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**Working Paper No. 17/20**  
September 2020

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## **Abstract**

We explore the impact of COVID-19 hotspots and regional lockdowns on the Dutch labour market. Using weekly administrative panel microdata for 50 per cent of Dutch employees until the end of March 2020, we study whether individual labour market outcomes, as measured by employment, working hours and hourly wages, were more strongly affected in provinces where COVID-19 confirmed cases, hospitalizations and mortality were relatively high. We do not observe a region-specific impact of COVID-19 on labour market outcomes. The results suggest individual characteristics are more important, including the employee's age, type of contract and type of job. The evidence suggests that the decline of the labour market was all due to the impacts from the government-enforced lockdown and higher virus case numbers did not reinforce this decline. This suggests that preventive health measures should be at the regional level, isolating hotspots from low-risk areas.

**JEL classification:** I15, I18, J20, J30, J64

**Keywords:** COVID-19, Coronavirus hotspots, Lockdown, Employment, Working hours, Wages

## **1. Introduction**

The pandemic that started in 2020 has led to the first world-wide economic downturn in recent times triggered by a deadly virus. As the outbreak of COVID-19 commenced, governments were confronted with the dilemma of how to balance the economic and health costs of a surge in COVID-19 cases versus the costs of preventive health measures to stop the spread of the virus (Layard et al., 2020). We focus on the effect of the COVID-19 outbreak on the labour market at a regional level, where there may be two complementary mechanisms.

First, there is a direct economic effect arising from the population's health concerns due to COVID-19, which may differ by location, as people living in so-called COVID-19 hotspot areas may be more aware of the presence and detrimental consequences of the virus. As a result, they would take voluntary preventive measures of social distancing more seriously, which is likely to have a negative impact on social activity and the labour market. Second, the indirect economic effect through (regional) enforced lockdown and social distancing regulations by the government in response to the virus would lead to an immediate loss of the economic activities that are no longer allowed, and a negative impact on labour market outcomes of workers who can be dismissed easily.

This paper contributes to the rapidly expanding literature on the economic effects of COVID-19 by assessing the relevance of the above two mechanisms for how the COVID-19 health shock has affected the labour market in the Netherlands.<sup>1</sup> Using unique Dutch administrative weekly panel microdata for a random sample, which covers 50 per cent of Dutch employees (about 4.2 million individuals) until March 2020, we estimate the importance of both mechanisms during the outbreak of COVID-19. Taking a regional perspective, we examine whether the economic slowdown as measured by individual labour market outcomes has been stronger in COVID-19 hotspot areas where a substantial proportion of the population were affected by the virus.

## **2. Regional differences in COVID-19 cases and preventive measures**

The outbreak of the COVID-19 pandemic has had a common pattern across countries. First, there was a phase of denial by the authorities and the public, downplaying the severity of the outbreak. Second, a substantial outburst of cases occurred in a local region. Governments

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<sup>1</sup> See Campbell Collaboration (2020) for a systematic review relevant to the COVID-19 policy response. See Baldwin and di Mauro (2020) and Brodeur, Gray, Islam and Bhuiyan (2020) for comprehensive reviews of the economic consequences of the COVID-19 pandemic.

responded by introducing preventive measures for this local area only. Third, COVID-19 cases spread to other parts of the country. During the outbreak of the virus, most governments started by imposing a regional lockdown, before broadening it to the entire country. Of all policy measures, the compulsory societal lockdown was the most disruptive to the economy, enforcing social distancing, staying at home and working from home rules.

The virus outbreak in the Netherlands followed this pattern. On February 27, the first person tested positive. In the first weeks of March, the southern province Noord-Brabant had about half of all detected infections in the Netherlands despite this province only accounting for 15 per cent of the Dutch population. At the same time, the northern provinces were almost free of infections. With regard to reported confirmed COVID-19 cases, hospitalizations and deaths, Noord-Brabant was leading in absolute terms per 100,000 residents (Figure 1) as well as in relative terms as a proportion of total Dutch confirmed COVID-19 cases (Figure 2). Consequently, the government's preventive measures were at first directed at Noord-Brabant only. On March 6, people living in this province were advised to stay home, particularly if they had colds, coughs or a fever. On March 9, the Dutch Prime Minister suggested the population of Noord-Brabant should work from home. On March 10, large gatherings were banned in Noord-Brabant. On March 12, restrictions were imposed on the entire country, including social distancing, banning of gatherings over 100 persons, and a work-from-home directive. From March 15 onwards, all restaurants, schools, childcare and sport facilities were closed. On March 23, physical distancing requirements were tightened, imposing the 1.5-meter distance measure and cancelling all gatherings including those with fewer than 100 people.

*<Figures 1, 2 about here>*

### **3. Statistical identification**

We estimate the causal impact of the COVID-19 outbreak on three individual labour market outcomes: employment, measured by a 0-1 indicator which equals one if the person was employed – at least partly – in a given week; (logarithm of) the number of hours worked; and (logarithm of) the hourly wage. At the individual level, the information on working hours and gross wages is derived from monthly data. If a calendar week sits across two calendar months, data from the first calendar month is used. Weekly variation in hours worked and hourly wage is driven by changes in employment only (from job to job or to unemployment).

For a panel of individual employees, we apply a difference-in-difference specification at the weekly level by interacting the 0-1 indicator for 2020 (which is set to zero for 2019

observations) with 0-1 indicators for each of the first thirteen calendar weeks of the year. The interaction terms are used for a comparison of the outcome variable by calendar week relative to week 9 – the week of the COVID-19 outbreak in the Netherlands. For each outcome variable, the specification is

$$y_{it} = \alpha_i + \sum_{\substack{\tau=1 \\ \tau \neq 9}}^{13} \beta_{\tau} DW_{\tau} + \sum_{\substack{\tau=1 \\ \tau \neq 9}}^{13} \gamma_{\tau} DY_c \times DW_{\tau} + \delta DY_c + \eta' X_{ic} + \varepsilon_{it} \quad (1)$$

$$\{i \in 1, \dots, N; t \in 1, \dots, 13 \text{ for } c = 2019; t \in 14, \dots, 26 \text{ for } c = 2020\}$$

for which  $y$  is the outcome variable. The subscripts  $i$ ,  $t$  and  $c$  refer to individual, week and year, respectively.  $\alpha$  is an individual fixed effect;  $\tau$  represents the calendar week number;  $DY$  and  $DW$  are 0-1 indicator variables for year and calendar week.  $\varepsilon$  is an idiosyncratic error term.

The vector  $X$  contains 50 variables which are time constant within a year but may vary between the two years.  $X$  includes dummy variables for age (6 categories), job characteristics (type of contract (2), type of job (4), full-time/part-time status (2)).<sup>2</sup> These variables are all measured in calendar week 9, preventing any endogeneity issues resulting from changes in covariates because of COVID-19. Additionally,  $X$  contains dummy variables for firm characteristics (size (3), economic sector (20) and a dummy variable for missing firm data although less than 1 per cent of observations fall in this category) and for household characteristics (married (1) and home location (11 provincial regions)), which are all measured on 31 December of the previous year. The results provided in Figure 3 are robust to excluding  $X$  and are available upon request.

Besides estimating baseline equation (1), we estimate a corresponding heterogeneous difference-in-difference equation. This model complements (1) by also including triple and double interactions between year, calendar week, and all variables in vector  $X$ :<sup>3</sup>

$$y_{it} = \alpha_i + \sum_{\substack{\tau=1 \\ \tau \neq 9}}^{13} \left[ \beta_{\tau} DW_{\tau} + \gamma_{\tau} DY_c \times DW_{\tau} + (\kappa_{\tau}' X_{ic}) DW_{\tau} + (\lambda_{\tau}' X_{ic}) \times DY_c \times DW_{\tau} \right] + (\mu' X_{ic}) \times DY_c + \delta DY_c + \eta' X_{ic} + \varepsilon_{it} \quad (2)$$

where  $\kappa_{\tau}$ ,  $\lambda_{\tau}$  and  $\mu$  are additional parameters to be estimated, with vector  $\lambda_{\tau}$  including the key parameters of interest.

<sup>2</sup> The number of categories does not include the reference category.

<sup>3</sup>  $X$  is the same as in equation (1), but here we also include triple and double interaction terms between year, calendar week and the individual's gender and country of birth, which are time constant and absorbed by the individual fixed effects in (1).

#### 4. Data and results

We use administrative data from Statistics Netherlands. For computational reasons, we take a 50 per cent random sample of Dutch employees who were employed in calendar week 9 of 2019 and 2020, respectively. We follow individuals from January 1 until March 31, calendar week 13, of each calendar year. Table A.1 in Appendix A reports the individual summary statistics for calendar week 9 of 2019 and 2020, respectively. Although there are some small differences in background characteristics, on the whole, the employee population in week 9 is quite similar in 2019 and 2020. We report on three sets of novel causal results.

First, the estimated week effects of equation (1) show that employment decreased slightly in weeks 10 to 12 and more substantially, by about 2 percentage points, in week 13 (Figure 3). The evidence shows a slightly higher employment rate (0.1 to 0.2 percentage point) in weeks 1 to 8 in 2020 (relative to 2019). For the number of paid working hours, a comparable development can be observed with a 1.5 per cent decrease in hours in week 13. We observe a small negative effect from COVID-19 on hourly wages of about 0.3 per cent.<sup>4</sup> The reported COVID-19 effects on working hours and hourly wages are conditional on employment. Including zeros for the unemployed, which limits the impact of selection into employment, Figure A1 in Appendix A shows a reduction of 1.75 hours in monthly working hours and a reduction of 0.25 euro in hourly wages. Relative to monthly mean working hours of 127 and a mean hourly wage of 19.65 in week 9 of 2020, this represents a decrease of 1.4 per cent and 1.3 per cent, respectively. The very small positive results for weeks 1 to 8 indicate that the labour market in 2020 was very similar to the labour market in 2019 before COVID-19 arrived; if anything, employment had been more stable for those employed in week 9 in 2020 than in 2019.

The effects of COVID-19 on the Dutch labour force are consistent with, but somewhat smaller than, those reported by Von Gaudecker et al. (2020), who use monthly data until late March 2020 from the Longitudinal Internet Studies for the Social sciences (LISS) panel, a Dutch survey of a limited number of salaried workers. They find a reduction in total working hours of 11 per cent or 3 hours. Overall, the evidence suggests that employment and working hours are the relevant margins of labour adjustment rather than hourly wages in the first response to the COVID-19 shock.

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<sup>4</sup> As the data on working hours and wages are reported at the monthly level, a small increase in 2020 relative to 2019 can be observed for working hours, explained by the fact that 2020 is a leap year. For the hourly wage, the impact of the leap year is removed as monthly gross wage is divided by monthly number of working hours.

Second, separate estimation of equation (1) for each of the provinces indicate small regional differences in the changes in the outcome variables (Figure 4). Importantly, these regional differences do not seem to be strongly related to COVID-19 hotspot provincial areas.

*<Figures 3, 4 about here>*

Third, Table 1 presents the estimated parameters on the triple difference interactions of equation (2) revealing which categories of employees had the strongest decline in the three outcome variables in week 13 of 2020. Consistent with the results provided in Figure 4, the evidence in Table 1 does not suggest a region-specific impact of COVID-19 on the outcome variables when comparing COVID-19 hotspots such as Noord-Brabant and Limburg to other Dutch provinces, including some of the northern provinces such as Groningen and Friesland which had very few cases but experienced a larger negative impact on employment than Noord-Brabant. Other characteristics of employees are shown to be more relevant. Individuals who (i) are aged below 20 years, (ii) have a non-permanent contract; and (iii) are in a flexible or payrolling job, were most negatively affected by the economic effects of the COVID-19 shock. Overall, for a country with a relatively small area size like the Netherlands, the results suggest that the employee's job characteristics are more important than the regional location of residency for the effects of COVID-19 on individual labour market outcomes.

*<Table 1 about here>*

## **5. Conclusion**

The results in this paper indicate limited regional differences in the negative impacts on the Dutch labour market during the outbreak of COVID-19. It appears that higher virus case numbers did not reinforce the decline of the labour market beyond the impacts from the government-enforced lockdown. As a result, the northern provinces, which experienced a limited number of COVID-19 cases, suffered a similar (or even worse) decline in labour market conditions as the provinces that were severely affected by the virus.

This result has important implications. Policy makers should be cautious when implementing preventive measures nationwide as the economic costs can be substantial. Thus, where feasible, preventive health measures should be at the regional level, isolating hotspots from low-risk areas. This would allow relatively unaffected parts of the country to continue economic activities as much as possible, ultimately benefitting the nation as a whole.

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## Tables

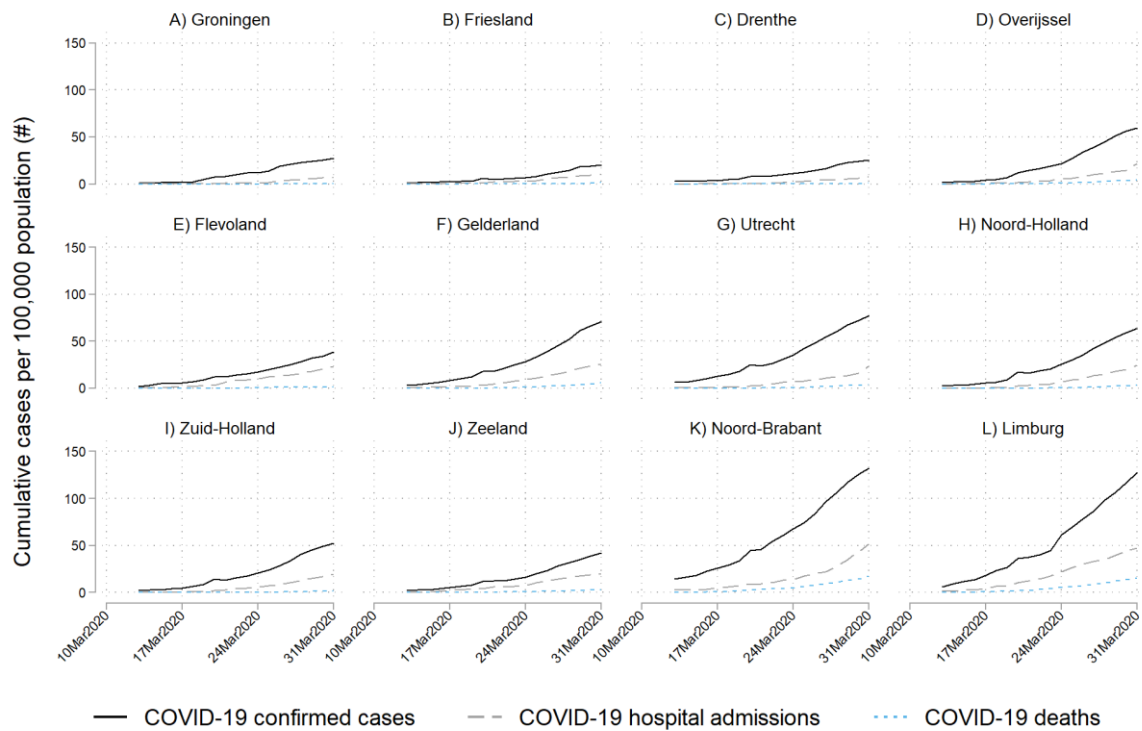
**Table 1**

The role of observed individual characteristics in the effects of COVID-19 (Equation (2))

	Employment (=1) (1)	Working hours (log) (2)	Hourly wage (log) (3)
<i>Triple interaction term: <math>DY \times DW_{13} \times</math></i>			
FEMALE: relative to male	0.0008** (0.0003)	-0.0019*** (0.0006)	0.0006** (0.0003)
AGE: relative to $14 \leq AGE \leq 20$ yrs			
20 < AGE $\leq$ 25 years	0.0303*** (0.0010)	0.0269*** (0.0022)	-0.0017** (0.0008)
25 < AGE $\leq$ 35 years	0.0250*** (0.0010)	0.0455*** (0.0020)	0.0014* (0.0008)
35 < AGE $\leq$ 45 years	0.0223*** (0.0010)	0.0475*** (0.0020)	0.0027*** (0.0008)
45 < AGE $\leq$ 55 years	0.0217*** (0.0010)	0.0476*** (0.0020)	0.0027*** (0.0008)
55 < AGE $\leq$ 60 years	0.0210*** (0.0010)	0.0474*** (0.0020)	0.0030*** (0.0008)
60 < AGE $\leq$ 70 years	0.0171*** (0.0010)	0.0497*** (0.0021)	0.0029*** (0.0008)
FOREIGN BORN: relative to born in the Netherlands	-0.0032*** (0.0004)	-0.0073*** (0.0008)	-0.0011*** (0.0003)
PARTNERED: relative to no partner	-0.0009*** (0.0003)	0.0016*** (0.0005)	0.0003 (0.0002)
CONTRACT: relative to permanent contract			
FIXED CONTRACT:	-0.0254*** (0.0004)	0.0024*** (0.0007)	0.0004 (0.0003)
OTHER CONTRACT	-0.0182*** (0.0005)	0.0128*** (0.0007)	-0.0060*** (0.0005)
TYPE OF JOB: relative to regular job			
FLEXIBLE JOB	-0.0628*** (0.0007)	-0.0445*** (0.0015)	0.0012** (0.0005)
PAYROLLING JOB	-0.1266*** (0.0036)	-0.0007 (0.0075)	0.0116*** (0.0025)
INTERN JOB	0.0095*** (0.0013)	-0.0176*** (0.0030)	0.0075*** (0.0021)
PROVINCE: relative to Noord-Brabant			
GRONINGEN	-0.0018** (0.0008)	0.0017 (0.0015)	0.0003 (0.0006)
FRIESLAND	-0.0029*** (0.0007)	0.0014 (0.0014)	0.0005 (0.0006)
DRENTHE	-0.0046*** (0.0008)	0.0009 (0.0016)	-0.0006 (0.0007)
OVERIJSEL	-0.0003 (0.0006)	-0.0010 (0.0011)	0.0015*** (0.0005)
FLEVOLAND	0.0034*** (0.0009)	0.0033** (0.0016)	-0.0006 (0.0007)
GELDERLAND	0.0013*** (0.0005)	0.0004 (0.0009)	0.0023*** (0.0004)
UTRECHT	0.0029*** (0.0005)	0.0041*** (0.0010)	0.0009** (0.0004)
NOORD-HOLLAND	0.0040*** (0.0004)	0.0036*** (0.0008)	0.0006* (0.0004)
ZUID-HOLLAND	0.0020*** (0.0004)	0.0025*** (0.0008)	0.0002 (0.0003)
ZEELAND	-0.0041*** (0.0009)	-0.0023 (0.0018)	0.0011 (0.0007)
LIMBURG	0.0032*** (0.0006)	-0.0018 (0.0011)	0.0012*** (0.0005)
Number of individuals	4,211,030	4,211,010	4,204,164
Number of observations	100,639,812	98,674,164	98,309,619

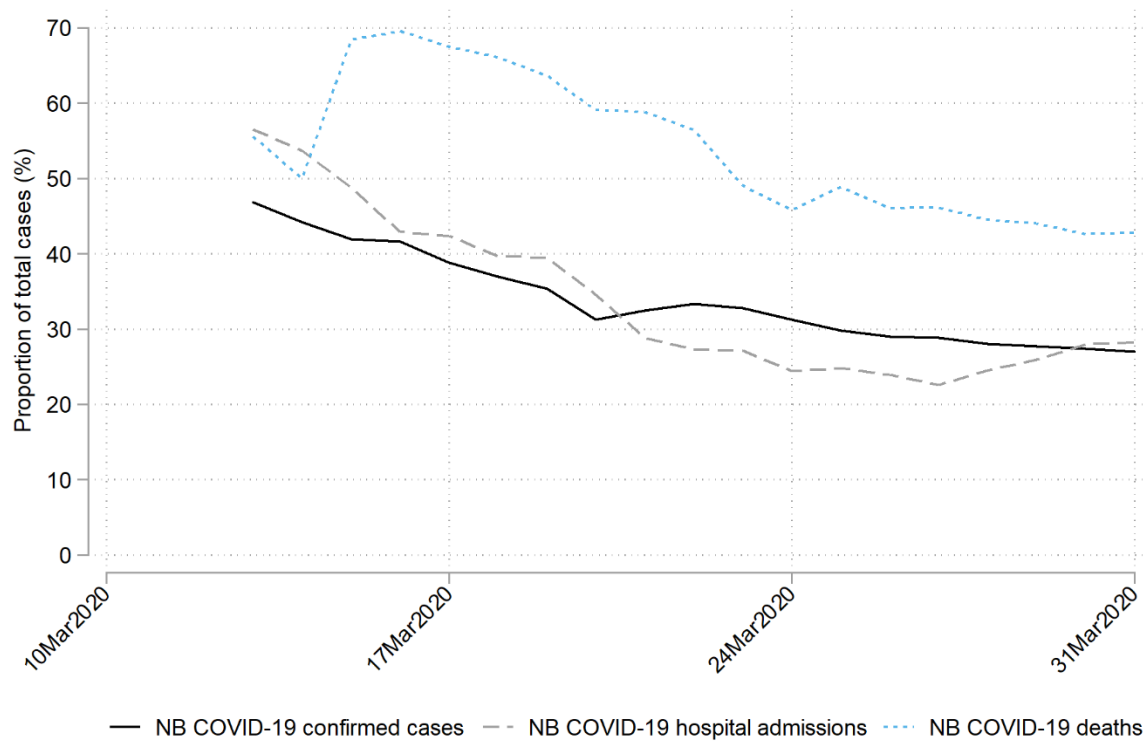
*Notes:* Parameter estimates of the triple interaction terms between year 2020, calendar week 13 and each of the covariates are reported. Each column represents a single regression for a different outcome variable. The variables log working hours and log hourly wage are observed conditional on employment. The covariates are measured in calendar week 9 of the year or on 31 December of the previous year. Two-way and three-way interaction terms are also included for full-time/part-time status, firm size and economic sector. These results are available from the authors upon request. The total number of estimated parameters equals 1,349. Standard errors, clustered by individual, are in parentheses. \*\*\*, \*\*, \*, correspond to the significance level of 1%, 5%, 10%, respectively.

## Figures



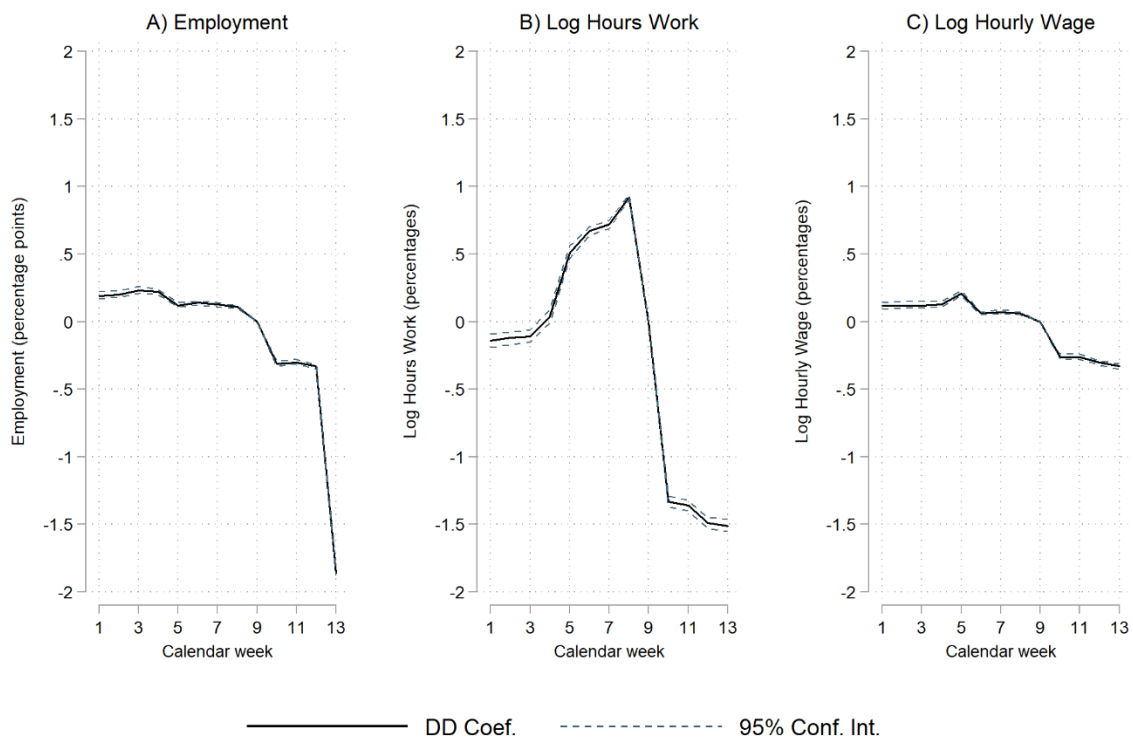
**Figure 1** – Cumulative number of cases per 100,000 residents by province, March 2020

*Notes:* See RIVM (2020) for the COVID-19 cases data. See CBS (2020) for the population data.



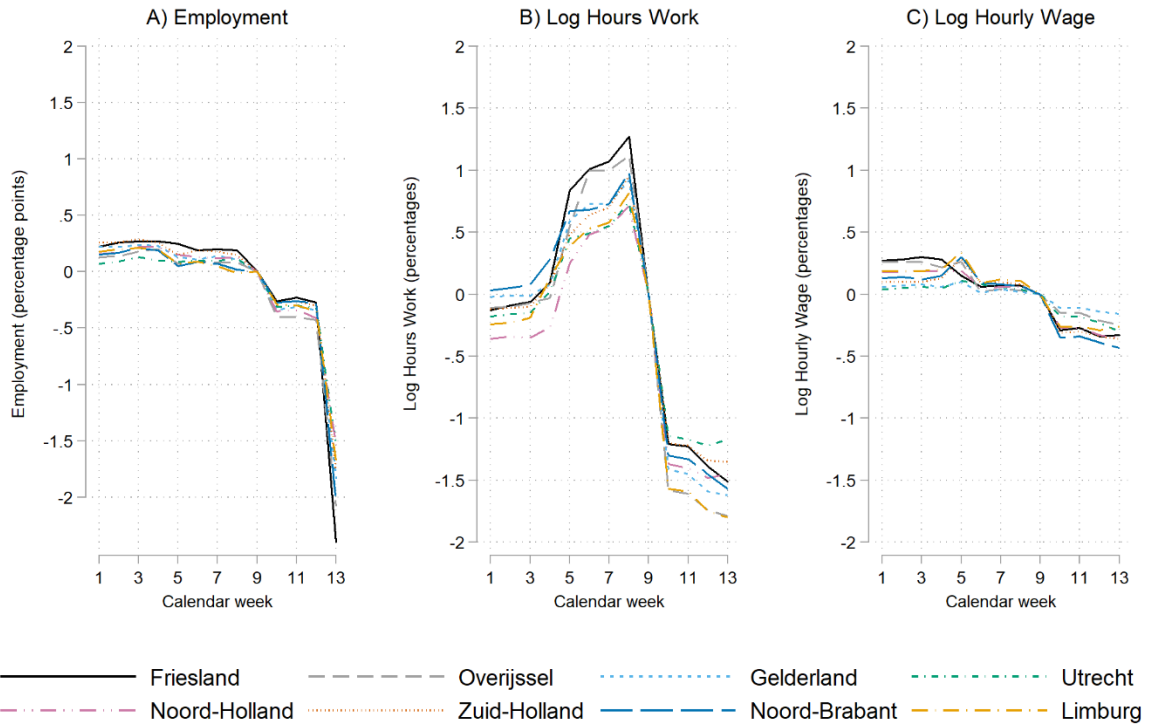
**Figure 2** – Proportion of cases in Noord-Brabant (NB), relative to the total number of cases in the Netherlands, March 2020

*Notes:* See RIVM (2020) for the COVID-19 cases data. See CBS (2020) for the population data.



**Figure 3** – COVID-19 Difference-in-Difference (DD) effects on employment, log hours worked and log hourly wages (Equation (1))

*Notes:* Parameter estimates of the double interaction terms between year and calendar week. Each graph represents a single regression for a different outcome variable. Reference year is 2019 and reference calendar week is 9. The 95% confidence intervals are computed based on standard errors clustered by individual. The total number of estimated parameters equals 75.



**Figure 4** – COVID-19 Difference-in-Difference effect stratified by province (Equation (1))

*Notes:* Each graph represents a different outcome variable and each line represents a single regression for a different province. Several provinces are left out from Figure 4 to ensure clear graphs. See Figure A.2 for the graph including all provinces. See Figure 3 for notes.

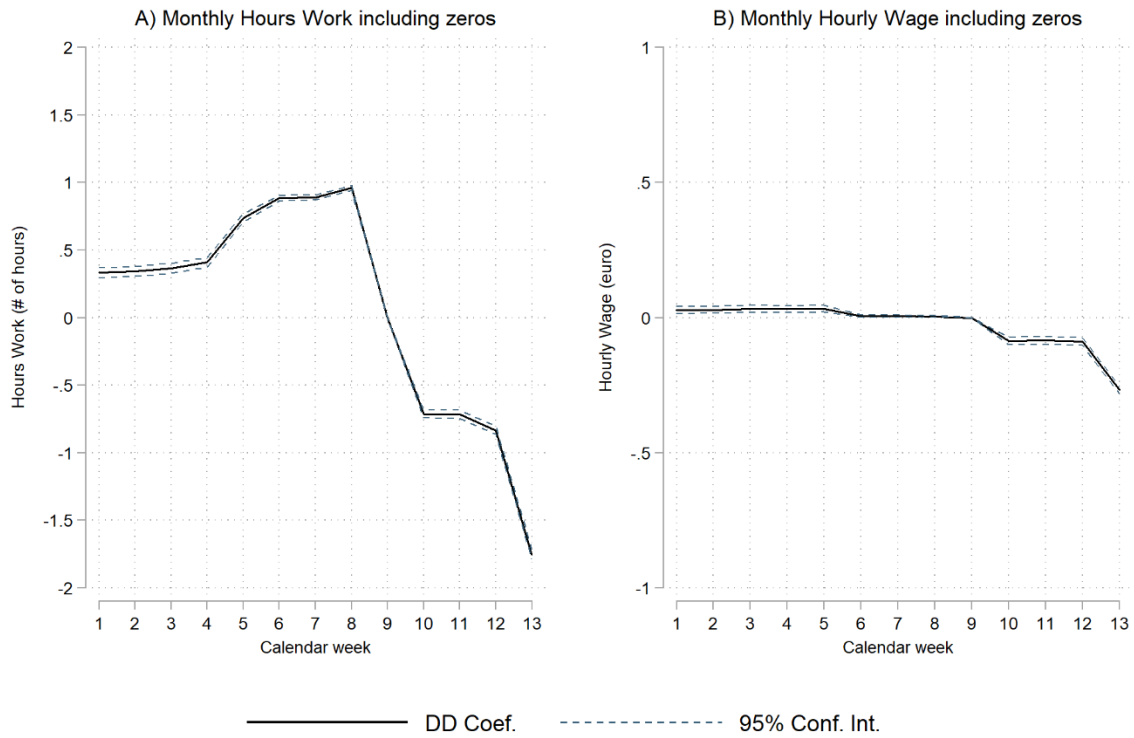
## Appendix: All for online publication

**Table A.1**

Individual summary statistics by year (proportions unless otherwise noted)

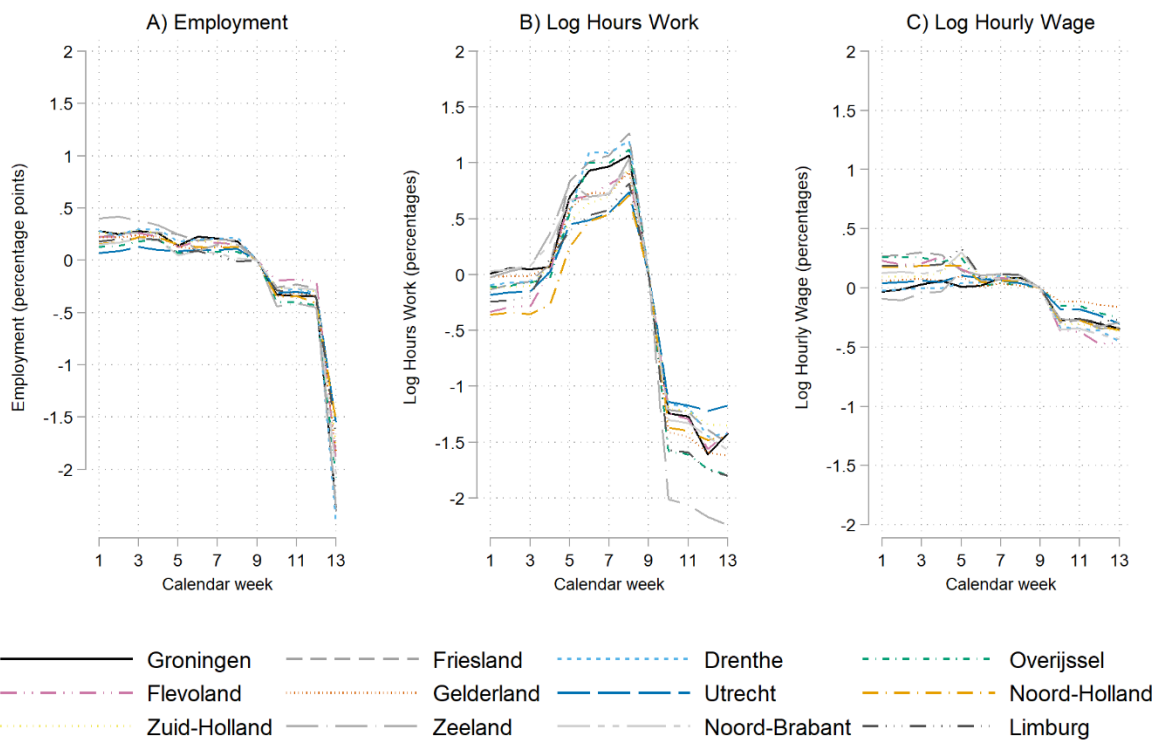
	2019		2020	
	Mean	St. Dev.	Mean	St. Dev.
Employment	1	0	1	0
Work hours (log)	4.6926	0.6770	4.7009	0.6623
Work hours (monthly hours)	126.95	51.29	127.2959	50.6043
Hourly wage (log)	2.7902	0.5923	2.8226	0.5885
Hourly wage (euro per month)	19.06	13.65	19.6545	16.5013
Gross wage (log)	7.4762	1.0923	7.5190	1.0722
Gross wage (euro per month)	2618.73	2193.85	2703.85	2258.76
Female	0.4788	0.4995	0.4814	0.4997
Age				
14 ≤ age ≤ 20	0.0797	0.2708	0.0791	0.2700
20 < age ≤ 25	0.0965	0.2952	0.0967	0.2955
25 < age ≤ 35	0.2143	0.4103	0.2158	0.4113
35 < age ≤ 45	0.1920	0.3939	0.1908	0.3929
45 < age ≤ 55	0.2248	0.4175	0.2188	0.4134
55 < age ≤ 60	0.1025	0.3033	0.1035	0.3047
60 < age ≤ 70	0.0903	0.2866	0.0953	0.2937
Born in the Netherlands	0.8729	0.3331	0.8671	0.3394
Partnered	0.6356	0.4813	0.6313	0.4825
Type of contract				
Permanent contract	0.6293	0.4830	0.6757	0.4681
Fixed contract	0.3425	0.4745	0.2962	0.4566
Other contract	0.0282	0.1655	0.0281	0.1654
Type of job				
Regular job	0.8293	0.3763	0.8054	0.3959
Flexible job	0.1104	0.3133	0.1341	0.3408
Payrolling job	0.0055	0.0739	0.0063	0.0792
Intern job	0.0169	0.1288	0.0169	0.1289
Full-time/part-time status				
≥ 35 work hours a week	0.4837	0.4997	0.4829	0.4997
20 ≤ hours a week < 35	0.3146	0.4643	0.3218	0.4672
Hours a week < 20	0.2017	0.4013	0.1952	0.3964
Province				
Groningen	0.0323	0.1768	0.0322	0.1766
Friesland	0.0352	0.1844	0.0352	0.1843
Drenthe	0.0269	0.1619	0.0269	0.1617
Overijssel	0.0680	0.2518	0.0682	0.2521
Flevoland	0.0250	0.1562	0.0253	0.1569
Gelderland	0.1202	0.3252	0.1203	0.3254
Utrecht	0.0808	0.2725	0.0810	0.2729
Noord-Holland	0.1661	0.3722	0.1661	0.3721
Zuid-Holland	0.2109	0.4080	0.2109	0.4080
Zeeland	0.0207	0.1425	0.0207	0.1423
Noord-Brabant	0.1520	0.3590	0.1520	0.3591
Limburg	0.0618	0.2408	0.0612	0.2397
Number of individuals (#)	3,848,057		3,893,467	

*Notes:* Sample means and standard deviations for individual characteristics are provided for calendar week 9 in 2019 and 2020, respectively. Summary statistics are not provided for all variables.



**Figure A.1** – COVID-19 Difference-in-Difference (DD) effects on hours worked and hourly wages including zeros for the unemployed (Equation (1))

*Notes:* Parameter estimates of the double interaction terms between year and calendar week. Each graph represents a single regression for a different outcome variable. Each outcome variable is in levels and zeros are used for unemployed individuals. Reference year is 2019 and reference calendar week is 9. The 95% confidence intervals are computed based on standard errors clustered by individual. The total number of estimated parameters equals 75. See Table 1 for additional statistics.



**Figure A.2** – COVID-19 Difference-in-Difference effect stratified by province (Equation (1))

