it the easiest to telework, as for instance in the IT sector or financial services. Thus relatively good labour market performance.

To provide further insight into the causes of such labour market outcomes it is useful to look at the percentage point deviations from the predicted trend. These are represented by the red line (*detrend_educ_p*). Even though in absolute terms the employment losses are relatively evenly distributed, by no means is it so in relative terms. The relative employment losses in the least educated groups remain well above 10%, significantly higher than for higher educated groups. Furthermore, the peak of the recession has hit these groups particularly hard. Both least educated groups have experienced an over 20% plunge in employment rates compared to respectively less than 15% and 10% in college and above college educated workforce. Herein lies the dependence of the hard-hit services sector on lower-educated workers.

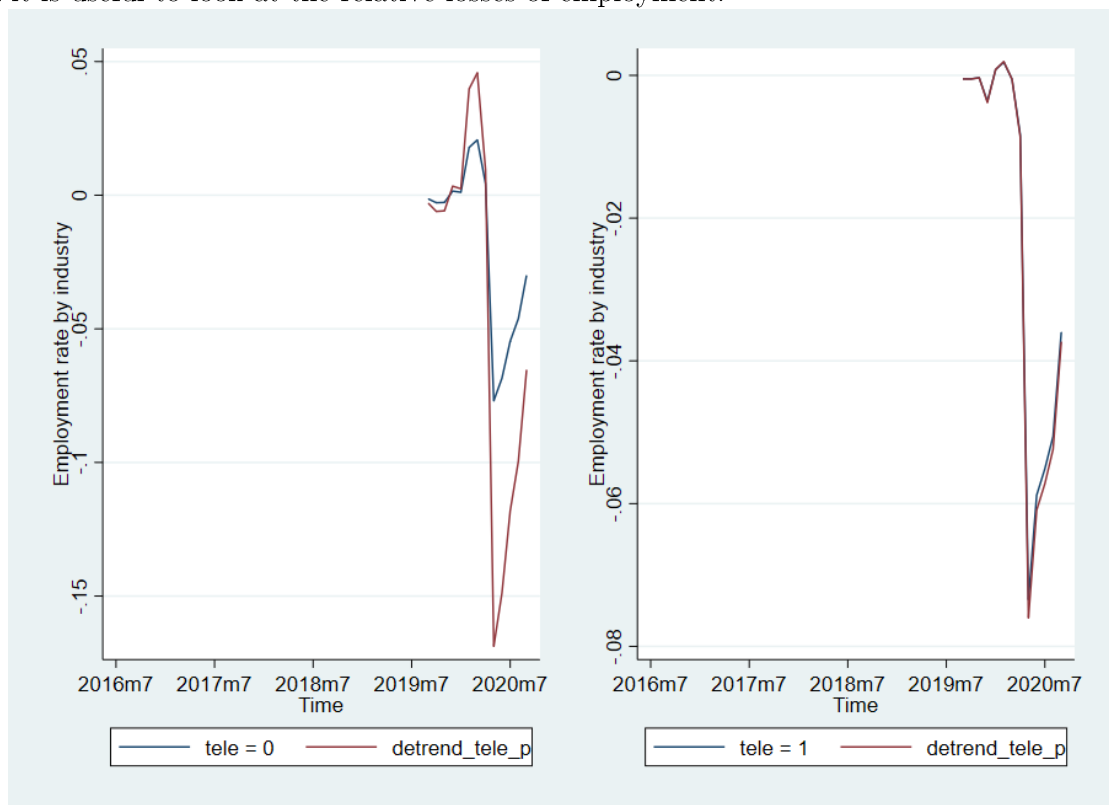
- Redo by industry (for example, create two groups of industries according to their ability to telework).

The industries are split into two categories based on the reported ability to telework from the ATUS survey. The *tele=0* represents the lower half of the industries in terms of ability to telework, while *tele=1* represents the upper half.



Although the pre-crisis employment rate in the low-ability sector was little more than a half of that of the high-ability sector, both have displayed an upward trend in employment as the economy grew at healthy rates. The absolute percentage-point losses of employment between the two sectors do not differ much. At the peak the low-ability sector has shed a little over 8 p.p. of employment rate and the high-ability sector has lost a small fraction less. The speed of recovery has been faster in the low-ability sector as it has been more affected by the lockdown measures.

Such separation of industries overlaps substantially with the educational cross-section as lower-educated workers are concentrated in the low ability to telework industries and higher educated workers in the high ability to telework industries. Similarly to the previous section it is useful to look at the relative losses of employment.

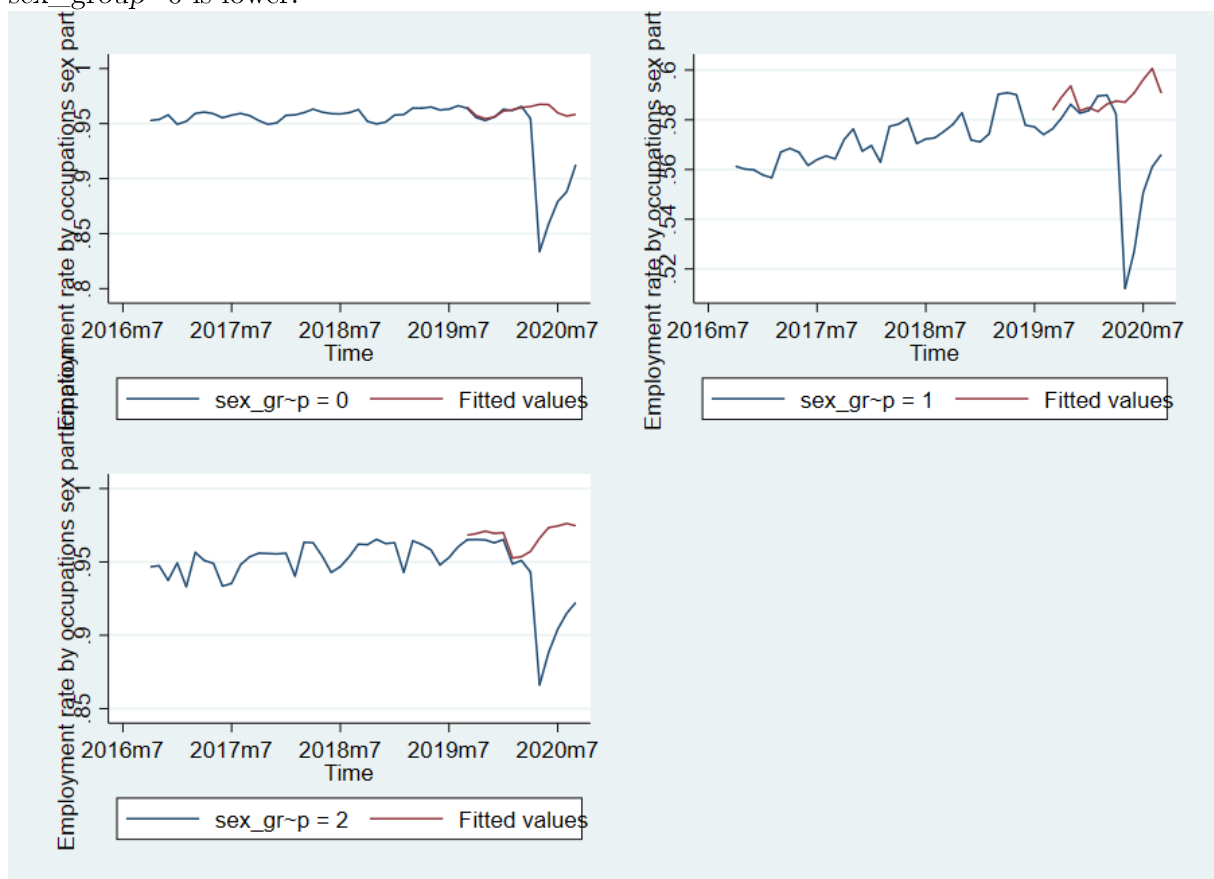


The data on the graph confirm that the absolute percentage point losses do not vary significantly across the high- and low-ability to telework industries. The pre-crisis base employment in the low-ability sector was well below that of the high-ability sector. This means, similarly to the low-educated groups in the previous point, that the labour market for the low-ability to telework employees has deteriorated way faster than for the high-ability to telework employees. This is in line with the intuition that the ability to telework is an important factor affecting the employment decisions in the pandemic environment. Moreover, the ability to telework is higher in the IT sector, which has enjoyed higher demand due to the lockdown measures and the substitution effect as other services have become unavailable or more risky.

- 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.

I have decided to split occupations by the women participation rate. It is of interest to analyze the impact of the COVID crisis on the female employment for a number of reasons. First of all, we would like to find out if the relative employment losses compared to men are lower in the US than in the developing countries such as India, where women have been particularly affected. Secondly, we would like to learn if the higher male risk of death due to COVID could adversely impact the male labour supply relative to women. Thirdly, it could be of interest to examine if the current crisis shall act as a catalyst for the improvement of the women's position on the labour market or not. Of course, the following analysis is far from sufficient to even try to answer these questions but I believe that the rationale for the split is sound.

I have split the sample into three groups. The $sex_group=0$ consists of occupations with over 70% female workforce, the $sex_group=2$ consists of occupations with over 80% male workforce and the $sex_group=1$ is made of the rest of the occupations. We want to pick groups with very high single sex participation but such that the sample is balanced. There are fewer occupations dominated by women that is why the threshold for the $sex_group=0$ is lower.



It is interesting to note that the employment rates in the male- and female-dominated occupations are higher than in the mixed group. This may be due to the higher demand for specialized services such as fashion and pubbers which often correlate with male or female characteristics. This is a subject for a separate investigation.

What is of interest for us is how the COVID crisis has affected the employment of women relative to men. Clearly, the drop in employment has been the most pronounced among women out of all the three groups (*sex group* = 0). The women dominated occupations have experienced an almost 15 p.p. plunge in the employment rate. This is likely due to the female dominated occupations often involving work in person being more affected by the lockdown measures and the increased risk of death. Moreover, it is to be verified if the lockdown measures have impaired women's ability to work. This could be the case due to kindergartens and school being closed, which makes parenting dramatically more difficult to reconcile with work. (Titan Talon, Matthias Doepke *The Impact of Covid on Gender Equality* and *This Time It's Different: The Role of Women's Employment in a Pandemic Recession*).

The detrended and deseasonalized graph on the next page renders the difference in the impact of the COVID crisis on the employment rates across occupations with varying levels of women's employment palpable. While the male dominated sectors experienced an initial drop of over 10 percentage point and have so far recovered to little over 5 percentage point loss in employment, the women dominated occupations have suffered an initial loss of almost 15 percentage points of employment, albeit the recovery has been robust thus far as the lockdown measures have been eased.

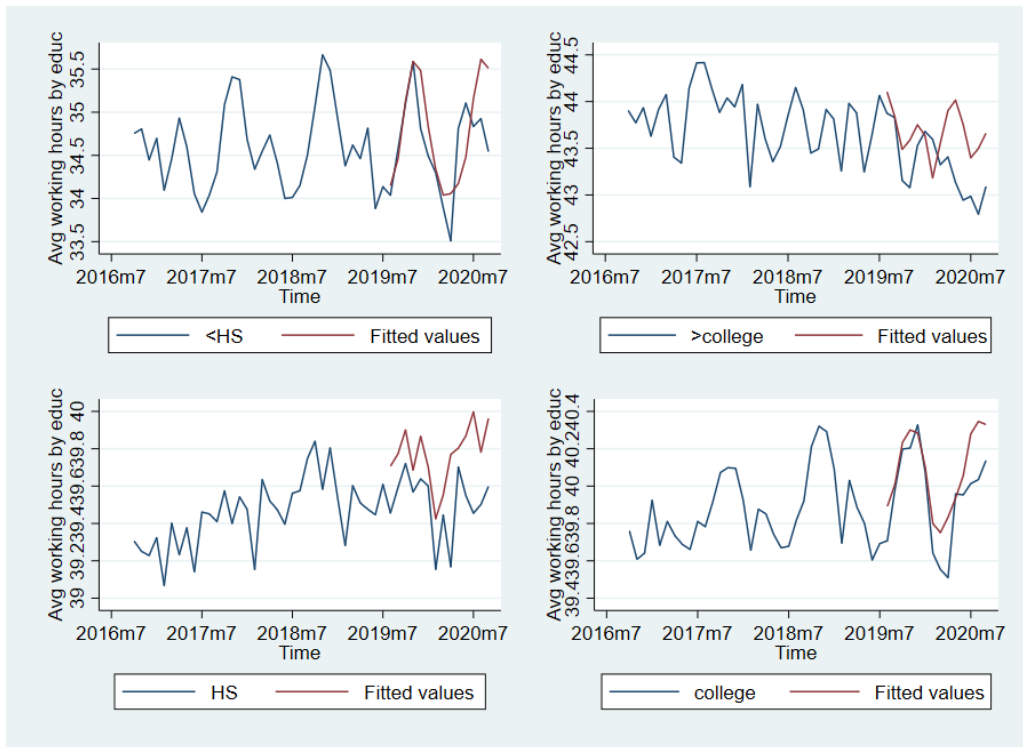


Although the initial response of employment in the female dominated occupations has been way more negative than in the male dominated sectors, the pace of recovery has also been quicker. It is yet to be seen if the medium-term impact of the COVID pandemic will be more adverse on the female dominated sectors. As the lockdown restrictions are eased the relative harm done to the women dominated sectors may be reversed, while the protracted loss of demand may start to work through to employment in the male dominated manufacturing and construction sector. It is in my opinion soon to shut the door on the possibility of another so called “mancession”.

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

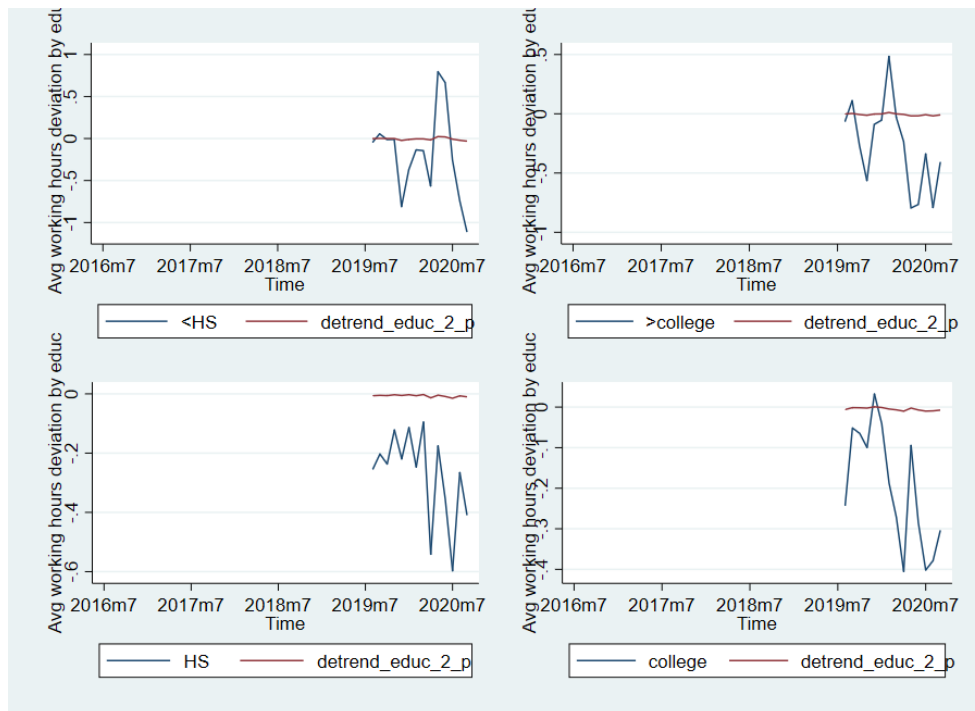
The first important remark is that in this section we drop all the observations where the exact usual weekly working hours are not known. This concerns the category “NIU” and “Hours vary”. These observations were not dropped in the analysis of the employment rate as all unemployed individuals have working hours “NIU”. This issue will be of relevance for the decomposition of the aggregate working hours and earnings.

- Redo by education.



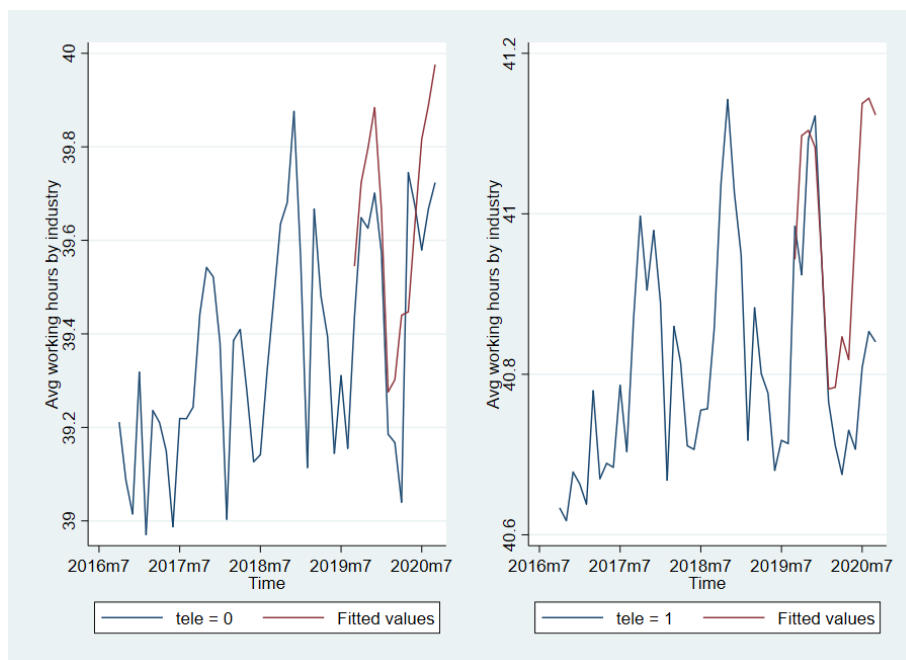
The differences between the predicted trend and the actual average weekly hours are substantially less pronounced than that for the employment rates. For the least and the most educated groups the average working hours had been moving sideways before the pandemic struck, while for the HS and college educated groups they had been slightly increasing as the labour market continued to tighten.

For all education groups except the least educated one, the average weekly hours have been somewhat below the trend during the course of the COVID crisis. This could be most likely interpreted as a negative labour demand shock as the weekly earnings have fallen as well, assuming that the supply schedule has positive slope. All in all, we can see a discernible reduction in the average weekly hours due to the pandemic.



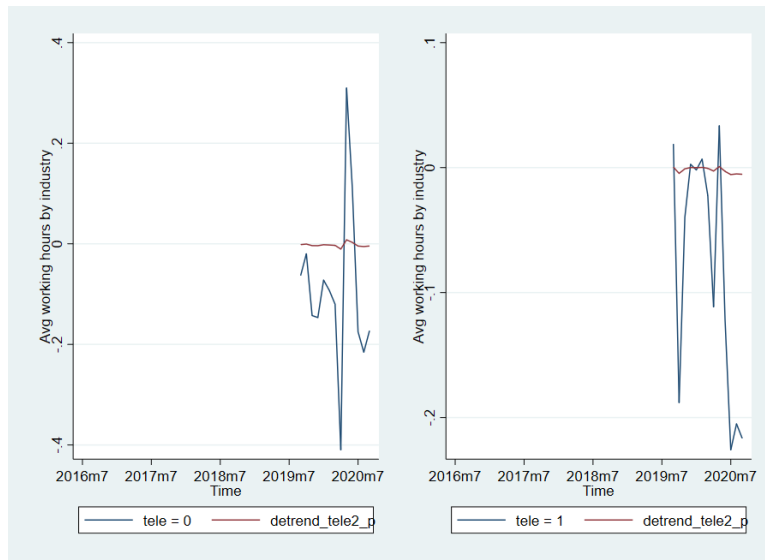
The adjustment of the working hours has been the strongest among the lowest educated workers most probably due to a higher share of part time employment in for instance seasonal occupations. For the rest of the groups the reaction of working hours seem to be fluctuating around the reduction of a half an hour a week or less which is not a substantial difference both in absolute and relative (the red line) terms.

- Redo by industry (telework)



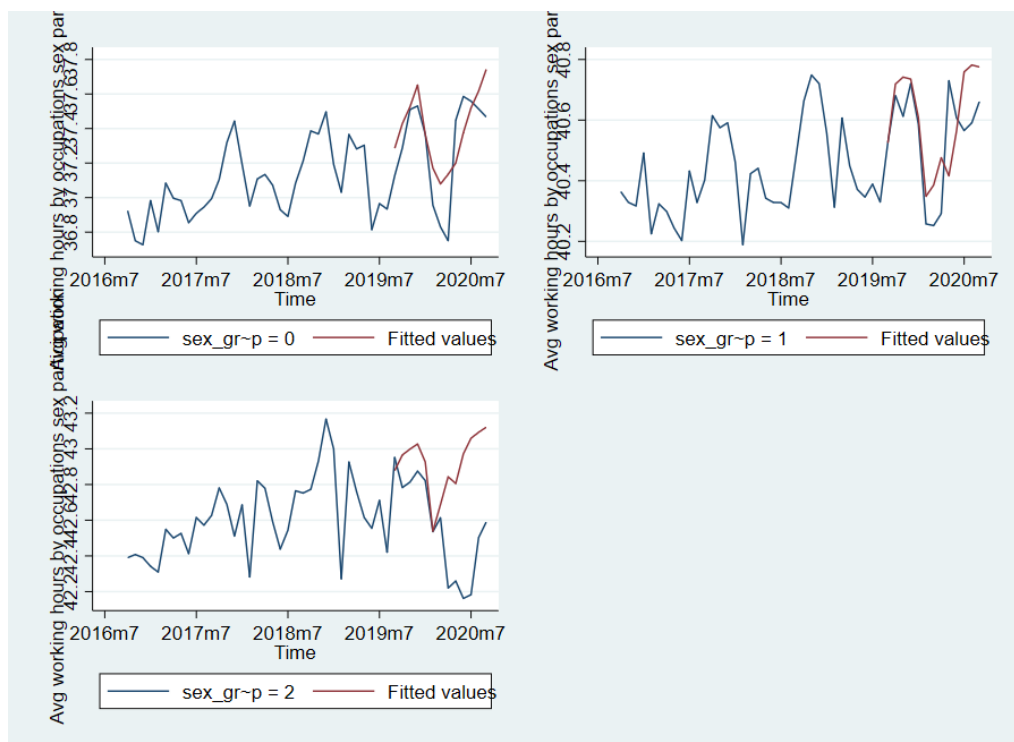
The average weekly hours in the low ability to telework sectors have not deviated significantly from the predicted trend. The AWH for the high ability sector, however, have been somewhat below forecast for the last few months. This could have to do with fewer hours spent on the lunch/coffee breaks and lower tendency to stay longer at work due to a fixed cost

of commuting from home to work. This could also be an indicator that in the higher ability to telework sector the loss of demand has been accommodated more by the change in hours worked than in the employment rate. We have some evidence to support this claim from the first point of the exercise.



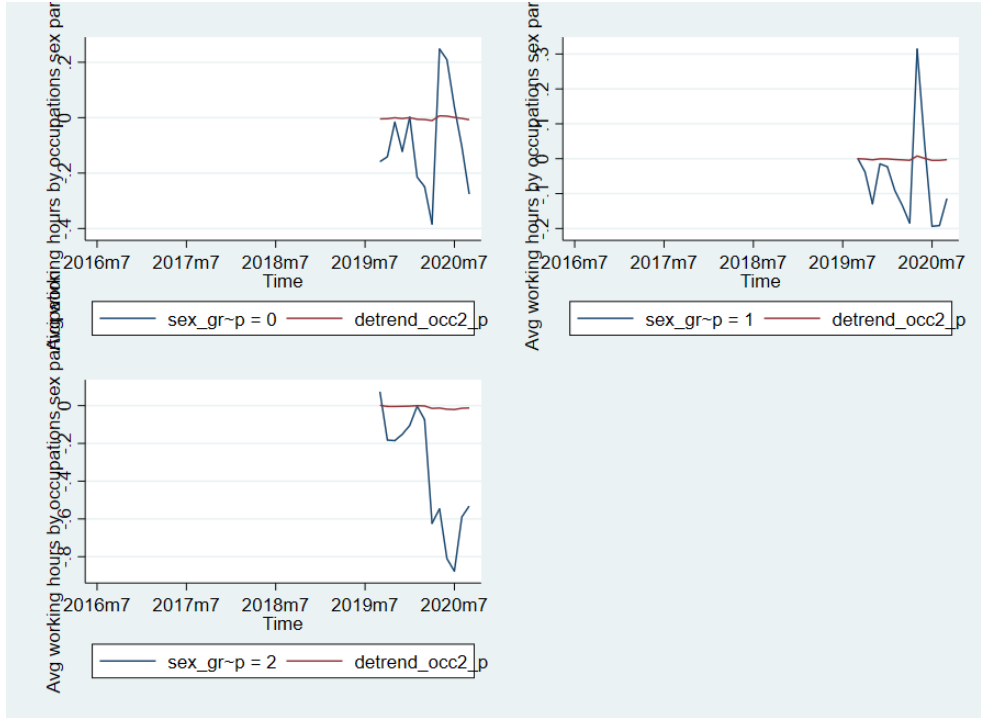
Both the deviation in the low and high ability sectors seem to display a downward trend with a lot of deviation. For the data available it is still too early to say if this series is stationary or displays some kind of persistence, which could indicate that the pandemic has caused structural changes in the weekly hours.

- Redo by occupation



There is no clear deviation from the predicted trend of average weekly hours for the female dominated *sex group* = 0 and the mixed *sex group* = 1. The average weekly hours for

the male dominated sector, however, have been consistently below trend for the last few months. This could again be interpreted as male dominated sectors such as IT and finance being more flexible in terms of adapting to the pandemic and thus accommodating the shock through structural changes leading to lower working hours and the less flexible female dominated sectors being forced to let people go.



The time structure of the deviation from the predicted trend for the female dominated $sex_group=0$ and mixed $sex_group=1$ largely resembles the time structure of the deviation of the average weekly hours from the predicted trend for the low ability to telework group from the previous. While the time structure of the deviation for the male dominated $sex_group=2$ is very similar to the corresponding graph for the high ability to telework group from the previous point. This is in line with the interpretation provided in the previous paragraph.

3. Is the behaviour 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.

I have obtained the deseasonalized and detrended time series for the aggregate working hours, average weekly hours and employment by subtracting the predicted values of the regression:

$$\widehat{agg_hours}_t = \alpha_0 + \alpha_1 * t + i.year * \alpha$$

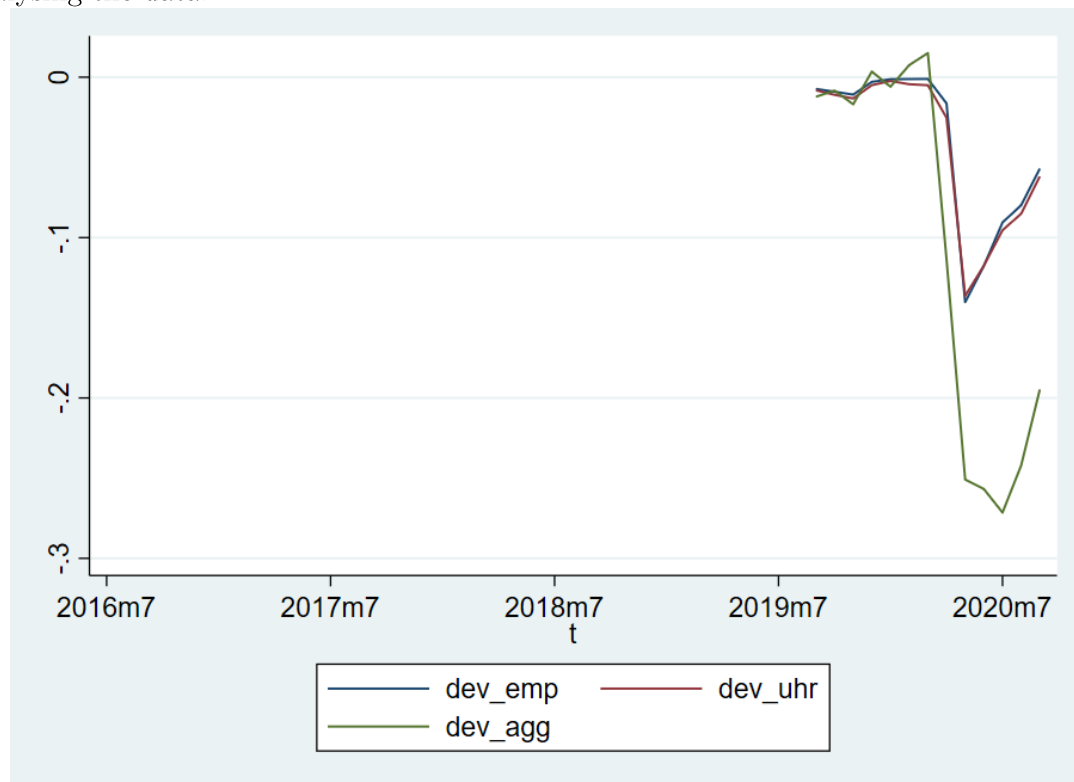
And then subtracting to obtain detrended and deseasonalized series:

$$dev_emp_t = \widehat{agg_hours}_t - \widehat{agg_hours}_t$$

And proceeding likewise for the average weekly hours and employment rates.

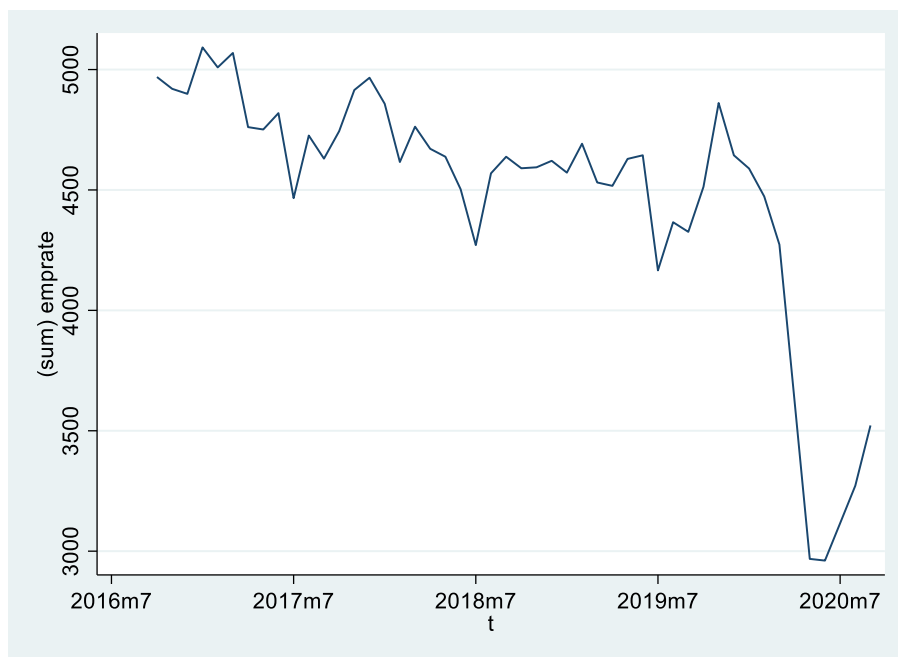
Another important issue is the question of usual weekly hours classified as “NIU” or “Hours vary”. For all “NIU”-s corresponding to the unemployed I reassign value 0, while I remove other observations assuming that the average is the best approximation of the unknown “Hours vary” and “NIU” for the employed people. This approach may cause me to attribute

greater flexibility to wages than it is in fact the case but I will take this into account when analysing the data.



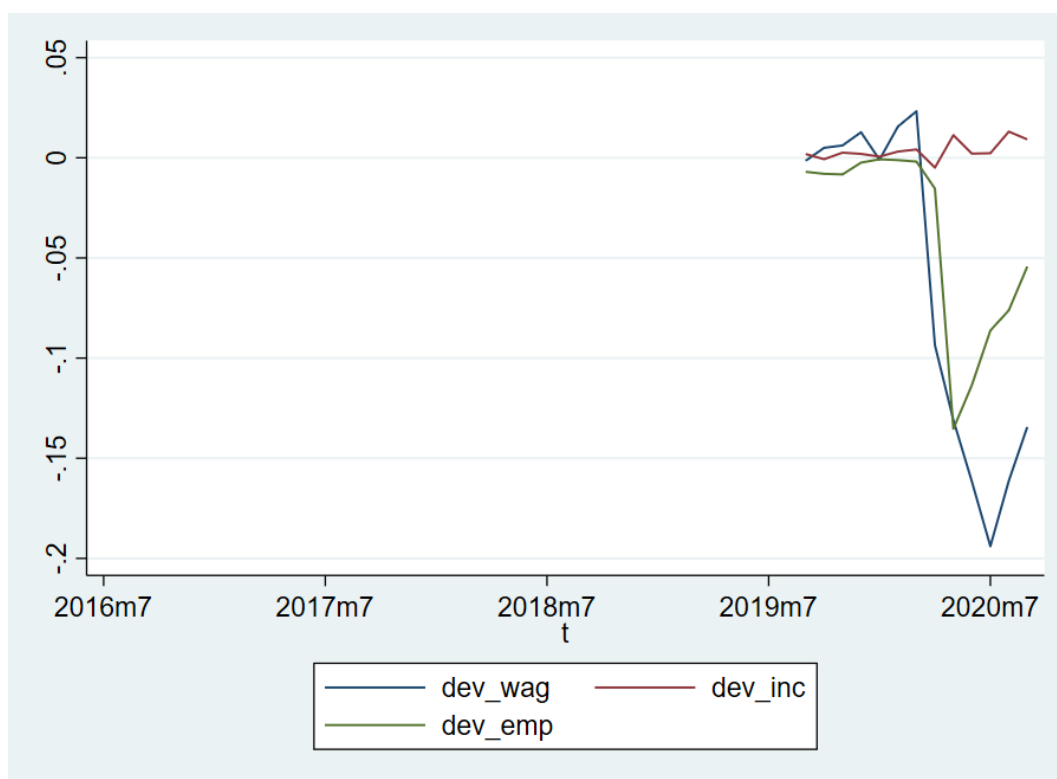
The decomposition procedure yields that the overall drop in the aggregate working hours of approximately 20% is driven almost equally by the reduction in the average weekly hours and employment. This structure of the aggregate hours suggests that we have to do with a negative demand shock as both employment and weekly hours go down. This means that the number of workers supplied in the equilibrium has dropped but the employers do not compensate it with increased workload for the employed. Actually the hours worked have dropped as well. Even if the negative labour supply shock has also taken place due to the lockdown measures, the negative labour demand shock appears to be stronger. The decomposition of aggregate wages should provide us further evidence in this matter.

It is perhaps surprising that the reduction in employment does not make up a large share of the overall reduction in the aggregate working hours, especially given our findings from point 1. and 2. This is most probably due to the elimination of the employed observations for the “Hours vary” and “NIU” categories. It could be that these individuals were more likely to move from the employed to unemployed category and we have underestimated the decrease in employment.

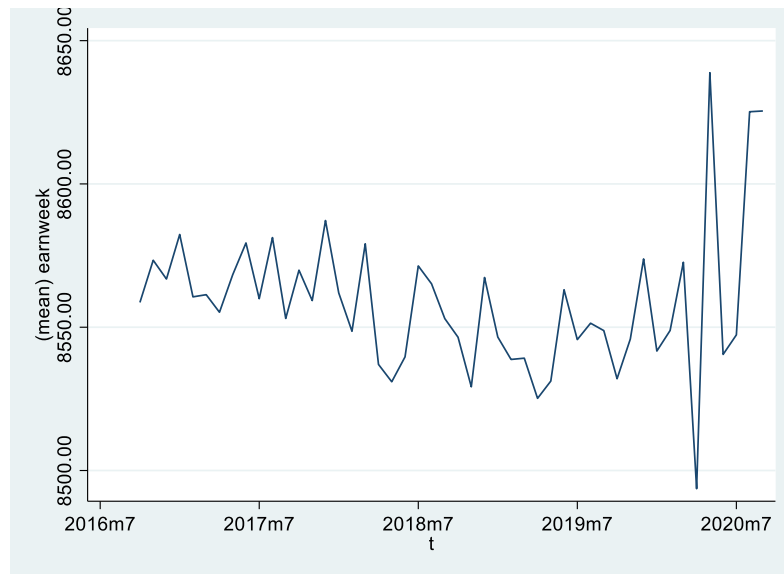


The plot of the number of employed categorised into “Hours vary” and “NIU” category suggests that these individuals have largely moved from the employed to the unemployed category as a result of the COVID crisis. Since we excluded them from the sample, we have underestimated the true impact of the employment rate on aggregate hours worked.

4. Redo for wages (or earnings).



The negative deviation of aggregate earnings from the predicted path is caused primarily by the reduction in employment. The weekly earnings have not deviated significantly from their predicted path, which is not surprising given that wages are sticky in the short run.

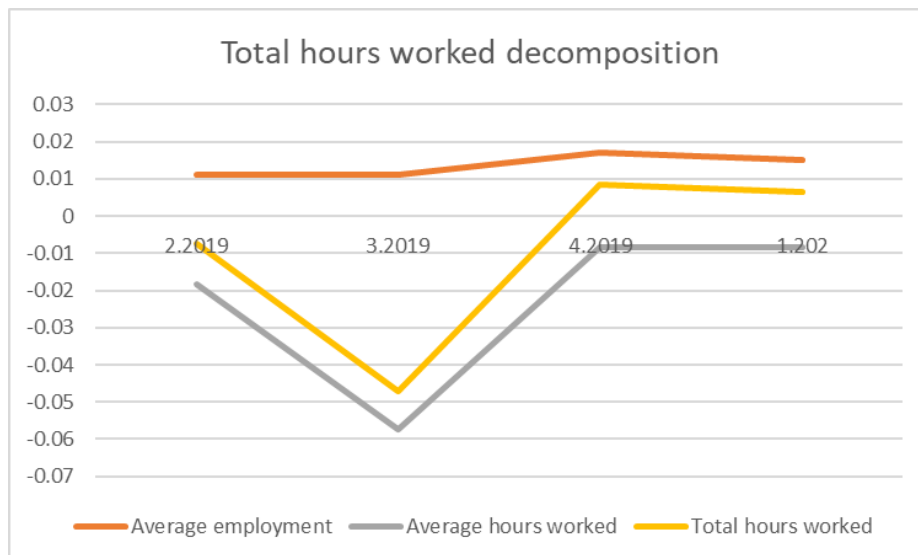


The behaviour of the weekly earnings does not help provide a clear answer on whether we have to do with a negative supply or demand shock. The simultaneous reduction in employment rate and rise in earnings does seem to suggest that we have to do with the negative supply shock. While the reduction in weekly hours would seem to suggest that we have to do with a negative demand shock. More detailed examination is needed.

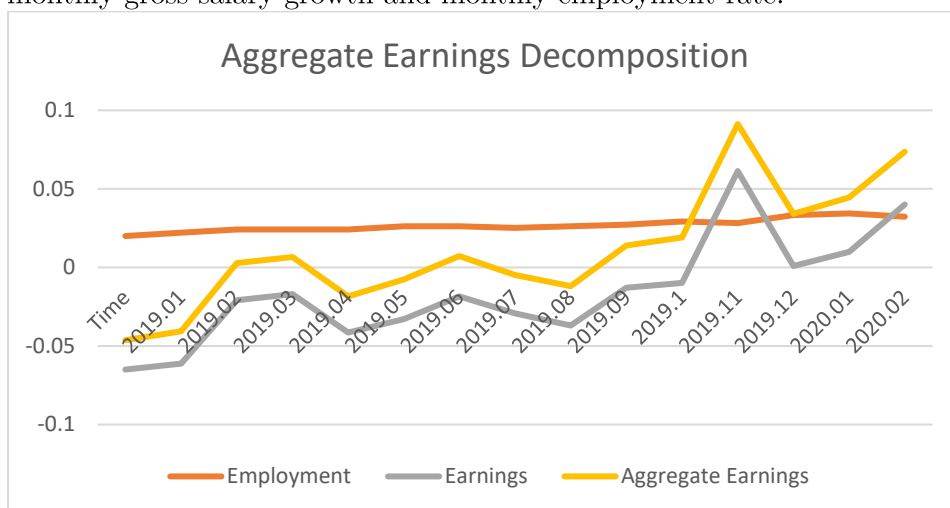
5. Redo for your own country. Discuss difficulties (if any) in getting the data. Discuss your results.

- First two points are impossible to reproduce as no microdata are available for the Polish labour market. The labour market data are published by the Central Statistical Office of Poland every quarter already in aggregation by industrial sectors or education categories. There are no survey data for individuals available. The lowest level data are available for the smallest administrative unit *gmina* in the Regional Data Base. This is of little help for the task at hand. There are attempts to collect survey labour market data but the relevant institutions such as consulting firms and research centres only make the end products such as reports available.
- It is possible to decompose the growth rate of aggregate working monthly hours worked between the growth rates of the monthly average hours worked and monthly employment rate.¹

¹ Data obtained from: <https://stat.gov.pl/obszary-tematyczne/rynek-pracy/pracujacy-zatrudnieni-wynagrodzenia-koszty-pracy/zatrudnienie-i-wynagrodzenia-w-gospodarce-narodowej-w-pierwszym-kwartale-2020-roku,1,38.html>, access: 28.09.2020 4:32AM. The processing of data in the .xls file attached.



- It is possible to decompose the growth rate of aggregate wages between the monthly gross salary growth and monthly employment rate.²



² Ibidem.