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Are remote work options the new standard? Evidence from vacancy postings during the COVID-19 crisis

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ARTICLE INFO

JEL classification:
J23
J31
J61
J63
O33
R23

Keywords:
Teleworking
Working from home
Job postings
COVID-19

ABSTRACT

This study examines how the COVID-19 crisis has changed the willingness of employers to offer teleworking options. We analyze job descriptions from vacancy postings on the largest Austrian job board to classify whether employers offer the option to telework to new hires. Our results show that the crisis has substantially increased the scope for remote work. About one year after the onset of the crisis, employers were 2–3 times as likely to explicitly offer such an option relative to levels before the pandemic. This effect is particularly strong for jobs that require at least a degree from a higher secondary school. Accounting for changes in vacancies by occupations and firms, we find that the impact is neither driven by an increase in the demand for teleworkable occupations nor by an increase in vacancies at teleworking-friendly firms. Although many social distancing restrictions were relaxed again during the summer of 2020, the effect persists throughout the first year of the crisis, suggesting that the pandemic may have long-lasting effects on remote working arrangements. To test the robustness of our results, we merge two external occupation-level teleworking measures to our sample. Both measures are highly correlated with our measure and yield comparable estimates for the impact of the pandemic on vacancies for teleworkable occupations.

1. Introduction

As a response to the outbreak of COVID-19, many countries have implemented far-reaching measures to contain the spread of the virus, leading to a mass social experiment in remote work arrangements. Due to severe contact restrictions, the number of people who work from home increased substantially. Various recent studies have documented the extent of remote work during the pandemic and measured the ability to telework in different occupations. Yet, it is still unclear how this experience will affect the willingness of employers to offer teleworking in the future.

Changes due to the pandemic may have long-lasting effects on the organization of work. While remote work used to be rather the exception than the norm in many firms, employers might increasingly consider such arrangements. First, the experience during the pandemic could have changed the attitudes towards teleworking. If workers can be equally productive at home, skeptical employers might have become more positive towards remote work arrangements. Also workers might have learned about benefits of teleworking that they were not aware of before. Second, many firms have invested in hardware and internet access to make teleworking feasible during the crisis, and workers have learned how to use collaborative software.

In this study, we analyze how the pandemic has affected remote work options of new vacancies in the first year of the crisis. We examine the job description of vacancy postings on the largest online job board in Austria and match expressions that are commonly used to describe remote work. We define a vacancy as teleworkable if at least one such expression is mentioned. Using these matches as proxy for the willingness of employers to offer teleworking allows us to quantify whether remote work options have become more common during the crisis.

Our results show that the number of job postings with teleworking reference increased substantially during the course of the pandemic. 14 months after the onset of the crisis, we observe that employers are 2–3 times as likely to offer remote work options to job applicants.

* We thank the IZA for support under its Emergency Research Thrust. A previous paper from this project circulated under the title How does the COVID-19 crisis affect labor demand? An analysis using job board data from Austria.

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1 Adams-Prasai et al. (2020a,b); Alipour et al. (2020); Bick et al. (2020); Boeri et al. (2020); Dingel and Neiman (2020); Fadinger and Schymik (2020); Gottlieb et al. (2021); Hensvik et al. (2020); Mongey et al. (2020); del Río-Chamona et al. (2020).

https://doi.org/10.1016/j.labeco.2022.102179
Received 16 June 2021; Received in revised form 28 April 2022; Accepted 10 May 2022
Available online 11 May 2022
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effect is particularly pronounced for jobs that require at least a degree from a higher secondary school. This group of jobs already offered teleworking more frequently before the crisis. Analyzing changes in occupations, we further show that this effect is not driven by an increase in the demand for teleworkable occupations. We neither find evidence that the change can be attributed to a relative increase in vacancies by teleworking-friendly firms, that is firms which frequently offer teleworking in their job postings. This suggests that employers have become more willing to offer telework options. Although many restrictions were loosened again during the summer of 2020, the impact persists throughout the year.

To validate our results, we repeat the analysis using two alternative teleworking measures, which are constructed from the O’NET database and the American Time Use Survey (see Dingel and Neiman (2020); Hensvik et al. (2020)). Merging these measures to occupations of job ads, we observe a high correlation between all three classifications. In line with our previous finding, neither of the two alternatives provides evidence for an increase in the relative demand for teleworkable occupations.

Our measure of telework options should be interpreted with caution. Even for more educated workers, who have a degree from a higher secondary school or (applied) university, the share of job postings with references to remote work was just 1.5 percent before the crisis and, despite substantial relative increases, remained on a low level one year after the onset of the crisis (3.5%). The absence of a teleworking reference in ad texts does not imply that employers will never offer it. And vice versa, if we observe a reference, it is not clear if and to what extent workers make use of such an option. The measure should rather be regarded as a proxy of general employer attitudes towards teleworking, which can foster both full-time telework arrangements and hybrid models.

Several papers document the prevalence and consequences of working from home. Oettinger (2011) investigates the growth in home-based work from 1980 to 2000. His findings suggest that employer costs of providing home-based work arrangements have decreased and that advances in information technology might be an important source of these falling costs. There is little evidence of the productivity gains or losses from switching to remote work arrangements yet. Conducting a randomized controlled trial within the call center of a Chinese travel agency, Bloom et al. (2015) show that working from home can increase performance. Many workers would also welcome more telework options. Mas and Pallais (2017) document that the average worker is willing to give up 8 percent of wages to work from home.

Since the beginning of the pandemic, there has been a remarkable volume of research on the potential of remote work to respond to the crisis. Dingel and Neiman (2020) use occupational descriptions from the Occupational Information Network (O’NET) to estimate the degree to which different occupations in the United States can be done remotely. They find that 37 percent of jobs in the United States can be performed entirely at home. Boeri et al. (2020) find similar results for Italy (24%), France (28%), Germany (29%), Spain (25%), Sweden (31%) and the United Kingdom (31%).

Recent survey evidence shows how the pandemic has affected telework. According to a survey conducted in 26 EU countries by Eurofound (2020), 37 percent of workers started to telework due to the pandemic. Austria is among the countries with the largest proportion of workers who switched to remote work arrangements (41%). Pointing to the potential benefits of teleworking, the same study finds that in countries where more people began working from home, fewer workers reported that their working time decreased. For the United States, Bick et al. (2020) find that about 35 percent of the workforce worked entirely from home in May 2020, up from 8.2 percent in February 2020. Brynjolfsson et al. (2020) report that nearly half of the individuals they surveyed said they were working from home during the first week of April 2020. Survey evidence by Barrero et al. (2020) shows that both workers and employers have become more positive towards remote work arrangements during the crisis.

Our study adds to this literature by providing direct evidence on how employers change their demand for teleworking as a response to the pandemic. We interpret our finding as an increase in the willingness of employers to offer remote work if the job can be done remotely. While new communication technologies make it increasingly possible to work from home, the pandemic might further accelerate the shift towards more flexible work arrangements. This pattern is in line with evidence from a recent study by Hershein and Kahn (2018), who show that recessions can accelerate structural changes in the labor market.

2. Data and setting

2.1. Austrian vacancy data

Our analysis is based on vacancy postings administered by the Austrian public employment office (AMS). The AMS job board offers the largest pool of vacancies in Austria. According to a representative quarterly survey among establishments conducted by Statistics Austria, it covers about 50–60 percent of all open vacancies in recent years. Using survey results from 2009 to 2018, Mueller et al. (2020) show that coverage rates of vacancies in the AMS database differ to some extent by industry and level of education. Compared to the average coverage rate, vacancies in the construction sector, accommodation and food services, and administrative and support activities are 20 percent more likely to be observed. On the contrary, jobs in finance, information technology and education appear less often on the job board (-30% to -40%). Similarly, we observe that coverage rates are lower for vacancies requiring post-secondary schooling (-30%) and somewhat higher when requiring compulsory schooling or apprenticeships (+ 10% to +20%). To account for these differences in the empirical analysis, we will report estimation results also separately by level of education.

Firms typically report their vacancies to the public employment office. The case workers at AMS process the provided information and regularly update the corresponding job posts. Contrary to other online job boards, which often contain inactive vacancies (Cheron and Decrease, 2017), the vacancy database thus allows to closely track the demand for labor at any point in time. Job seekers can use the AMS online job board to search for available vacancies. Unemployed workers who are registered as benefit recipients might also be directly referred to suitable vacancies by the public employment office.

We make use of both structured and unstructured information from the vacancy database. Structured information is reported in separate data columns and includes firm identifiers, firm location, occupation, required education, the extent of work and wage postings. Unstructured information includes attributes described in the open text section which are extracted using text pattern matching. Characteristics that we obtain from the ad text are a teleworking indicator and whether employers mention that work experience is required from applicants. To measure the availability of teleworking options, we search for matches to 12 expressions that are commonly used to describe remote work in the German and English language (e.g. ‘telework’ or ‘working from home’).

We label a job as teleworkable if there exists at least one reference in the job description.

The Austrian public employment service uses a detailed occupation classification scheme, which distinguishes about 3000 different occupations in our sample of vacancy posts. The appendant occupational dictionary includes references to the corresponding 4-digit codes of the International Standard Classification of Occupations (ISCO).
Table 1
Characteristics of (non)-teleworkable jobs.

|                          | Non-teleworkable | Teleworkable |
|--------------------------|------------------|--------------|
| **Extent of work:**      |                  |              |
| - Full-time              | 0.701            | 0.771        |
|                         | (0.458)          | (0.420)      |
| - Part-time              | 0.202            | 0.126        |
|                         | (0.402)          | (0.331)      |
| - Full- or part-time     | 0.0967           | 0.103        |
|                         | (0.295)          | (0.304)      |
| **Required level of education:** |               |              |
| - Compulsory schooling   | 0.364            | 0.0630       |
|                         | (0.481)          | (0.243)      |
| - Vocational training    | 0.480            | 0.296        |
|                         | (0.506)          | (0.456)      |
| - Higher secondary school| 0.101            | 0.374        |
|                         | (0.302)          | (0.484)      |
| - (Applied) university   | 0.0554           | 0.267        |
|                         | (0.229)          | (0.442)      |
| # words in ad            | 180.3            | 305.5        |
|                         | (88.29)          | (112.2)      |
| Posted monthly wage      | 2063.1           | 2885.0       |
|                         | (637.2)          | (1011.7)     |
| Work experience required | 0.660            | 0.817        |
|                         | (0.474)          | (0.387)      |
| Vacancy duration (days)  | 59.86            | 67.24        |
|                         | (44.55)          | (45.36)      |
| Observations             | 1,261,735        | 4,411        |

Note: The table reports means with standard deviations in parenthesis for all vacancies listed between January 2017 and April 2021. Posted wages are only observed for 95.5 percent of the sample. Vacancy duration is censored at 150 days.

national Standard Classification of Occupations (ISCO 08). We use the ISCO classification to estimate occupation-specific teleworking shares, which proxy to what extent remote work arrangements are feasible in each occupation. The ISCO codes also allow us to link our data to external databases that have previously been used to quantify the extent or potential of teleworking. Following Dingel and Neiman (2020) and Hensvik et al. (2020), we merge the job postings to telework classifications derived from the Occupational Information Network (O’NET) and from the American Time Use Survey (ATUS). These additional measures will be used to corroborate our teleworking measure and to test the robustness of our estimates.

The estimation sample covers all new vacancies for permanent employment listed between January 2017 and April 2021 and contains information on more than 1.2 million job ads. Our pre-Covid control period runs from January 2017 to February 2020. The period affected by the crisis spans 14 months from March 2020 to April 2021, which is the last month that is available in the data. To minimize measurement error, we drop a small number of postings with very short ad texts (<50 words) and ads without information on occupation and required education, which amounts to 13 percent of the initial sample.

2.2. Characteristics of teleworkable jobs

Table 1 compares the characteristics of vacancies with and without remote work option in our estimation sample. Within the vacancy pool of the public employment service, teleworkable jobs represent a small minority of better paid jobs for high skilled workers. Because the job board offers many vacancies that only require compulsory schooling or vocational training, less than 1 percent of ads contain a reference to teleworking. Teleworkable jobs offer 40 percent higher wages than non-teleworkable jobs and require a higher level of education and work experience. A quarter of teleworkable jobs are for university graduates, compared to only about 5 percent of non-teleworkable jobs. Similarly, basic school education is only sufficient for 6 percent of vacancies with remote work option but for 36 percent of the remaining ads. Also, job ads for teleworkable vacancies are significantly longer (about 70 percent more words), suggesting that such jobs may be more complex and may offer more benefits than non-teleworkable jobs. Comparing the average duration that vacancies are posted on the job board, we find that teleworking jobs remain about 7 additional days active, which corresponds to a relative difference of 12 percent. This can be to a large extent explained by the strong education gradient in telework because vacancies with higher education requirements take substantially longer to get filled. All in all, the descriptive evidence suggests that telework options are only offered for a small share of jobs targeted at higher educated workers with more work experience.

As shown in Table 1, teleworkable jobs are associated with substantially higher wage postings. On the one hand, employers might be able to offer better compensation to teleworkers because they save on office space and other related costs. Also, when competing for the highest skilled workers, they may both pay higher wages and offer additional fringe benefits such as remote work options. On the other hand, workers could be willing to trade off lower wages for higher flexibility if they, and not employers, have a preference for teleworking. This would be in line with the findings of Mas and Pallais (2017) who show that workers are willing to accept lower wages for the option to work from home.

To better understand the determinants of the observed wage gap, we regress log wages on the teleworking indicator and various additional job characteristics. Controlling for time trends, labor market region, extent of work and required work experience reduces the pay gap between teleworkable and non-teleworkable jobs from 40 percent to about 25 percent. When we additionally include indicators for the required level of education, the gap further decreases to 10 percent. Vacancies with remote work option also tend to be in higher-paying firms and occupations. If we further account for firm and occupation fixed effects, teleworkable jobs still pay about 4 percent more than non-teleworkable jobs. Because a sizable wage gap remains, the regression estimates suggest that teleworking is often offered as part of the benefits package of higher paying jobs.

To determine the extent to which teleworking is feasible in different occupations, we use the sample of vacancies that were posted before the crisis and compute the percentage of teleworking references for every occupation. Fig. 1 reports the corresponding shares for each 2-digit ISCO code. As expected, employers report no teleworking options at all for most blue-collar occupations such as drivers, assemblers, or agricultural workers. For white-collar occupations, we observe large differences between the different groups, mostly ranging between 0 and 1 percent. Especially professionals and managers are more frequently offered the possibility to telework. IT occupations constitute a clear outlier with the highest share of teleworking jobs (2%). While these shares appear to be too low to capture the full potential of teleworking in the labor market, the observed differences can be used to classify occupations by the degree of teleworking capabilities.

2.3. Covid-related restrictions

Like many other countries, Austria quickly implemented several measures to prevent the spread of COVID-19 in spring 2020. A nationwide lockdown was enacted on 16 March, which affected many parts of the economy such as retail and the cultural sector. As virus cases declined since mid-April, most businesses were gradually allowed to re-open and most restrictions were loosened again by June. Following a surge in cases in autumn 2020, the government mandated a second and third lockdown in November and December, which lasted until early February 2021. Many businesses such as hotels, restaurants and cultural institutions still had to remain closed for another two months.

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5 The occupational dictionary is available at https://www.ams.at/bis (in German). If no unique match exists, we attribute the respective job to multiple ISCO codes with equal weight.
By law, there exists in Austria neither a right nor an obligation to telework unless explicitly specified in the work contract. On 10 March 2020, the government advised firms to allow teleworking. About one week later, a decree by the social ministry demanded that all firms had to switch to teleworking if the job did not require the presence of the employee. A second decree from 1 May 2020 further specified that employers had to guarantee that employees could always keep a minimum distance of one meter. If it was not possible to keep the minimum distance, other suitable safety measures such as dividing walls or working in fixed teams were required. In the wake of the second and third lockdown, the government strongly advised firms again to retreat to remote work whenever feasible. On 1 April 2021, a new law came into effect, which was intended to ease teleworking arrangements between employers and employees. Whereas the law did not introduce a right to telework, it included several regulations about working time, work equipment and insurance of teleworkers. Moreover, tax benefits were introduced, making teleworking financially more attractive to workers.

Our period of observation thus covers different stages of the crisis. In the first two months (March and April 2020), all teleworkable jobs had to be done from home but little regulation of telework arrangement existed yet. In the subsequent summer months (May-August 2021), the restrictions were lifted and many workers could return to their workplace. This changed again in the subsequent autumn and winter months, which led to a situation comparable to the beginning of the crisis. In spring 2021, the restrictions were gradually removed and the new telework law incentivized remote work arrangements.

3. Empirical findings

3.1. Descriptive trends

Our data show that the pandemic had a huge overall impact on labor demand in Austria. Fig. 2 plots the monthly number of new vacancies from 2017 onwards. To illustrate the impact of the pandemic on the labor market, we use calendar month indicators and a quadratic annual trend to predict inflow levels that would have occurred in the absence of the crisis (grey plot). As shown in Fig. 2, the number of new vacancies significantly dropped since March 2020. While during the same months of the previous year, firms posted about 25,000 new vacancies, we observe only about 15,000 new entries at the beginning of the crisis. This corresponds to a relative decrease of about 40 percent. Starting from autumn 2021, however, labor demand almost returned to its pre-pandemic level, suggesting that the economy recovered from the initial shock.

Analogous to the previous graph, Fig. 3 plots trends in the share of job ads with teleworking references. Using the same regression model as for labor demand, we again predict counterfactuals based on pre-crisis

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6 See decree Covid-19-Lockerungsverordnung issued by the Austrian social ministry (in German).

7 As a first step, we use the pre-Covid sample to estimate the following equation: \( \text{vacancies}_n = \alpha_n + \beta_1 \text{year}_n + \beta_2 \text{year}_n^2 + u_n \). The outcome variable is the number of vacancies in each month, \( n \), \( \alpha_n \) indicates the calendar month and \( \text{year}_n \) is the year normalized to 2017. We then use the parameter estimates to compute predictions for the number of vacancies in each month.

8 This effect is similar in magnitude to the decrease in Swedish vacancies as documented by Hensvik et al. (2021).
vacancy observations. The plot shows a steady growth in teleworking references between 2017 and 2019. After the summer of 2020, this trend picked up considerably and the share increased almost threefold within a year.

Fig. A1 in the appendix shows the equivalent graph when the sample is restricted to vacancies for more educated workers. As discussed before, telework references are much more likely for these jobs. The graph shows that the divergence from the long-run teleworking trend started immediately after the onset of the crisis, decreased again in the summer of 2020 and grew even stronger in the subsequent months.

These graphs show that, even though labor demand recovered by spring 2021 to pre-crisis levels, remote work options have become much more common, suggesting that the observed increase may have long lasting effects on work arrangements in the post-Covid labor market.

3.2. Estimation

To examine the effects of the pandemic, we propose the following regression equation,

$$televork_{i} = \alpha_{0} + \beta_{1} \text{year}_{i} + \beta_{2} \text{year}_{i}^2 + \sum_{k=1}^{7} \gamma_{k} \text{Covid}_{k,i} + \delta X_{i} + u_{i}$$

where telework, is an indicator for teleworking references in vacancy i. Covid_{k,i} each indicate two consecutive months during the Covid pandemic, ranging from March/April 2020 to March/April 2021. Calendar month fixed effects, denoted by \(\alpha_{0}\), and a quadratic specification for calendar year (year_{i}) account for seasonality and time trends. To control for additional confounding factors, we also add a vector \(X_{i}\) of job characteristics. Our base controls include indicators for labor market regions, the extent of work and whether experience is required. In some specifications, we additionally control for the required level of education as well as occupation and firm fixed effects. \(u_{i}\) denotes the error term.

We are interested in parameters \(\gamma_{k}\), which capture changes in remote work options in the months that are affected by the crisis. Because many restrictions were temporarily removed and reinstated again during that period, it is likely that the impact changes over time.

3.3. Impact on teleworking

Our hypothesis is that the pandemic increased the willingness of employers to offer remote work options to new employees. Due to the strict contact restrictions in the first months of the crisis, many workers were temporarily forced to work from home. If employers, who were initially reluctant to allow teleworking, realize that their employees can be equally productive at home, they may decide to introduce this option even for new hires.

At the same time, the crisis might have changed the demand for teleworkable vacancies. Especially at the onset of the pandemic, jobs without telework options might not have been possible to execute due to contact restrictions and closed premises. Because employers face uncertainty about the duration of implemented measures, they might decide to postpone hiring for such vacancies. As a result, occupations in which teleworking is feasible would experience a weaker drop in labor demand.

To distinguish between demand-driven changes and changes in employer attitudes towards remote work, we next turn to the regression analysis. Note that all estimates on the incidence of teleworking references are reported in percentage points. Results of Table 2 show how the crisis affected the occurrence of teleworking references in job ads. The point estimates refer to the respective percentage point changes in the share of ads offering remote work options. To quantify the impact in relative terms, we can compare each coefficient to the average share of teleworking options in the 2 months before the crisis (Pre-Covid mean), which is shown at the bottom of the table. For the full sample of vacancies, we observe a statistically significant increase starting from September/October 2020. The point estimate steadily grows over the

### Table 2

| Impact on teleworking by education. |
|-------------------------------------|
|                                  | All            | Compulsory schooling | Vocational training | Higher schooling |
|-----------------------------------|----------------|----------------------|--------------------|-----------------|
| March/April 2020                  | 0.089*         | 0.012                | -0.060             | 0.933***        |
|                                   | (0.047)        | (0.032)              | (0.047)            | (0.260)         |
| May/June 2020                     | 0.032          | 0.007                | 0.034              | 0.387*          |
|                                   | (0.040)        | (0.030)              | (0.049)            | (0.213)         |
| July/August 2020                  | 0.061          | 0.007                | 0.076              | 0.438*          |
|                                   | (0.040)        | (0.028)              | (0.049)            | (0.219)         |
| September/October 2020            | 0.289***       | 0.060*               | 0.175***           | 1.340**         |
|                                   | (0.047)        | (0.035)              | (0.056)            | (0.239)         |
| November/December 2020            | 0.559***       | 0.139***             | 0.332***           | 1.704***        |
|                                   | (0.064)        | (0.049)              | (0.074)            | (0.271)         |
| January/February 2021             | 0.588***       | -0.012               | 0.275**            | 2.327***        |
|                                   | (0.070)        | (0.049)              | (0.077)            | (0.326)         |
| March/April 2021                  | 0.679***       | 0.055                | 0.323***           | 2.963***        |
|                                   | (0.070)        | (0.050)              | (0.079)            | (0.335)         |
| Pre-Covid mean                    | 0.389          | 0.091                | 0.226              | 1.526           |
| Observations                      | 1,266,146      | 459,230              | 606,450            | 200,466         |

Note: * p<0.10, ** p<0.05, *** p<0.01. Estimates are reported in percentage points. All regressions control for region, extent of work and required work experience. Pre-Covid means are measured in January and February 2020.
Table 3

|                      | (1)  | (2)  | (3)  | (4)  |
|----------------------|------|------|------|------|
| March/April 2020     | 0.955*** | 1.034*** | 0.842*** | 0.832*** |
| May/June 2020        | 0.267 | 0.267 | 0.229 | 0.229 |
| July/August 2020     | 0.422 | 0.533 | 0.795*** | 0.784*** |
| September/October 2020 | 1.379*** | 1.503*** | 1.325*** | 1.326*** |
| November/December 2020 | 1.702*** | 1.788*** | 1.878*** | 1.883*** |
| January/February 2021 | 2.314*** | 2.355*** | 2.096*** | 2.020*** |
| March/April 2021     | 2.948*** | 2.948*** | 2.519*** | 2.509*** |
| Occupation FE        | ✓    | ✓    | ✓    | ✓    |
| Firm FE              | ✓    | ✓    | ✓    | ✓    |

Note: 191,785 observations. Estimates are reported in percentage points. The sample covers all job postings that require at least a degree from a higher secondary school. Fixed-effects groups with only one observation are excluded from the sample. All regressions control for region, extent of work and required work experience. Pre-Covid outcome mean (January/February 2020): 1.543. * p<0.10, ** p<0.05, *** p<0.01

The subsequent months and is 2–3 times larger in spring 2021 compared to pre-crisis levels (increasing from 0.4% to 1.1%).

Splitting the sample by level of education, we find that the effect is mostly absent for jobs which only require compulsory schooling. Yet, teleworking references had been already rare before the crisis, which suggests that remote work might often not be feasible in these jobs. Thus, we would neither expect to observe increases due to the pandemic.

On the contrary, we observe strong increases in the sample of vacancies that require at least a degree from a higher secondary school (labeled as higher schooling). Large effects already occur at the start of the crisis, diminish in the summer months and subsequently build up again. Within one year, the teleworking share increases by 2–3 percentage points from a pre-crisis share of just 1.5 percent. This increase is larger, both in absolute and relative terms, than the rise of teleworking job ads for workers with vocational training, which constitute the largest education group on the job board.

To examine whether changes in employers or occupations can explain the rise in teleworking, we additionally control for firm and occupation fixed effects. Because the largest impact comes from job ads for more educated workers, who have a degree from a higher secondary school or (applied) university, we restrict our estimation sample to this group. The corresponding estimates are reported in Table 3.

If the relative demand for occupations that can be performed remotely increases during the crisis, the within-occupation effect on teleworking should be smaller compared to the overall effect. Yet, controlling for occupation indicators leaves the estimate in Column (2) almost unchanged. The coefficient is even somewhat higher but not statistically different from the estimate in the first column. This shows that the observed increase is not driven by higher demand for teleworkable occupations.

The positive impact can neither be attributed to a relative rise in vacancies at teleworking-friendly employers. Adding firm indicators to the regression has little effect on the point estimates in most months. An exception is the summer of 2020, during which effect sizes become even larger. Firms that used to offer options for remote work before the crisis are less likely to post vacancies during this period, which leads to smaller estimates in specifications without firm fixed effects.

Our preferred specification controls for both firm and occupation fixed effects. As shown in Column (4), we estimate in March/April 2021 a 2.5 percentage point increase in teleworking references due to the pandemic. This effect is not much smaller than the point estimate of our baseline specification. Because the impact persists even conditional on changes in firms and occupations, we interpret it as a change in the willingness of employers to offer remote work. References in job postings can only serve as a proxy for the availability of remote work arrangements. Some employers, who eventually allow teleworking, might not want to already commit to such options in a job ad. Given that the estimated impact on references is large, it is likely that telework arrangements have also become more common in jobs without explicit reference.

Is this pandemic-induced increase in teleworking temporary or permanent? Controlling for firm and occupation fixed effects, we find that the impact of the Covid crisis can be observed in all affected months and grows even larger over time. Even when social distancing restrictions are relaxed and remote work is not required anymore in the summer, the impact prevails. These results are suggestive of a permanent change in teleworking habits.

3.4. The role of occupations and experience

To better understand the underlying mechanisms, we estimate changes in remote work options as of March/April 2021 for each major occupational group (2-digit ISCO code) separately. Fig. 4(a) plots the group-specific change in teleworking references by the share of references observed before the crisis. Analogue to our previous regression estimates, the likelihood of teleworking increases for most occupations. Overall, we observe a positive correlation between pre-COVID levels and increases. As expected, occupations with almost no references before the crisis are not affected because the associated tasks cannot be done from home. Instead, job postings for occupations with medium or
high levels of teleworkability, such as business and administration professionals, increase opportunities for remote work. Occupations in the group of IT and communication professionals, which frequently offered remote work already before the pandemic, exhibit similar increases. In relative terms, most of the large changes stem from occupations with medium pre-crisis levels. This is in line with the hypothesis that some employers refrain from offering telework even though the job would allow to work remotely. Due to the pandemic, teleworking has become a more common feature for these occupations.

Our fixed-effects regression estimates in Table 3 indicate that the rise in telework does not result from an underlying change in labor demand for specific occupations. To illustrate this finding, we compute the relative change in the number of vacancies by March/April 2021 for all major occupational groups and sort them by their pre-Covid share of remote work references. Fig. 4(b) shows no clear correlation between the change in vacancy inflow and the pre-pandemic level of teleworkability.

A major caveat of remote work is that information cannot be transmitted between employees of a firm as smoothly as at the workplace. Mokyr (2002) argues that one reason to bring workers under the same roof during the industrial revolution was for them to learn from each other. Even in our present days, one may worry that if workers interact remotely rather than in person, this learning channel might be disrupted. In that case, we should expect employers to be more willing to increase teleworking options for workers who are already trained and well-prepared for the job.

As shown in Table 1, teleworkable jobs require prior work experience more often than non-teleworkable jobs. Moreover, we find that the effect of Covid on teleworking is mostly driven by vacancies requiring work experience (see Table A1 in the appendix). This suggests that the increase in teleworking options during the pandemic benefited mainly experienced workers.

3.5. Robustness

Our measure of remote work is solely based on information provided by the employer in job postings. While this procedure allows to easily classify job ads, it is not clear to what extent short job descriptions can capture the full scope of teleworking options. To validate our measure, we consider two external occupation-level measures of remote work that have been used in recent related studies. Dingel and Neiman (2020) construct a teleworking measure ranging from zero to one, which is based on detailed task descriptions from the Occupational Information Network (O’NET). Hensvik et al. (2020) use the American Time Use Survey (ATUS) to estimate the share of work done from home. We merge both measures by ISCO-08 occupation to our dataset.²

Table A2 in the appendix reports high correlations between our teleworking measure, calculated in the pre-pandemic period, and the two external measures (O’NET and ATUS). Depending on the ISCO level of aggregation, the correlation coefficients range from 0.5 to 0.8. This shows that, by and large, all three measures lead to a similar classification of teleworkable occupations. Appendix Fig. A2 visualizes the relationship between our teleworking measure and the O’NET classification at the ISCO 2-digit level. Despite the strong correlation, some occupational groups such as teaching professionals are teleworkable according to O’NET but do not provide teleworking references, and vice versa. While, for example, many tasks of teachers could theoretically be done from home, it may not yet be a usual work arrangement for this group of workers.

Fig. 4(b) showed that occupations with more telework references are not in higher demand during the crisis. To test the robustness of this finding, we estimate crisis effects using the two alternative teleworking measures, O’NET and ATUS, as outcome. Because both measures proxy to what extent teleworking is feasible for a given occupation, we can only exploit variation across occupations. Again, positive coefficients of the Covid indicators would imply that the demand for teleworkable occupations has become relatively stronger. For comparison to our own measure, we also estimate regressions where the occupation-level share of teleworking references before the pandemic is the dependent variable. Note that, contrary to the teleworking indicator used in previous regressions, this outcome abstracts from vacancy-level differences. To make coefficients comparable, we normalize each measure to have mean zero and standard deviation one in the first month of observation.

Table A3 in the appendix shows that all three measures yield similar estimates. If at all, our results suggest that teleworkable occupations are slightly more affected by the downturn but the estimated coefficients are very small.

4. Conclusions

The COVID-19 pandemic has caused an unprecedented sudden shock to the labor market. Within days, many businesses were put on hold and a large share of the workforce was not allowed to return to their workplace. The shock was unique because, despite these restrictions, many jobs could still be done from home. This raises the question to what extent physical presence is still required when many workers can complete their tasks remotely in today’s economy. Improvements in IT and communication technologies have substantially increased the feasibility of teleworking over the last decades. Many firms might not have used these opportunities yet and still rely on traditional work arrangements. Some employers may fear that workers are less productive at home due to distractions and the lack of suitable equipment. If experiences with remote work during the pandemic are positive, this crisis might lead to persistent changes.

A large-scale switch to remote work represents a fundamental change in the labor market. If the physical location does not matter anymore for some occupations, workers become much more mobile and worker competition increases in the absence of local labor markets. Workers and firms will also be able to save commuting time and expenses.

Using data on Austrian vacancies, our analysis shows that employers have become more likely to offer teleworking to new hires. Due to the pandemic, some firms might have realized that telework is a feasible option for them. There is no evidence that the negative demand shock of the crisis is less pronounced for occupations that were already associated with teleworking before the pandemic. Using two alternative telework measures, we obtain very similar results. Other occupation-specific demand shocks may be correlated with the feasibility of telework and thus disguise increases in the demand for such occupations.

Can our results be interpreted as a structural change in the organization of work, or do they merely represent the mechanical effect of social distancing rules? One may argue that the increase in remote work references represents the response of employers to cope with social distancing and limited office space. However, since the end of the first lockdown in Austria, many employees could return to their workplace. Given that the estimated impact persists, we interpret the results as an actual organizational change, which may have long-lasting effects.

Appendix A

L.1 Teleworking key words: ‘home office’, ‘telearbeit’, ‘teleheimarbeit’, ‘zuhause arbeiten’, ‘arbeit zuhause’, ‘arbeiten von zuhause’, ‘working from home’, ‘home working’, ‘telework’, ‘heimarbeit’, ‘remote work’. (The teleworking indicator refers to vacancies with at least one case-insensitive match in the ad text.)
Table A1
Teleworking and job experience.

|                     | No work experience |         |         |         |
|---------------------|--------------------|---------|---------|---------|
|                     | (1)                | (2)     | (3)     | (4)     |
| March/April 2021    | 1.968***           | 1.085*  | 1.965***| 1.065*  |
|                     | (0.734)            | (0.628) | (0.731) | (0.632) |
| Work experience     |                     |         |         |         |
| March/April 2021    | 3.103***           | 2.793***| 3.163***| 2.778***|
|                     | (0.388)            | (0.368) | (0.387) | (0.368) |
| Occupation FE       | ✓                  | ✓       | ✓       | ✓       |
| Firm FE             | ✓                  | ✓       | ✓       | ✓       |

Note: Observations: 35,239 (No work experience) - 153,411 (Work experience). Estimates are reported in percentage points. The sample covers all job postings that require at least a degree from a higher secondary school. Fixed-effects groups with only one observation are excluded from the sample. All regressions control for region and extent of work. Pre-Covid outcome mean (January/February 2020): 1.343 (No work experience) - 1.578 (Work experience). * p<0.10, ** p<0.05, *** p<0.01.

Table A2
External occupation-level teleworking measures.

| ISCO-08 4-digit | ISCO-08 2-digit |
|-----------------|----------------|
|                 | Corr. coeff. | Groups | Corr. coeff. | Groups |
| Job ads - O’NET | 0.607        | 327    | 0.742        | 38     |
| Job ads - ATUS  | 0.678        | 323    | 0.744        | 38     |
| O’NET - ATUS    | 0.678        | 323    | 0.816        | 38     |

Note: Estimated correlations are weighted by the number of job ads in each group. Column 2 and 4 report the number of occupation subgroups for which data are available.

Table A3
Impact on teleworkable occupations.

|                     | Ad measure | O’NET measure | ATUS measure |
|---------------------|------------|---------------|--------------|
|                     | (1)        | (2)           | (1)          | (2)          | (1)            | (2)            |
| March/April 2020    | -0.029***  | -0.009        | -0.025***    | -0.022***    | -0.016**       | -0.021***      |
|                     | (0.006)    | (0.006)       | (0.006)      | (0.006)      | (0.006)        | (0.006)        |
| May/June 2020       | -0.034***  | -0.004        | -0.010*      | -0.012**     | -0.017***      | -0.016***      |
|                     | (0.006)    | (0.005)       | (0.006)      | (0.005)      | (0.006)        | (0.005)        |
| July/August 2020    | -0.015***  | -0.010*       | 0.012*       | -0.013***    | 0.002          | -0.014***      |
|                     | (0.006)    | (0.005)       | (0.006)      | (0.005)      | (0.006)        | (0.005)        |
| September/October 20| -0.023***  | -0.012**      | 0.009        | -0.016***    | 0.014**        | -0.012***      |
|                     | (0.006)    | (0.005)       | (0.006)      | (0.005)      | (0.006)        | (0.005)        |
| November/December 20| 0.005      | -0.005        | 0.040***     | 0.004        | 0.026***       | -0.009         |
|                     | (0.007)    | (0.006)       | (0.007)      | (0.006)      | (0.007)        | (0.006)        |
| January/February 2021| -0.002    | -0.014*       | 0.036***     | -0.006       | -0.002         | -0.031***      |
|                     | (0.009)    | (0.008)       | (0.009)      | (0.008)      | (0.009)        | (0.008)        |
| March/April 2021    | -0.005     | -0.021**      | 0.057***     | 0.002        | 0.002          | -0.025***      |
|                     | (0.009)    | (0.009)       | (0.009)      | (0.008)      | (0.010)        | (0.009)        |

Firm FE ✓ ✓ ✓

Note: 1,256,570 observations. Fixed-effects groups with only one observation are excluded from the sample. All measures are normalized to have mean zero and standard deviation one in February 2020. All regressions control for region, extent of work, required work experience and level of education. * p<0.10, ** p<0.05, *** p<0.01.
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