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**Conference Paper**

## Working from Home for Good? Lessons Learned from the COVID-19 Pandemic and What This Means for the Future of Work

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**WORKING FROM HOME FOR GOOD?  
LESSONS LEARNED FROM THE COVID-19 PANDEMIC AND WHAT THIS  
MEANS FOR THE FUTURE OF WORK\***

*Christian Kagerl\*\**

*Julia Starzetz\*\*\**

*February 26, 2022*

**Abstract**

In the wake of the Covid-19 pandemic, more firms than ever before have enabled their employees to work from home. Based on a unique establishment survey conducted in Germany, this paper provides suggestive evidence concerning the effects of working from home (WFH) at different points in time during the pandemic and discusses implications for the future of work. We assess the potential of WFH in Germany to be 25%-30% of private-sector employees. On the firm side, we find that higher WFH use is inversely related to business success during the crisis, with avoided personnel shortages and increased employee productivity being possible mechanisms. Larger firms in particular are open towards expanding their WFH offerings after the pandemic. However, working on site brings advantages firms will not want to sacrifice, pointing towards a hybrid model of work in the future.

*JEL Codes:* D22, J24, M21

*Keywords:* Working from home, remote work, Coronavirus, Covid-19, firms

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## 1. Introduction

Beginning with the lockdowns in March 2020, the Covid-19 pandemic has forced firms to move much of their work from corporate offices to their employees' homes. Within a few days, firms were required to revise entire work processes and to replace, where possible, the otherwise common face-to-face contact with digital alternatives. The effects of this shift in the way of working are of interest to researchers and practitioners alike, and, with this paper, we aim to contribute by presenting early findings on the role of WFH during the pandemic in Germany and discussing its implications for the future of work. Based on data available to us, we consider the following questions: Who enables WFH? What experiences have companies had with WFH during the lockdowns? How have firms which enabled WFH weathered the crisis and was the intensity of WFH use related to business success? Is WFH establishing itself as a new, relevant form of work which is thus becoming a central component of a new mode of working after the pandemic has subsided?

In this paper, we are focusing in particular on the firms' point of view and thus add value by bringing a new perspective to an area of research which has predominantly concentrated on employees so far (e.g., Baumann and Kohlrausch 2021, Barrero et al. 2021a, Emanuel and Harrington 2021, Etheridge et al. 2020, Sahni 2020, Yang et al. 2021). Compared to other studies which are also considering the firm perspective (e.g., Bartik et al. 2020, Erdsiek 2021), we differ in that we use a comprehensive data set that is representative of the German economy as a whole and which allows an analysis over time as it is based on surveys conducted at different times during the pandemic. To the best of our knowledge, there is no other study to date that provides a thorough overview of WFH during the Covid-19 pandemic, in terms of both temporal variation as well as thematic diversity.

In the remainder of this paper, we will use the term "working from home" (WFH) to refer to a concept that describes the work of an employee in his or her private sphere and that, unlike teleworking, does not necessarily require a fixed workstation (Backhaus et al. 2021a). This term best describes the reality that could be observed during the pandemic, since due to the rapid progression of events in early 2020, hardly any conventional workstations could be set up at the employees' homes, but most employees have created a more or less improvised workplace for themselves.

We find that, with the first Covid-19 infections in the beginning of 2020, there was a sharp increase in companies enabling WFH which reached a constantly high level of almost 50% during the course of the crisis. Calculations regarding the WFH potential, i.e., the proportion

of employees who can potentially work from home, show a share of 25-30% of private-sector employees which was almost completely exhausted, especially during lockdown periods in early 2021. Moreover, we find suggestive evidence that WFH companies were less frequently affected by negative consequences of the pandemic. Among mechanisms explaining this observation are the prevention of personnel shortages through the reduction of employees' risks to get infected and having to quarantine, general productivity increases by employees as well as productivity increases made possible by investments in digital technologies. Regarding a post-Covid-19 future, the majority of larger companies (with more than 250 employees) plans to expand their WFH offering as compared to the time before the crisis. Overall, WFH seems to work well in many companies (e.g., the companies' assessments of work ethic/team spirit, of productivity of employees, and of quality of work are net positive) although there are also areas which confronted companies with difficulties (e.g., communication, on-boarding of new employees). In particular for smaller firms that plan to continue remote work, working exclusively or predominantly remotely seems to be an option while larger companies are more likely to plan a hybrid way of working that, in addition to WFH options for up to two days per week, includes regular office attendance.

This paper is structured as follows: Section 2 gives an overview of the current state of research. In this context, we present findings from before and the most important early results from during the Covid-19 pandemic, also providing a timeline of events in Germany that were relevant for WFH during the crisis. Then, we turn to the establishment survey, describe the data set (Section 3), and outline the key results in three steps. First, we present general firm-level results regarding WFH before and during the Covid-19 pandemic (Section 4). Second, we investigate the impact of WFH on establishments during the Covid-19 pandemic, also considering possible mechanisms (Section 5). Third, in Section 6, we discuss firms' plans for WFH after the pandemic has subsided. Section 7 concludes.

## 2. Literature Review

With the spread of the first information and communication technologies (ICT), the idea emerged that employees could perform tasks from outside their offices. For the first time in the 1970s, in order to reduce commuting times, employees in the information industry in the US were enabled to do their work close to or from their homes (Nilles 1975). While the opportunities were also gaining attention in other industries and countries, during this initial phase, work was stationary and usually done at home due to the nature of the technologies available at this time (Messenger and Gschwind 2016). But as the technologies have changed since then, so have the possibilities. With the emergence of even smaller and lighter devices, work has increasingly become independent of place and time. Particularly through the extensive development of cloud technologies, workers are now no longer dependent on specific hardware but can rather access their “virtual office” from several different devices which can be as small as a smartphone or a smartwatch.

While more and more employees are being given the opportunity to work from home, it is not yet completely resolved how WFH affects employees’ performance and thus a company’s overall results. Basically, the question is whether employees use the autonomy they gain through WFH to shirk, since they can no longer be monitored so well, or whether their intrinsic motivation increases as a result with a positive impact on employee effort. While supporters particularly emphasize the positive effects on a better work-life balance, employee satisfaction, and thus employee motivation, which are supposed to go hand in hand with a better performance, others doubt whether these positive effects are present at all and claim that employees use the greater autonomy to shirk. Yahoo, HP and IBM are well-known examples of companies in which the management has restricted or even completely abolished the possibility of WFH, which had existed for years (Cirigliano and Niemeyer 2020). In these cases, the reasons given were a lower willingness to perform on the part of WFH employees and a lack of communication and interaction possibilities within and between organizational units (e.g., Green et al. 2020). This corresponds to the often-invoked lack of “water-cooler conversations” when WFH that supposedly leads to declining employee creativity and less innovation<sup>1</sup>. Overall, for most companies, letting employees work from home implies decentralization of decision-making, which can be perceived as a strong loss of control (Aghion et al. 2014).

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<sup>1</sup> For example, the CEO of JPMorgan, Jamie Dimon, stated in the Annual Report of 2020 (JPMorgan Chase & Co., 2020, p.46) that “[...] remote work virtually eliminates spontaneous learning and creativity because you don’t run into people at the coffee machine, talk with clients in unplanned scenarios, or travel to meet with customers and employees for feedback on your products and services.”

The difficulty in fully encompassing the effects of WFH lies, among other things, in the complexity of the measure which is very closely related to many different aspects of employees' professional and private lives (e.g. work-family conflict, job satisfaction, health outcomes, career perspectives, interpersonal cooperation, innovation) the effect of which is often, also from a theoretical perspective, open (Allen et al. 2015). In addition, there are disagreements about the definition of WFH, about how it should be measured and there are few experimental settings which allow meaningful results (Bloom et al. 2015, Dutcher 2012). However, in these cases, mainly positive effects of WFH on productivity can be found. Moreover, Rupiotta and Beckmann (2018) find that the more is worked from home, the more pronounced the effect on employee effort.

On January 27, 2020, the first Covid-19 infection was reported in Germany and within a very short time period the whole country found itself in a state of emergency. From March 22, 2020, public life was largely shut down for the first time. Citizens were asked to isolate themselves as much as possible, to reduce personal contacts and to leave their homes only for absolutely necessary matters. This often had an impact on working life as well, because, regardless of the previous opinions and experiences with the topic, suddenly more or less every company had to deal with the option to let employees WFH where tasks made that feasible.

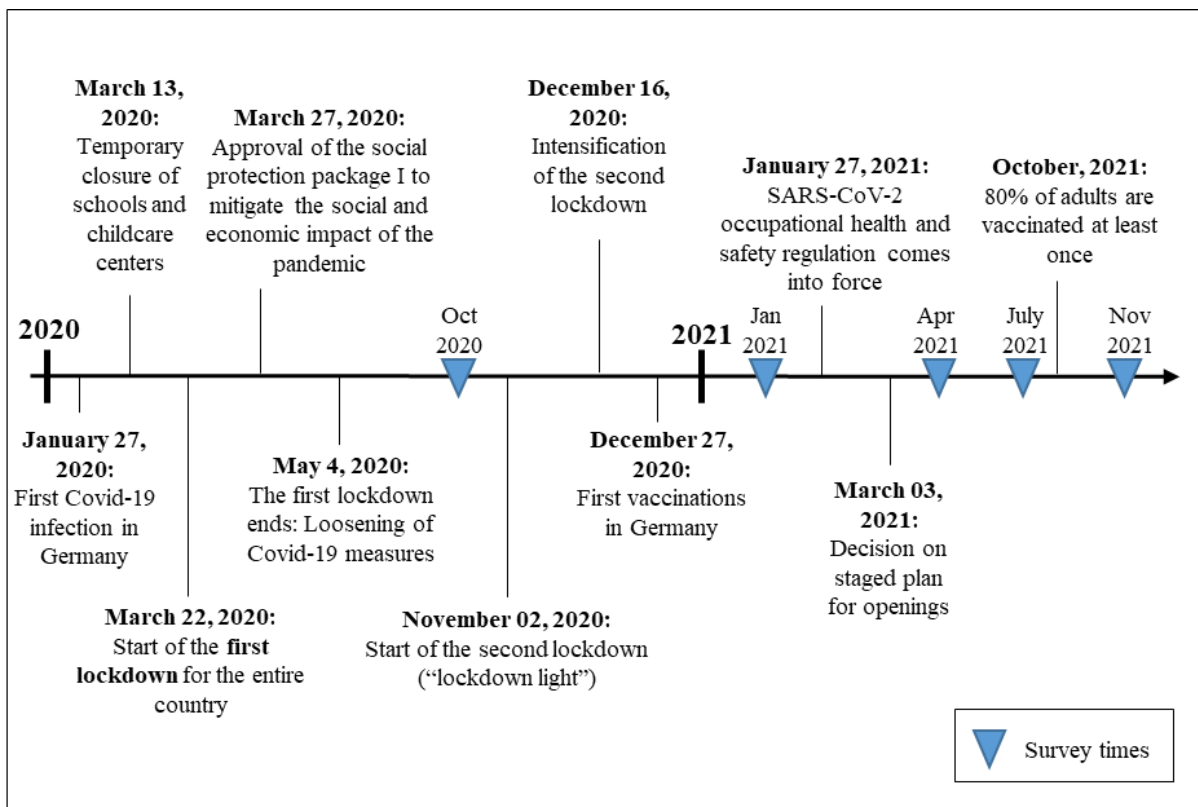
According to the International Labor Organization (2020), globally, more than 15% of jobs could be done from home. In advanced countries (like Germany), this proportion is estimated to be around 25% by the ILO. Based on a job classification conducted by Dingel and Neiman (2020), the projected share is even higher, at 37% in the US. However, in order to realize these potentials, possibly expensive investments in the technical infrastructure are necessary. Accordingly, jobs that can be performed from home are primarily well-paid jobs which also explains why countries with a lower income level have a lower WFH potential. These disparities related to countries, income, and education are also highlighted by other studies which is why already existing inequalities between countries may increase further in pandemic times (Adams-Prassl et al. 2020, Adams-Prassl et al. 2022, Bartik et al. 2020, Barrero et al. 2021b, Bick et al. 2020, Bonacini et al. 2020, Gottlieb et al. 2020, Hatayama et al. 2020). Furthermore, there are also differences in the industries and hierarchy levels in which WFH is possible or more common. Here, again, it is often the case that more highly qualified, often non-physical employees are more likely to be able to WFH and were laid off less frequently during the current crisis period than if they have had a lower level of education and did physical work (Bartik et al. 2020, Brynjolfsson et al. 2020).

In the current literature on WFH during the Covid-19 pandemic, some studies have addressed the effects that the rapid increase in WFH has had on both employees and employers. Among the positive experiences employees have had while working from home in the last few months is an improved work-life balance and work efficiency as well as greater work control (e.g. Angelici and Profeta 2020, Ipsen et al. 2021). Negative effects were particularly evident in the form of declines in mental well-being, in difficulties to perform work when family obligations had to be fulfilled at the same time and in WFH not being a perfect substitute to office work due to, e.g., the lack of (technical) equipment and/or the limitations of virtual collaboration (Etheridge et al. 2020, Ipsen et al. 2021). When mentioning these disadvantages or negative effects of WFH, however, it is also important to point out the exceptional situation that prevailed during this period, for example, school closings and contact restrictions in general. In terms of productivity, the available studies found no or hardly any negative effects, rather, being able to work from home seemed to help mitigating the negative effects of the crisis (Ali-pour et al. 2021b, Angelici and Profeta 2020, Etheridge et al. 2020).

Regarding the future of WFH after the pandemic, based on an employee-level study, Barrero et al. (2021a) found evidence that there will be a strong shift towards more WFH which can be explained, at least in part, by a reduced stigma regarding WFH. Accordingly, negative expectations were often not confirmed. On the contrary, WFH worked better than expected in most cases. Consequently, these developments should have positive effects in the long term as should the fact that many places have invested in a technical infrastructure. For Germany, Bellmann et al. (2021) document an increase in investments in digital technologies in the wake of the pandemic, concentrated among larger employers and knowledge-intensive sectors. These investments are strongly tied to changes in WFH with firms particularly spending on hardware, communication software (e.g. Zoom, Microsoft Teams) and remote access capabilities. Based on the changes made during the pandemic, Barrero et al. (2021a) further predict that productivity will increase as soon as the crisis have been overcome. Erdsiek (2021), who presents the results of an employer survey which is representative for the German information and manufacturing industries, also expects more work to be done from home even after the pandemic. Similar to the study by Barrero et al. (2021a), he justifies this by the employers' positive experiences made with WFH, for example, barely any negative productivity effects could be observed, and by the technical progress and the far-reaching investments made in this very short time frame.

Figure 1 displays important events and decisions with regard to our research question during the Covid-19 pandemic in Germany as well as the times when surveys of the Institute for Employment Research with questions about WFH were conducted. Germany was for the most part in lockdown between March and May 2020 and between November 2020 and March 2021. During these periods, public life was kept to a minimum and citizens were instructed to socially distance themselves to the greatest possible extent. Many companies suffered greatly from these restrictions and were helped in the form of social protection packages to mitigate the social and economic impact of the pandemic. For example, access to short-time work was simplified and other relief schemes were implemented. During the second lockdown, which was initially announced as a “lockdown light” and which was further intensified after one and a half months, SARS-CoV-2 occupational health and safety regulation came into force. In this context, distance and hygiene measures were defined and employers had to allow WFH wherever feasible. This WFH obligation ran out as of July 1, 2021. In October 2021, more than 80% of adults were vaccinated at least once in Germany (RKI 2021).

Figure 1: Chronology of the Covid-19 Pandemic in Germany



Source: Own graphical illustration based on reports from the German Federal Ministry of Health (2021), Handelsblatt GmbH (2021), Deutsche Welle (2021)



With regard to the chronology of the Covid-19 pandemic in Germany displayed in Figure 1, the question arises as to what effects could be observed over the course of time with respect to WFH. Based on the data set introduced in the next section and approaching the topic from the companies' perspective, we examine whether the literature's findings discussed so far can be confirmed, what specific experiences have been made in Germany and whether there have been changes throughout the pandemic's phases.

### 3. Data

We analyze data from an establishment survey<sup>2</sup> that was repeatedly conducted by the Institute for Employment Research in Germany during the Covid-19 pandemic (Backhaus et al. 2021b). Starting in August 2020, 1.500 to 2.000 establishments were surveyed roughly every month on the varied effects of the crisis and how firms have adapted to it. Due to the high frequency of survey waves, the study is designed as a rotating panel, i.e. after about half a dozen participations, establishments were rotated out of the sample in order to ease the burden and keep response rates stable. As the sample is drawn from administrative data from the federal employment agency that contains the universe of establishments, descriptive results from each wave are weighted to be representative of all privately owned establishments in Germany. In addition to a set of always recurring questions on the direct effects of the pandemic and the measures to contain it, waves have changing thematic focal points. The topic of WFH was covered in multiple instances, first in October 2020 and then at various points during 2021, with questionnaires focusing, among other things, on which firms made how much WFH possible, how they see WFH affecting their operations, how they assess the future of WFH, and which reasons are pertinent in establishments wanting to (not) increase the possibilities of WFH.

The surveyed responses are further linked with administrative data on the establishments from before the onset of the pandemic coming from the Establishment History Panel (BHP) (see Ganzer et al. (2020) for more details). The key advantage of these administrative records is that they allow us to observe establishment characteristics that are not available from surveys, e.g. median wages within firms and the employment trend for the years prior to the crisis. Particularly relevant for the topic of WFH is the information on the workforce composition. We observe the shares of employees by gender, by nationality, and – crucially – by occupational requirement levels as well as by broad occupational groups.

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<sup>2</sup> While the units of observation are explicitly establishments, we will interchangeably refer to them as firms or companies throughout the text.

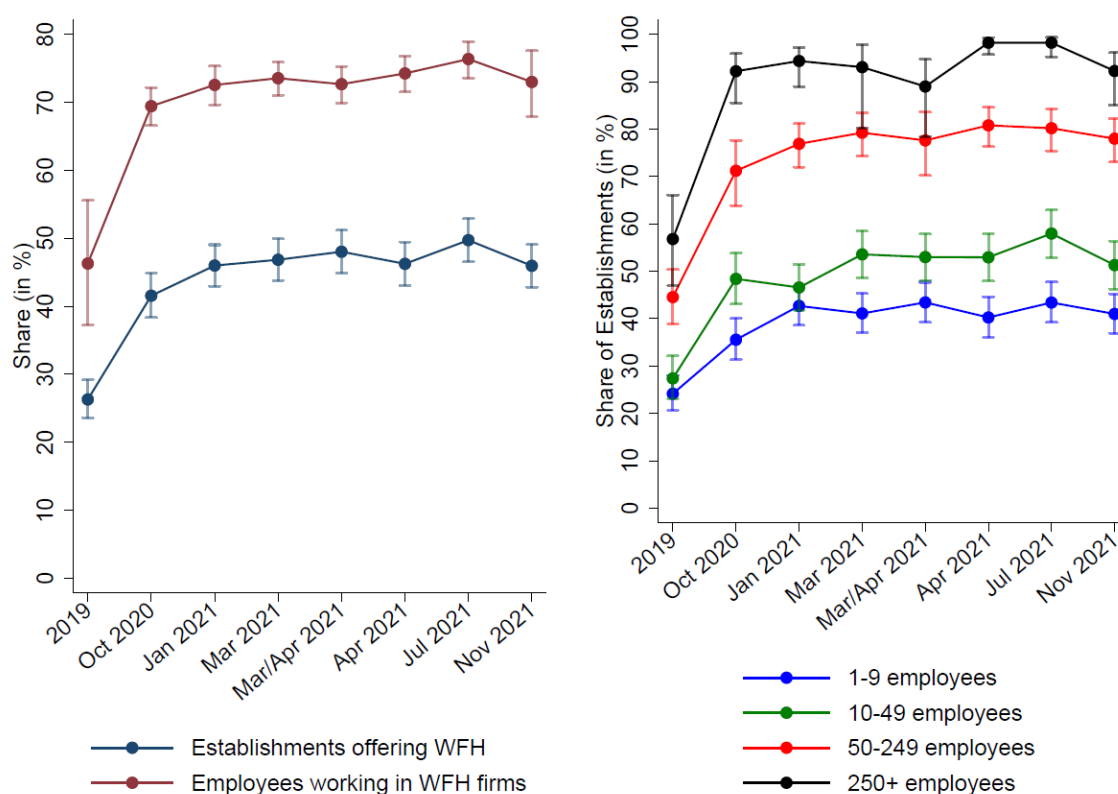
## **4. WFH before and during the Covid-19 pandemic**

How much was worked from home before and at different points in time during the pandemic? Which kind of companies have made WFH possible? What are the barriers to WFH and why are companies reluctant to implement WFH? This first step is intended to give an overview of what has happened in the months of the pandemic in Germany with regard to WFH and on how profound changes were in comparison to before Covid-19 hit the country.

### **4.1. WFH over the course of time**

First, we consider the extensive margin of WFH, i.e. which establishments implemented WFH. Figure 2 shows the share of establishments that enabled WFH for (at least a part of) their workforce between 2019 and 2021 and the proportion of employees that work in these establishments (left panel). Whereas before the pandemic, 25% of establishments enabled WFH, nearly half did make it possible in the summer of 2021. Many establishments have had their first ever experience with WFH when the pandemic started as 40% of establishments that resorted to WFH in the crisis have not made it possible at all for their workforce before the pandemic hit. While the share of establishments enabling WFH was roughly 50% in 2021, that half accounts for 75% of employees in Germany, hinting at strong differences by firm size. Yet, as we show below in Section 4.3, WFH is often only possible for a subset of an establishment's workforce. In the right panel of Figure 2, differences in establishment size are displayed. WFH was made possible in many large firms from very early on in the pandemic and this level has remained stable at over 90% since. Smaller establishments – which constitute around three quarters of the approximately 2.1 million establishments in Germany – switched less often to WFH initially, but an increase could be recorded over the course of the crisis, from 36% in October 2020 to 43% in July 2021.

Figure 2: WFH over time in establishments and by establishment size



Notes: Establishment shares are weighted to be representative of all private-sector establishments in Germany, the employee share is representative of all private-sector employees in Germany. 95%-CIs are shown. The information on WFH before the pandemic was asked retrospectively in 2021. Since firm exit regulation changed during the pandemic, fewer firms were exiting than before, making it very unlikely that the values for 2019 exhibit a survivor bias.

The relevance of establishment size for enabling WFH is also borne out by regressing the binary indicator of WFH possibility on a broad range of variables to determine what correlates with the adoption of WFH. As shown in Table A1 (in the Appendix), a regression pooled across the survey waves yields that establishments with 250 or more employees have, on average throughout the crisis, a probability of enabling WFH that is 40 percentage points higher than for small establishments with less than ten employees, conditional on holding different firm attributes and the workforce composition fixed. Apart from the strong gradient in establishment size, some other variables have robust associations with WFH. Among others, establishments in the ICT sector as well as firms active in the service industry are more likely to offer WFH relative to production firms. Both export activity and higher log median wages correlate strongly positively with the possibility of WFH. Further, there is a positive time effect with WFH being significantly more likely to be offered in the first half of 2021 compared to October 2020. Also, as one would expect from the literature discussed above, the workforce composition plays a prominent role. More specifically, here, the firms' shares of requirement levels

from 2019 were used as a proxy for the occupational structure. Requirement levels describe what level of skills are demanded within occupations. These are closely linked to education<sup>3</sup>, e.g. the majority of Germans works in specialist occupations (the omitted category in Table A1), which require having completed vocational training. Similarly, highly complex occupations usually necessitate a university degree. Tasks, on average, become more cognitively oriented, more abstract and more analytical with an increasing requirement level, therefore making those occupations more amenable to WFH. Indeed, estimates from Table A1 suggest that a share of highly complex occupations that is 10 percentage points larger, *ceteris paribus* robustly increases the probability of offering WFH by about 6 percentage points.

#### **4.2.Barriers to WFH**

Although there has been a major increase in WFH use in the pandemic as compared to before the pandemic, there is still a fairly large proportion of companies that do not offer WFH at all, despite the general situation during the pandemic requiring that as many employees as possible actually work from home in order to minimize the general risk of infection. This leads to the question of the barriers that make WFH infeasible, or the barriers because of which employers are reluctant to introduce WFH options. In the fourth survey wave, in October 2020, establishments which did not offer WFH were surveyed on the reasons for this decision. The majority of companies that did not offer WFH stated that this was due to a lack of suitability of the tasks being performed within their company (98%). Other reasons, more widespread among small establishments, were the lack of technical equipment such as mobile devices and access to company servers (37%) as well as that data protection and data security regulations generally did not permit it or would make the implementation of WFH prohibitively expensive (25%).

While activities that are not suitable for WFH are probably difficult to change in the short term, the proportion of WFH establishments could presumably be increased through targeted adjustments with regard to the two other barriers mentioned. In Section 5, we will discuss the role of investments in technical infrastructure in more detail. Concerning data protection, it is important to note that cybersecurity threats, which were already assessed as a considerable risk prior to the pandemic, have now taken a new dimension as the vulnerabilities companies faced

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<sup>3</sup> Throughout the paper, we focus on shares of requirement levels instead of education or schooling shares for multiple reasons. First, education variables in the BHP contain imputations but still leave a significant portion of persons with missing values. Second, the requirement levels come from the fifth digit of the occupational code and thus more closely capture the type of tasks being performed, e.g. eliminating potential mismatch. Third, as elaborated on in the main text, the requirement levels correspond to relevant qualifications in the German labor market.

in these times of crisis have increased the opportunities for cyber criminals to do harm (Ahmad 2020, Williams et al. 2020, Pranggono and Arabo 2021). Accordingly, companies that offered WFH during the pandemic were increasingly facing problems due to phishing and ransomware attacks which specifically exploited the concerns and difficulties of individuals in setting up a workspace at their homes by themselves. However, in general (also irrespective of WFH), the pandemic has exposed many (cyber) security gaps which, on the one hand, explain the companies' concerns in terms of allowing WFH but, on the other hand, reveal the general need for the revision of companies' security concepts, although cyber defense may require costly investments in technical infrastructure as well as in employee training.

### **4.3.WFH potential**

Even though about three quarters of all employees in Germany work in firms which enabled WFH at least to some degree during the pandemic, not all occupations and tasks performed in these establishments were also done (or doable) from home. For example, a large plant might have sent some administrative staff to WFH, but out of necessity retained physical presence for production workers.

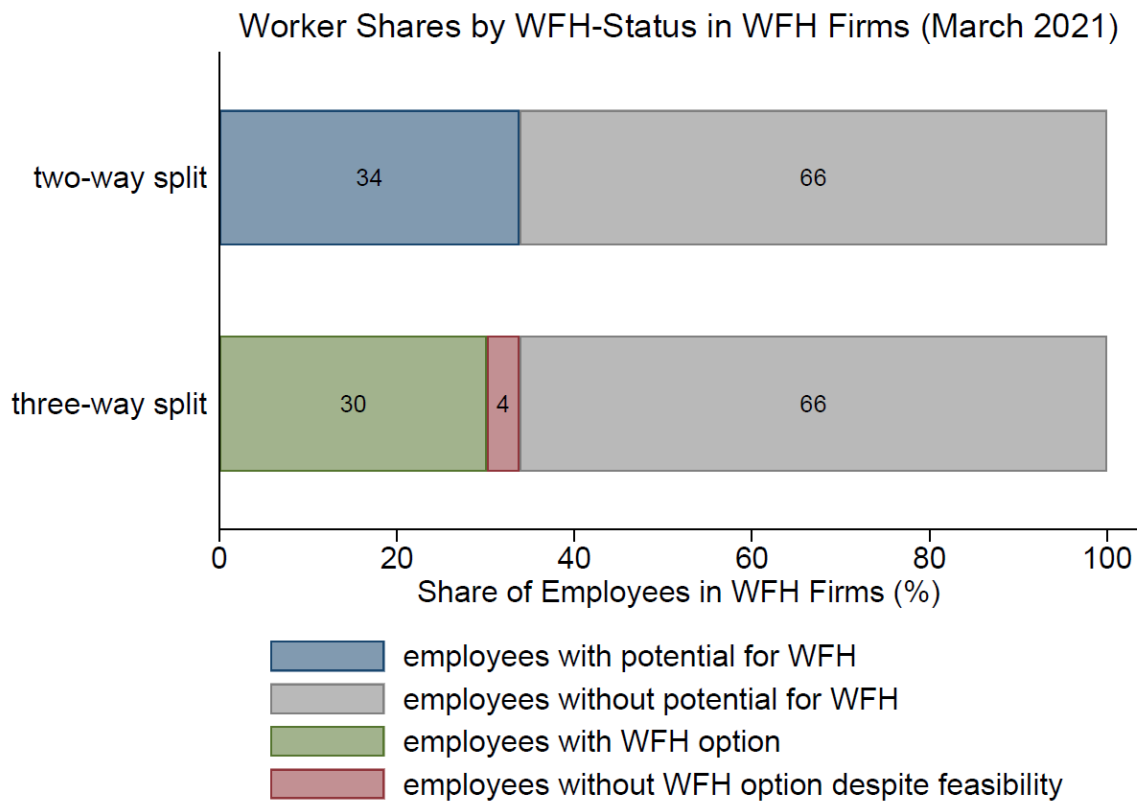
Within the survey, employers offering WFH were asked about how many employees they deem able to WFH in theory based on to their task structure (we call this the "WFH potential") and, subsequently, how many were actually given the option to WFH<sup>4</sup>. Specifically, we split an establishment's workforce into various subgroups: First, there is the share of employees that could WFH ("employees with potential for WFH") which is defined as the number of potential remote workers as judged by the establishment divided by the total number of employees. The second subgroup ("employees without potential for WFH"), defined as the proportion of employees who cannot work from home due to their tasks, by construction adds up to 100% with the first subgroup; all employees can therefore be mapped into these two subgroups. However, the first group can be split up once more by how many employees were actually given the opportunity to work remotely. This results in, on the one hand, the share of employees that was given the option to WFH and, on the other hand, the share of workers with jobs feasible for WFH but without the opportunity to do so. This last group can be interpreted as the unused

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<sup>4</sup> Intermittently, the survey further asked how many employees were actually WFH, either fully or partially. But apart from fully remote situations, firms might not be able to accurately answer this when employees have flexibility regarding WFH. In order not to conflate employee reasons for not WFH (e.g., wanting to set boundaries between personal and work life) with employer reasons, we take the share (or number) of employees that have the possibility of WFH to be the variable of interest. Moreover, since we investigate establishment level outcomes, the offering of WFH more closely reflects the WFH decisions of firms.

potential of WFH. On average, across WFH firms, about half of the workers are classified as being able to WFH in theory. Yet, weighting by overall employment suggests that two thirds of all employees across WFH establishments do jobs unsuitable for WFH. Using employment weighted proportions and March 2021 as an example, Figure 3 exemplifies how the workforce in all WFH establishments can be split up into the aforementioned groups.

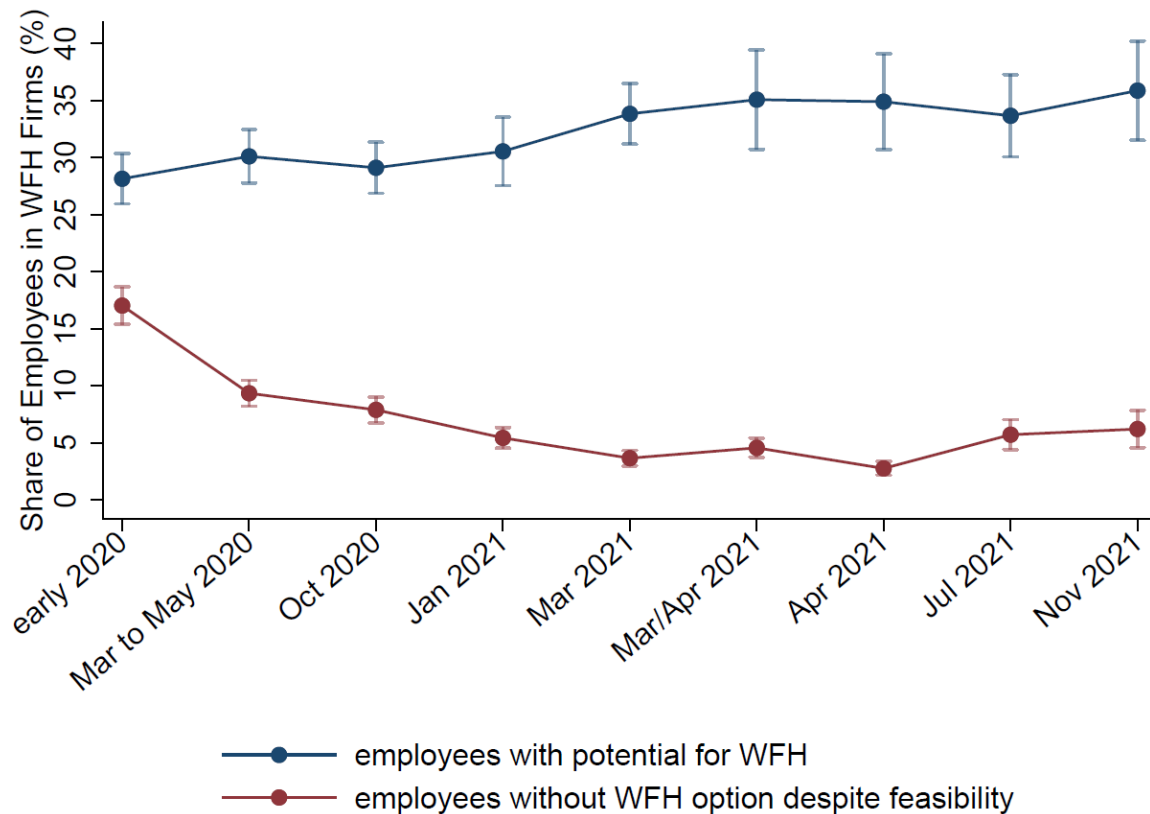
Figure 3: Types of WFH Shares



*Notes: Shares are employee-weighted.*

Figure 4, for all firms that offer WFH, then plots how two of these proportions, the WFH potential and the unused WFH potential, have developed over the course of the pandemic. The WFH potential has increased slightly, but not significantly so, likely tied to the fact that short-time work prevented many layoffs in Germany. However, establishments extended the possibility of WFH to a growing number of their employees with suitable tasks. While, before the pandemic, more than half of the potential went unused, this share has almost steadily dropped until spring 2021, before significantly increasing again afterwards.

Figure 4: (Unused) WFH potential in WFH firms over time



Notes: Shares are employee-weighted. 95%-CIs are shown. The information on WFH right before the pandemic was asked retrospectively in October 2020. Since firm exit regulation changed during the pandemic, fewer firms were exiting than before, making it very unlikely that the values for early 2020 exhibit a survivor bias.

Given the data at hand, no causal explanation can be discerned, but there are multiple potential factors that could explain this development. The trends in the WFH potential, for example, line up with temporary regulations aimed at containing the pandemic that were put into place by the German Federal Government between January and June 2021. The SARS-CoV-2 Occupational Health and Safety Regulation, which was in force in this time period, included measures for reducing the likelihood of infection while at work, e.g. through mandating that employers offer antigen tests. In 2021, from January until the end of June, establishments were also required to make WFH possible for all employees unless the establishment had explicit reasons against WFH. While the unused WFH potential declined after the regulation took effect and increased again after it ran out, this could also be due to other reasons. For one, the virus was surging in winter and ebbed going into spring and summer along with vaccinations becoming available to all adults, potentially leading firms to adjust their WFH offers. However, country case numbers of Covid-19 show no association with the WFH possibility in the pooled sample and there is no change in the usage of the potential in November 2021 despite a strongly increasing number of infections during that month. Furthermore, the WFH possibility could also

depend on employee demands unrelated to federal regulations. In general, though, most workers in Germany with the opportunity to work from home had access to it during the pandemic. Although no direct evidence is available to us on employees' take-up of WFH possibilities before the pandemic, it stands to reason that many more workers actually used their WFH offer or, in some instances, were even forced into WFH by their employers. Roughly 20% of establishments (mostly larger ones) had at one point until November 2021 obligated their employees to WFH and recommendations for using WFH were given in over 60% of firms.

The results also allow to calculate the share of workers (excluding the public sector as it is not part of the survey) in Germany who have the potential to WFH. Multiplying the approximately 75% of all workers accounted for by WFH firms with the roughly 33% of feasible jobs within those companies yields a WFH potential of about 25% of the workforce. Prior results for Germany vary widely – 29% are estimated by Boeri et al. (2020), 37% is the number by Dingel and Neiman (2020) and 56% according to Alipour et al. (2021a) – placing our estimate at the lower end of the spectrum. Importantly, most measures rely on job characteristics or on worker-level evidence, e.g. from surveys on tasks, while our number uses estimates from employers. Therefore, it is likely that establishments resort to a narrower definition of who can work from home, for example by judging employees to not be among the potential WFH group if a small share of their tasks could be done from home since it would possibly not make much sense to have these workers WFH from the business's perspective. Such a conceptual difference between *theoretical* and *practical* WFH capacity could explain the wide discrepancies in the estimated potentials. Further, our estimate should be interpreted as a lower bound since there might be untapped potential among the establishments never offering WFH (which we would miss), although that is likely to be small with many of such firms clustering in sectors like hospitality or construction. Still, to provide some insight on the potential scale of the underestimation, we take the potential share of WFH as the dependent variable in a (fractional response) logit model, regressing it on a rich set of survey and administrative variables<sup>5</sup>, pooling the survey waves. Specifically, we only consider the first appearance of a firm in the survey, exclude those establishments that do not offer WFH at all (for which we have no information on the potential) and use the estimated coefficients to predict the potential WFH share for *all* establishments, including those never making WFH possible. Using the predictions from this

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<sup>5</sup> Included are sector, size, age, exporter status, works council existence, German ownership, median wage, county type, mean age as well as employee shares by gender, nationality, minor employed, trainees, occupational requirement levels and nine broad occupational groups – also see Ganzer et al. (2020) for variable definitions.



exercise in combination with the employment weights suggests an economy-wide WFH potential of 30%. Because the independent variables cannot fully capture differences in the potential between WFH and non-WFH establishments, the estimation relying only on WFH firms makes the resulting proportion very likely an upper bound. Therefore, overall, the firm survey results suggest that there is a WFH potential between 25% and 30% in the private sector in Germany.

## 5. Impact of WFH on establishments during the Covid-19 pandemic

Apart from reducing contacts and thereby aiming to slow the spread of SARS-CoV-2, what were the experiences and effects of increased WFH use on establishments? Was WFH an extra burden during a severe economic crisis or a useful tool for successfully weathering it? What are mechanisms through which any effects manifest themselves? We now turn to these questions.

### 5.1. WFH and Business Success

At first, we examine how the use of WFH is related to various measures of business success during the pandemic. We run regressions of the following type to establish first suggestive evidence:

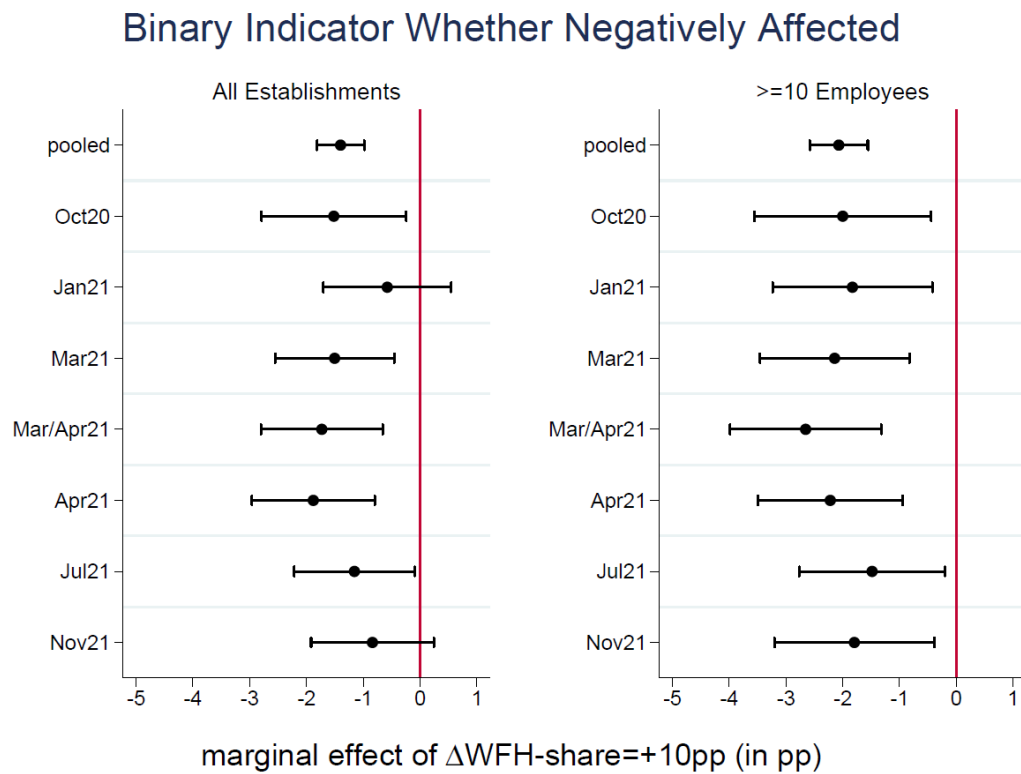
$$Y_f = \alpha + \beta * WFHshare_f + \gamma * X'_f + \varepsilon_f \quad (1)$$

The independent variable of interest is the WFH share of a firm  $f$  that is equal to zero if an establishment has no WFH option and lies between zero and one for the other firms as calculated by the employers' responses regarding the share of employees allowed to work from home at the time of the survey.  $Y$  refers to a selection of outcome variables which reflects how strongly the respective company was affected by the crisis that were also queried with regard to the survey's timing. These variables include the subjective assessment of whether the firm is negatively affected by the pandemic, whether revenue has decreased relative to the same month one year earlier (and before the crisis), whether liquidity reserves would suffice for the next two months if the situation would remain unchanged and the share of employees in short time work.  $X$  captures a rich set of control variables, motivated by the correlating factors of WFH adoption shown in Section 4 (and Table A1 in the Appendix). Included is the sector along the dimensions of knowledge intensity and production/services, capturing the stronger orientation to WFH especially in knowledge-intensive services. Whether an establishment is part of a larger company and the establishment size in categories account for the increased propensity

among larger employers (see Section 4). Further variables from the survey cover the exporter status, foreign ownership and the existence of a works council. Regional information on the county level (East/West Germany as well as four categories for the urban/rural split) resulting from administrative records are, even after holding employee structure and firm characteristics fixed, related to WFH. For the same reason, the worker shares according to the occupational requirement levels are included. One further variable we add is the employment trend from 2016 to 2019 coming from the BHP, since this pre-trend can capture differences in business strength and viability that existed before the crisis. The remaining controls are the median wage, the average age as well as employee shares of German nationals, women, minor employees, apprentices, and temporary workers. Given the multiple survey times, we estimate effects separately for each wave and also run the regressions on the pooled data, further incorporating a set of time dummies there.

Using a dichotomous variable for being negatively affected by the pandemic at the time of the interview, Figure 5 shows average marginal effects of the WFH share from logit regressions. The left panel considers all establishments, whereas, in the right panel, the sample is restricted to those with more than nine employees. We have included this smaller sample as the share-based WFH variable can be volatile in very small establishments. In general, the estimates suggest that increasing the WFH share by about ten percentage points *ceteris paribus* decreases the probability of reporting negative consequences due to the pandemic by 1.5 to 2 percentage points. When excluding the smallest firms, estimates are relatively stable. In the full sample, the effect of WFH is also significant for the most part, but seems to be less strong after the wide availability of vaccines in the second half of 2021.

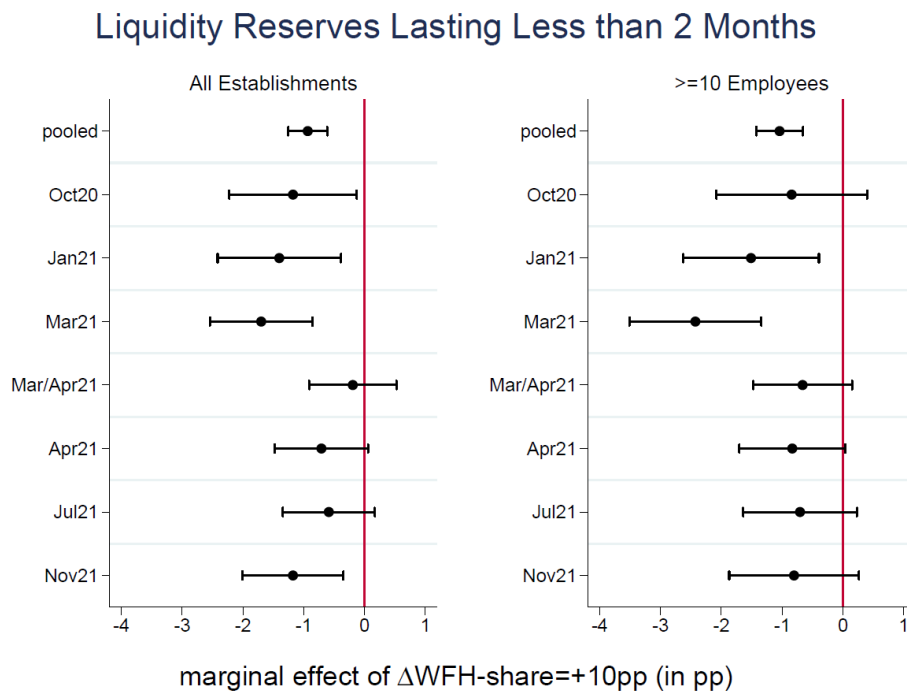
Figure 5: WFH and Crisis Effects



*Notes: Marginal effects and 95%-CIs from logit-regressions with robust standard errors are shown. The regressions include all the controls which are mentioned in the text. Pooled specifications further contain time dummies.*

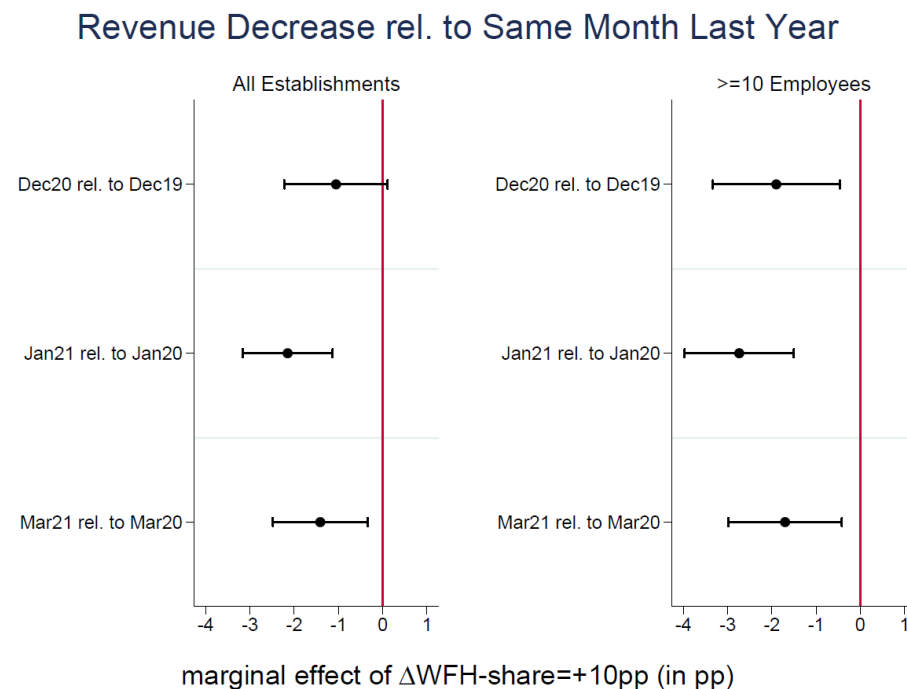
Moving on from the potentially somewhat ambiguous subjective assessments of the pandemic, we turn to measures of liquidity and of revenue change. Figure 6 plots coefficients for the probability that an establishment reports having less than two months of liquidity reserves. The underlying question asks for the amount of time – counting from the interview date – until the firm would have to close down due to liquidity constraints if the current situation would remain unchanged. Results indicate that the association between WFH and liquidity existed mostly during the lockdown of early 2021 when more WFH correlated with a decreased likelihood of having liquidity issues. After the upswing in the economic mood in spring, the coefficients decrease in absolute size and partially lose significance. In a similar vein (see Figure 7), a higher WFH share connects to a firm being less likely to experience a revenue decrease relative to the same month of the preceding year, with an estimated magnitude of two to three percentage points for ten percentage points more WFH-share. This suggests that WFH keeps business operations rolling where possible and thus can prevent a deterioration of the economic outlook.

Figure 6: WFH and Liquidity



Notes: Average marginal effects and 95%-CIs from multinomial logit-regressions with robust standard errors are shown. Next to sufficient and insufficient liquidity reserves (cutoff at two months), the third category is “don’t know/no response” which is quite common for the liquidity question. The regressions include all the controls which are mentioned in the text. Pooled specifications further contain time dummies.

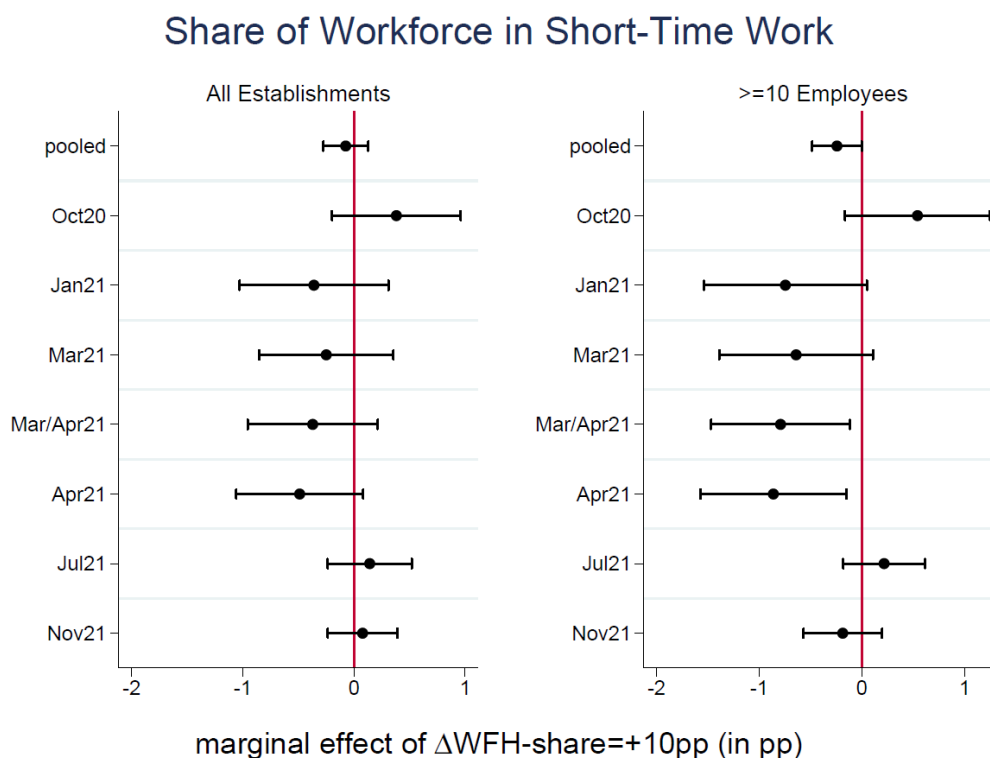
Figure 7: WFH and Revenue



Notes: Average marginal effects and 95%-CIs from multinomial logit-regressions with robust standard errors are shown. Next to increasing and decreasing revenue, the third category is “revenue staying roughly the same”. The regressions include all the controls which are mentioned in the text. Pooled specifications further contain time dummies.

One of the main instruments of the German government during the pandemic to avoid a massive surge in unemployment was to expand and simplify the use of short-time work (STW). During the first wave, a maximum of six million workers were in STW and the monthly average during 2020 was nearly three million. The German system of STW theoretically allows for a partial compensation as well, e.g. a worker can be in STW for 50% of its contractually specified working hours and not all workers of an establishment have to be in STW. Accordingly, in Figure 8, we investigate whether WFH helped establishments avoid sending employees into STW. Consistent with the earlier evidence, STW becomes less likely with an increasing WFH-share; however, this seems tied to larger firms and is only apparent in early 2021 during a lockdown phase when STW increased again after receding during the summer and autumn of the first pandemic year. Moreover, with a STW-share decreasing by only one percentage point for an increase of ten in the firm's share of WFH, this relationship is economically less meaningful.

Figure 8: WFH and short-time work



*Notes: Average marginal effects and 95%-CIs from (fractional response) logit-regressions with robust standard errors are shown. The regressions include all the controls which are mentioned in the text. Pooled specifications further contain time dummies.*

## 5.2.Mechanisms

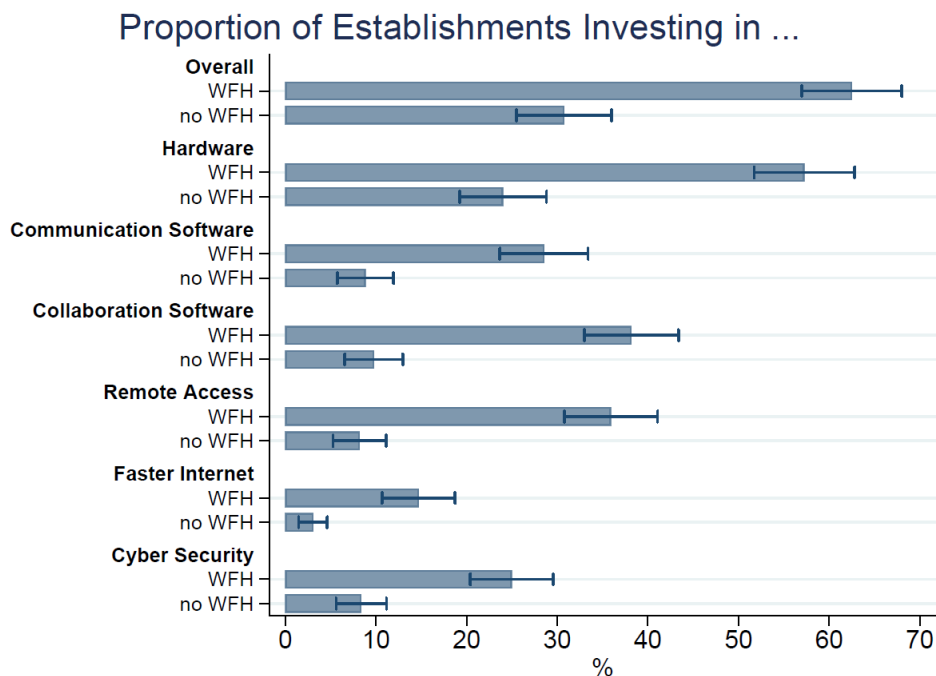
If WFH can indeed help establishments to weather the pandemic-induced crisis, the question arises as to the mechanism(s) behind this effect. We now explore a string of possible channels which we can proxy for in a dichotomous manner with our data set. Considering a simple canonical production function, WFH has in principle two levers through which it can affect firm outcomes. First, it can change the amount of labor input. Second, WFH could impact labor productivity, i.e. affecting output per unit of input, either on the human side (e.g. through improved management or less distracted workers) or on the side of capital (e.g. through improved technology like new hard- or software).

Hence, one channel could be employees working more hours when WFH, e.g. because the time spent commuting is eliminated, but then (partially) added to working time. Given the circumstances of the pandemic, WFH could also prevent workers from getting sick or having to quarantine. In this case, the positive effect of WFH could be due to a prevention of personnel shortages in establishments, i.e. a smaller reduction in the number of hours worked in WFH establishments relative to firms working more in presence. While we have no information on the working time of the establishments' employees, in May 2021, establishments were asked if they experienced unexpected, Covid-19-related, unavailability of employees (e.g., due to quarantine, infections or childcare responsibilities) during the pandemic's first year and whether these shortages caused problems for business operations. In total, roughly half of firms report that personnel shortages had negative ramifications on the organization of work. "Personal shortage" is the first possible channel we examine. Its dummy takes the value one if an establishment reports negative ramifications of unexpected worker absences on their business operations and zero otherwise.

With the data available to us, the possible productivity channel can be approached from two different angles: Once, by the queried investment decisions into IT and digitization efforts and, alternatively, by the companies' assessments of how WFH has affected their employees' productivity. Unfortunately, due to survey's design and structure, we have no establishments for which we can ascertain both the reported effect on employee productivity and investment behavior and therefore have to consider them separately. First, in February 2021, firms were surveyed about their investments in IT and digitization since March 2020. For further analysis, this second possible channel "IT investments" takes on the value one if any investments in IT or digitization were made during the pandemic (that is, whether an investment has been made in at least one of the categories described below) and zero otherwise. Some insights on this

possible channel are given in Figure 9. Descriptively, there are massive differences in investment behavior between firms with and without the option of WFH. WFH firms are substantially more likely to invest in various areas that are also important or complementary to effective WFH, e.g., hardware, software for collaboration and communication, remote access as well as cyber security. Having the right digital tools can be conducive for productive WFH and can further facilitate employees acquiring skills from which they may benefit later. Correspondingly, the provision of IT training during the pandemic is much more widespread in WFH firms (35%) than in firms without a WFH option (8%). Although investment and WFH are both strongly correlated with establishment size, the correlation regarding investments also holds in similar magnitude when utilizing the full set of controls.

Figure 9: Investments in IT/digitization and the option of WFH



Notes: 95%-CIs are depicted. Shares are weighted to be representative of all private-sector establishments in Germany. The information on investments comes from February 2021, whereas the data on WFH come from the same establishments at different points in time (either January, March or April). N=1.506 establishments.

Second, in November 2021 establishments were asked what consequences WFH has had on several aspects of their operations (also see Section 6). One category concerned employee productivity, where 22% reported an increase in productivity due to WFH, 13% a decrease and 60% no consequences (the remaining 5% fall into “don’t know”). Interestingly, none of our standard control variables have any meaningful predictive power on who assesses WFH to be productivity-enhancing. “Productivity increase through WFH” is the third mechanism we examine, which takes on the value one if employee productivity has increased due to WFH according to the company’s assessment, and zero if productivity decreased or remained the same.

To provide indirect evidence on some of the aforementioned channels, we use dichotomous indicators in our specifications that we fully interact with the WFH-share:

$$Y_f = \alpha + \beta * WFHshare_f + \psi * M_f + \tau * (WFHshare_f \times M_f) + \gamma * \mathbf{X}'_f + \varepsilon_f \quad (2)$$

In equation (2), which we run three times,  $M$  denotes a dummy for the three possible mechanisms (respectively: personal shortage, IT investments, and productivity increase through WFH).  $Y$  refers to the first outcome variable we used in Section 5.1, the self-assessment whether the firm is negatively affected by the pandemic. The definitions of all other variables are the same as in equation (1).

Results regarding the possible channels on WFH influencing firm performance are reported in Table 1. Specifically, Table 1 gives two types of marginal effects. The marginal effect of increasing the WFH share by ten percentage points if the respective dummy equals zero (that is,  $\beta$ ) and if the dummy equals one ( $\beta + \tau$ ). Columns 1 and 2 give results on the personnel shortage mechanism. The AME if there is a personnel shortage is insignificant. Yet, in the absence of a personnel shortage, the observed effect is about three times as big and significant, suggesting that fewer missed working hours due to WFH could play a role in explaining the positive impact of WFH on firm performance. Columns 3 and 4 consider investments in conjunction with WFH, revealing a positive association between WFH and negative pandemic effects that is clustered in firms that have invested in digitization efforts during the crisis. More specifically, increasing the WFH share by 10 percentage points decreases the likelihood of reporting negative crisis effects by 2 to 2.5 percentage points if investments in digitization during the pandemic have also taken place. Lastly, columns 5 and 6 report AMEs separately for establishments that do report positive productivity effects of WFH and those that do not. Similar to before, WFH helps more strongly those firms whose productivity increased (especially among larger companies), further indicating that increased productivity could as well be a mechanism for WFH improving firm-level outcomes. Table A2 in the Appendix provides some robustness checks confirming this, using liquidity issues as the dependent variable and utilizing an alternative variable capturing personnel issues<sup>6</sup>.

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<sup>6</sup> In this version, the dummy  $M$  equals one if an establishment reports being concurrently affected by personnel shortages in January 2021.



Table 1: Mechanisms (Average Marginal Effects, AMEs)

	Dep var: Negatively Affected					
	(1)	(2)	(3)	(4)	(5)	(6)
	All Firms	Firms >9 empl.	All Firms	Firms >9 empl.	All Firms	Firms >9 empl.
AME if personnel shortage ( $\beta + \tau$ )	-0.90 (0.86)	-1.07 (1.02)				
AME if no personnel shortage ( $\beta$ )	-3.24*** (0.90)	-4.03*** (1.11)				
AME if invested ( $\beta + \tau$ )			-2.08** (0.86)	-2.46** (1.09)		
AME if not invested ( $\beta$ )			0.46 (1.32)	-0.37 (1.78)		
AME if WFH positive for productivity ( $\beta + \tau$ )					-1.86** (0.90)	-3.40*** (1.09)
AME if WFH not positive for productivity ( $\beta$ )					-0.57 (0.57)	-1.40* (0.74)
N	884	698	829	648	1.608	1.257

*Notes: AME abbreviates average marginal effect. The dependent variable is a dummy taking the value one if an establishment reports being negatively affected by the crisis and zero otherwise. Percentage point effects of increasing the WFH share of the work force by 10 percentage points are shown. All specifications are logit regressions and fully interact the WFH share with the respective dummy variable of interest (personnel shortage, digitalization investments, positive effect of WFH on productivity reported) and contain the full set of controls, see equation (2). Columns 1 and 2 use data from the survey wave in January 2021; columns 3 and 4 use data from March 2021 with the investment decisions surveyed in February 2021; columns 5 and 6 use data from November 2021. Robust standard errors are reported in parentheses. Stars denote significance levels: \*=10%, \*\*=5%, \*\*\*=1%.*

Hence, results suggest that there is no single mechanism which helps WFH establishments fare better. A reduction in personnel shortages seems relevant, as does increased productivity. Depending on the establishments' prior endowment, productivity gains through WFH may necessitate investing into technical tools (e.g. hardware, software) and training employees on how to effectively and efficiently use these tools. Additionally, WFH may require nimble leadership adjusting management practices to a situation of remote work and communication. While we cannot, with the data at hand, infer anything about management or business culture, it stands to reason that management within firms can play a crucial (mediating) role for how WFH is used.

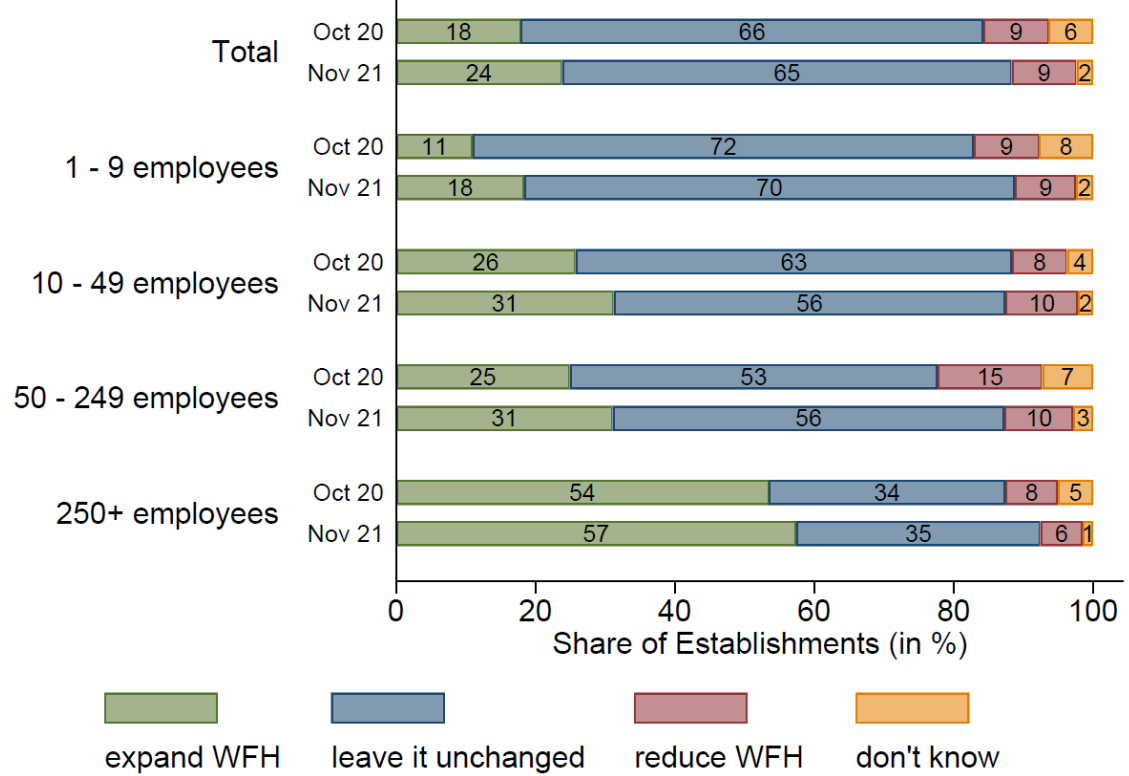
## **6. WFH after the Covid-19 pandemic**

With a possible link between WFH and business success during the pandemic, what will the future hold for WFH? Is WFH establishing itself as a new, relevant form of work which is thus becoming a central component of a “new normal” in companies, or are companies scaling back to the WFH level prior to the Covid-19 pandemic? Based on the results in Section 5, one would expect WFH to stay an integral part of the world of work moving forward. Because companies were queried with regard to their planning for after the pandemic as part of the surveys, we can draw some preliminary conclusions for the future. In the following, we will critically discuss the descriptive results available to us and address their implications for what a “new normal” might look like.

### **6.1. Post-pandemic WFH**

Both in October 2020, just before the start of a long winter lockdown, and one year later, in November 2021, again during an increasingly serious situation in terms of Covid-19 case numbers, companies were asked how they plan to proceed with WFH after the pandemic ends (see Figure 10). At both points in time, the majority of companies indicated that they did not want to make any changes compared to pre-pandemic levels (Oct 20: 66%; Nov 21: 65%). The share of companies which intended to reduce WFH as compared to the time before the crisis remained stable at 9 %. However, there was an increase in the number of companies that plan to expand WFH after the pandemic (Oct 20: 18%; Nov 21: 24%). If one looks at the breakdown by establishment size, it becomes apparent that the larger the establishment, the greater the willingness to offer more WFH after the crisis. Small companies with fewer than 10 employees appear to be mostly satisfied with their pre-pandemic work arrangements while more than half of large companies (with more than 250 employees) are considering to expand WFH. This large proportion of companies planning to expand WFH suggests that experiences with WFH during the crisis were largely positive in particular in larger companies. Moreover, for all establishment sizes, there is a slight temporal trend for companies to evaluate WFH more positively after yet another year of the exceptional situation during which time they may have become accustomed to the expanded WFH use and positive effects may only have become visible.

**Figure 10:** To what extent do you intend to give your employees the option of homeworking or teleworking in future, when the current pandemic is over? Compared to the time before the crisis, do you intend in future to...



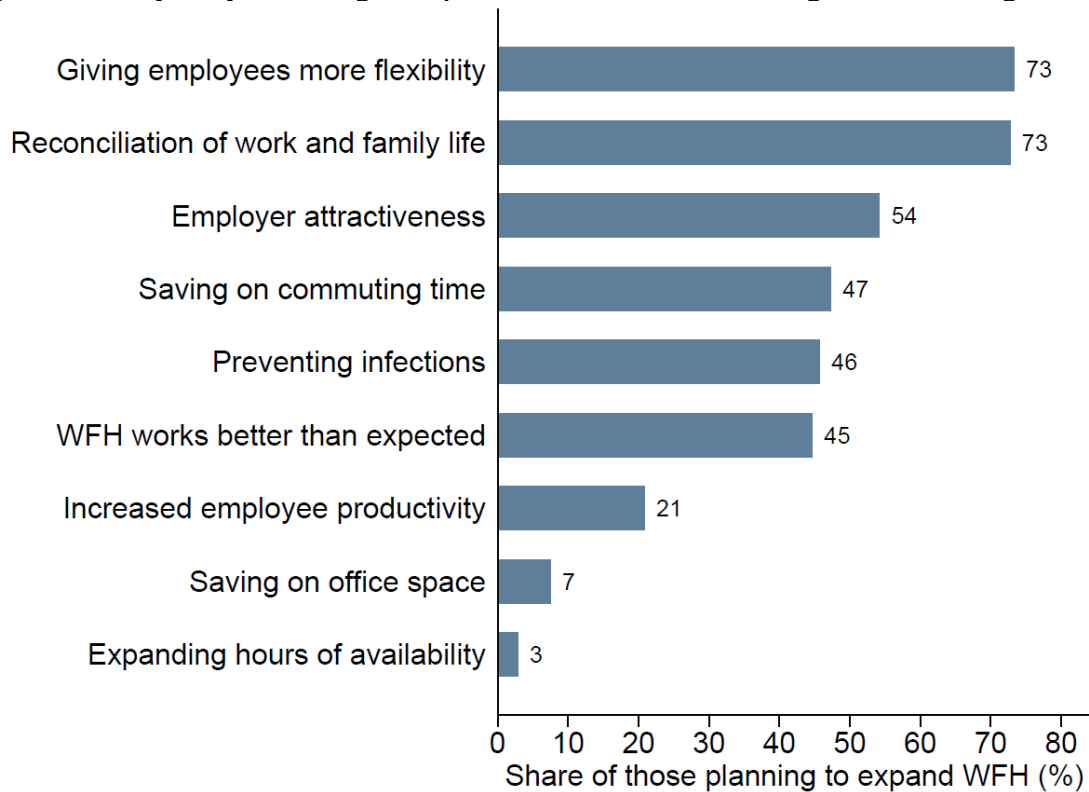
Notes: Shares are weighted to be representative of all private-sector establishments in Germany.  $N_{oct20} = 1.052$  establishments and  $N_{nov21} = 1.178$  establishments.

In October 2020, companies that wanted to expand WFH and companies that planned to reduce WFH or leave it unchanged in the future as compared to the time before the crisis, have been asked a follow-up question addressing the reasons for their continued plans (see Figures 11 and 12). For companies planning to expand WFH in the future, the most frequently cited reasons for this decision were to permit a better reconciliation of work and family life and to give their employees more flexibility (73% each). Furthermore, employers seem to anticipate that many employees have come to appreciate benefits of WFH during the pandemic and that it will therefore be important in the future to offer WFH options in order to being considered an attractive employer (54%). Already at an early stage of the pandemic, a noticeable WFH boom could be observed in online job advertisements (Alipour et al. 2021b).

In terms of diminished stigma associated with WFH, what Barrero et al. (2021a) found at the employee level could be confirmed at the employer level with the data set available to us: More than half of the companies that plan to expand WFH in the future reported that WFH worked better than expected. In contrast to the skepticism observed in various companies before the pandemic, one in five companies that want to expand WFH wants to do so in order to increase

productivity. While 47% mention a reduction in commuting time as another reason, merely 7% do so for reducing office space, a topic that has received considerable attention in the popular media as a purported consequence of the change to WFH. Very few companies state that they want to expand the hours of availability of their employees (3%).

**Figure 11:** Why are you aiming to expand the use of homeworking or teleworking?

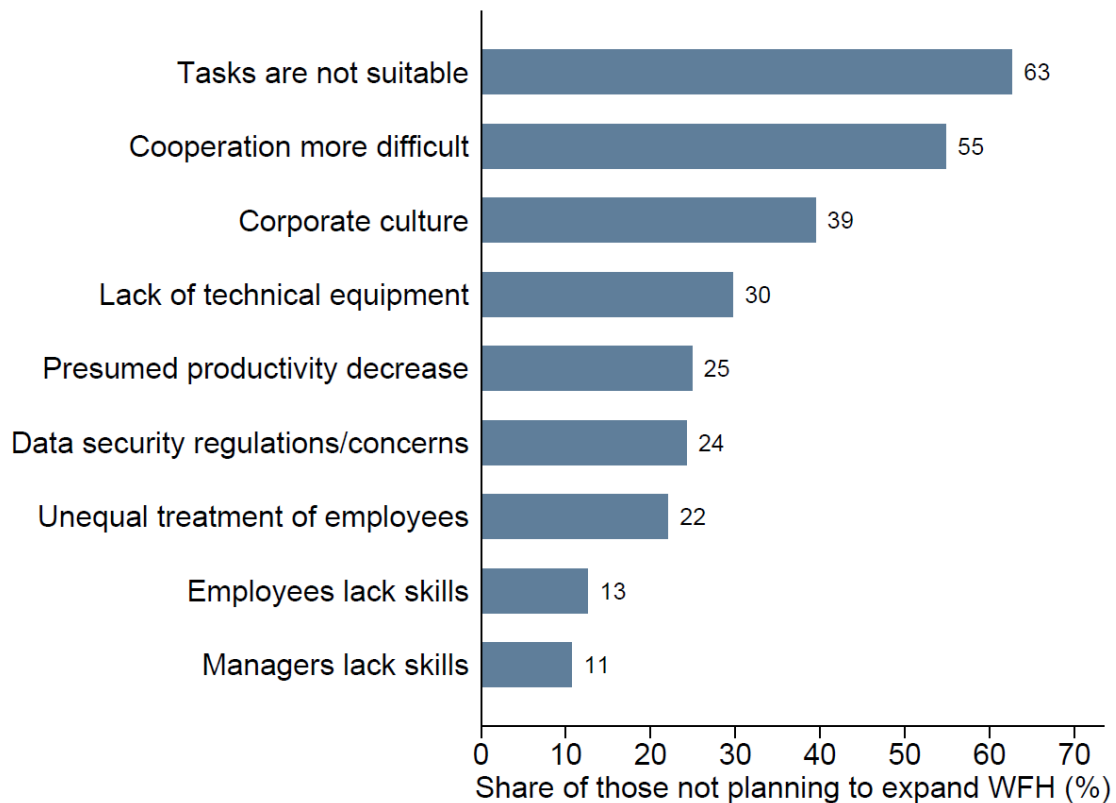


*Notes: Establishments could give answers on a scale from one to five, with five being “applies entirely”, represented constitute those answering four or five. Shares are weighted to be representative of all private-sector establishments in Germany. Question was asked in October 2020, N = 272 establishments.*

Also, those firms that intended to reduce WFH in the future or to leave it unchanged as compared to the time before the crisis were asked about the reasons for their plans (see Figure 12). The most frequently mentioned reason for not expanding WFH compared to the pre-pandemic state is again that tasks are not really considered suitable for WFH (63%). Since only companies that enabled WFH during the pandemic were surveyed for this question, this means that they gave WFH a chance, but did not rate it as equivalent to the non-WFH option. The further answer options provide information about how this assessment was formed. Accordingly, co-operation was considered more difficult (55%), employees’ performance was expected to be lower when WFH (25%) and managerial as well as non-managerial staff were supposed to lack skills (11% and 13%). As in the original question, which explored the reasons for not offering WFH, lack of technical equipment (30%) and data protection and data security regulations (24%) were also reasons for not expanding WFH, albeit to a reduced extent here. Furthermore,

more than one in three companies surveyed said that they do not want to expand WFH as they want to avoid unequal treatment of employees. 39% of firms surveyed indicate that WFH does not fit their corporate culture and therefore, they would like to leave their extent of WFH unchanged, or even reduce it as compared to the extent before the pandemic.

**Figure 12:** Why are you aiming to return to the same or a lower level as compared to before the Covid-19 crisis?



*Notes: Shares are weighted to be representative of all private-sector establishments in Germany. Question was asked in October 2020, N = 702 establishments.*

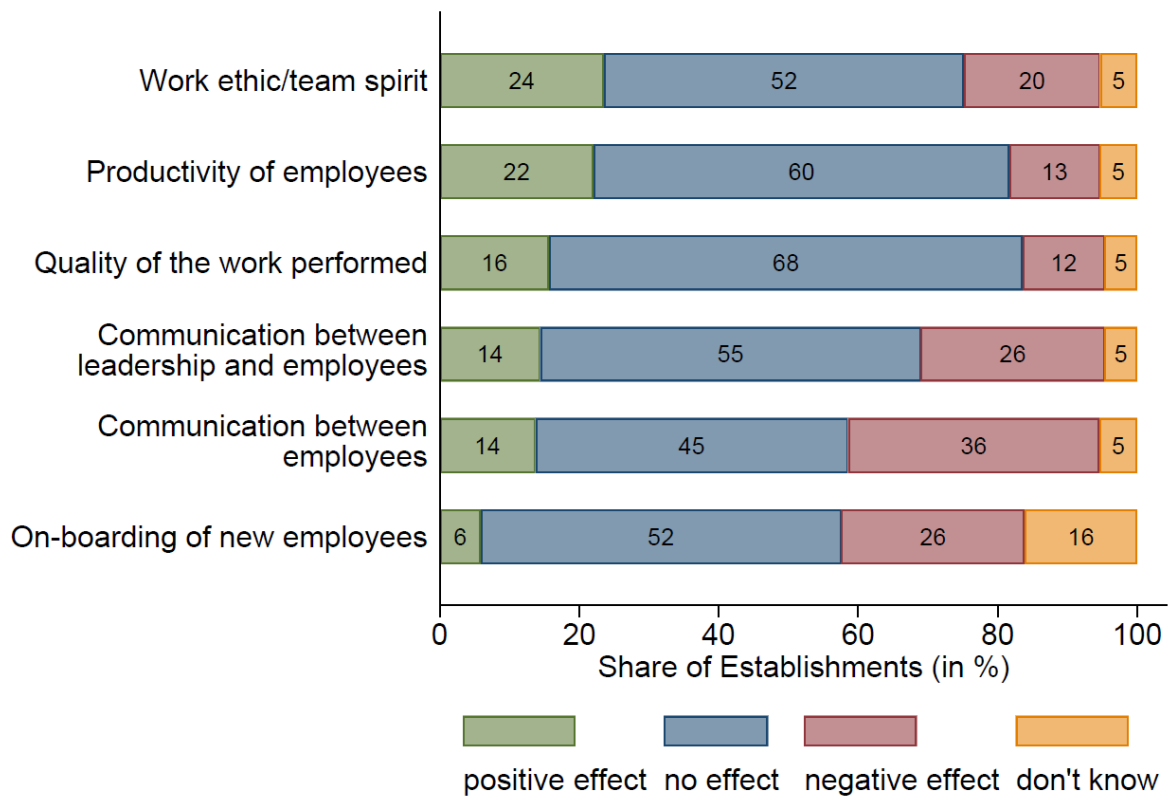
A glance at the distribution of reasons mentioned for not expanding WFH in the future gives the impression that WFH confronts companies with interpersonal challenges in particular. Technical feasibility and general productivity losses seem to be less of a problem than the fact that cooperation per se is made more difficult and people might feel unfairly treated with potential negative effects on corporate culture. It seems that companies that discovered deficits with regard to technical equipment and/or their employees' IT skills at the beginning of the crisis have already reacted in this respect. This hypothesis is supported by findings of Barrero et al. (2021a), Bellmann et al. (2021) and Erdsiek (2021) as well as by the results in Section 5 on what kind of investments haven taken place (see Figure 9 above). Approximately two-thirds of the WFH firms surveyed stated that they have invested in digitization during the pandemic,

mostly focusing on acquiring hardware such as laptops, tablet computers, webcams, and headsets, and on software such as video-conferencing software or project planning tools. In addition, despite difficulties of moving training activities to a virtual format, companies enabling WFH have conducted IT training (35%) for their employees. Through these investments, companies have lowered important hurdles that would have originally made WFH difficult. It can thus be assumed that many employees are now equipped with an infrastructure that permits WFH now but presumably also after the crisis. Moreover, employees have acquired skills throughout the two years they worked remotely, for example through IT training which they might benefit from also after the end of the pandemic. In general, results indicate that many companies have made a leap forward in the use of new workplace technologies and in the development of remote working within a very short period of time which otherwise would have probably taken several years. This catalyzing influence can, for example, be seen in the rapid advancement of technologies and tools that promote virtual collaboration which can be measured, among other things, by patent applications as shown by Bloom et al. (2021).

## **6.2. Changes in the way of working through WFH**

That the pandemic has changed the way work is done nowadays can hardly be denied but the question remains as to what lessons have been learned from this formative period and what a “new normal” might look like in companies once it is no longer considered necessary to keep social distancing rules. In this context, the assessment of companies regarding the effect of WFH on different areas are revealing, showing conditions under which WFH could work well and can produce positive outcomes, but also areas which are considered difficult or even problematic when working remotely (see Figure 13). In more than three quarters of companies, WFH did not cause a negative effect on the work ethic and/or the team spirit, one quarter even observed a positive effect. Also, with regard to productivity of employees and quality of work performed, positive effects were observed more frequently than negative effects while a large proportion of companies did not observe any effect, suggesting a net positive effect on WFH on the economy. Again, these assessments are in contrast to the shirking hypothesis widespread in corporate circles before the outbreak of the pandemic. Unlike previously expected, the WFH situation did not prevent employees from performing their work at a similar level of productivity and quality as before the pandemic, and also employee motivation did not seem to deteriorate in most cases as a result of the new work location.

**Figure 13:** Assessment of the impact of WFH on different areas during the pandemic



*Notes: Shares are weighted to be representative of all private-sector establishments in Germany. Establishment assessments from November 2021, N = 1.187 establishments.*

Aspects that, however, worked less well when WFH from the perspective of many companies – particularly larger ones – were the communication both between employer and employees (26%) as well as among employees (36%), and the on-boarding of new employees (26%). During the pandemic, whenever WFH was possible, the usual face-to-face communication had to be largely abandoned and replaced by new mediums of communication which in some respects could only inadequately meet the needs of employers and employees, potentially leading to stress in organizations (Kirchner et al. 2021, Putri and Irwansyah 2020, Sahni 2020, Yang et al. 2021). For example, Yang et al (2021) found that there was a decline in synchronous communication which had a negative impact on information distribution and resulted in collaboration networks becoming more static. Probably also exacerbated by communication challenges, more than one in four companies surveyed stated that WFH had a negative effect on the on-boarding process of new employees. Using the example of on-boarding of software developers, Rodeghero et al. (2021) found that not meeting your team in person has a negative impact on the social connection as well as the integration into existing teams. This raises the question as to whether WFH during the pandemic may have worked well in part because the majority of

teams already knew each other from before the crisis and had the opportunity to build a relationship of trust which may have also been useful during the pandemic when WFH. Individual team members could still be integrated into existing team structures, albeit with difficulties, but how cooperation would work if an entire team has never met in person is uncertain and will probably have to be explored in future.

### **6.3. The extent of future WFH**

Overall, it seems that while it has worked better than expected, with many employees suddenly WFH for the most part, there are also areas which cannot be considered equivalent to the non-WFH solution. While during the pandemic it seemed necessary to reduce employee attendance as much as possible and to accept possible disadvantages of WFH, it can be assumed that after the pandemic has been overcome, it will be possible to return to original workplaces and to implement new forms of work organization that both pick up advantages and absorb disadvantages of WFH. In this context, so called “hybrid solutions” seem possible which allow a combination of different work locations (Bloom 2021).

Within the survey, companies were asked about such possibilities and, in this context, the maximum number of days they would like to allow their employees to WFH in post-pandemic future (see Figure 14). 60% of companies could imagine letting their employees work from home for more than half of their working time (more than or equal to 3 days per week). If one looks at the breakdown by establishment size, it becomes apparent that smaller companies can imagine their employees to work from home to a larger extent than it is the case for larger companies. More than half of companies with fewer than 50 employees can imagine having their employees work from home for a major part of the week (three or more days per week). Among the smallest companies (fewer than 10 employees), 47% could imagine almost completely abandoning attendance times (only one day or less of attendance). However, those smaller firms are selected in the sense that they constitute the minority of small establishments that actually want to continue using WFH.

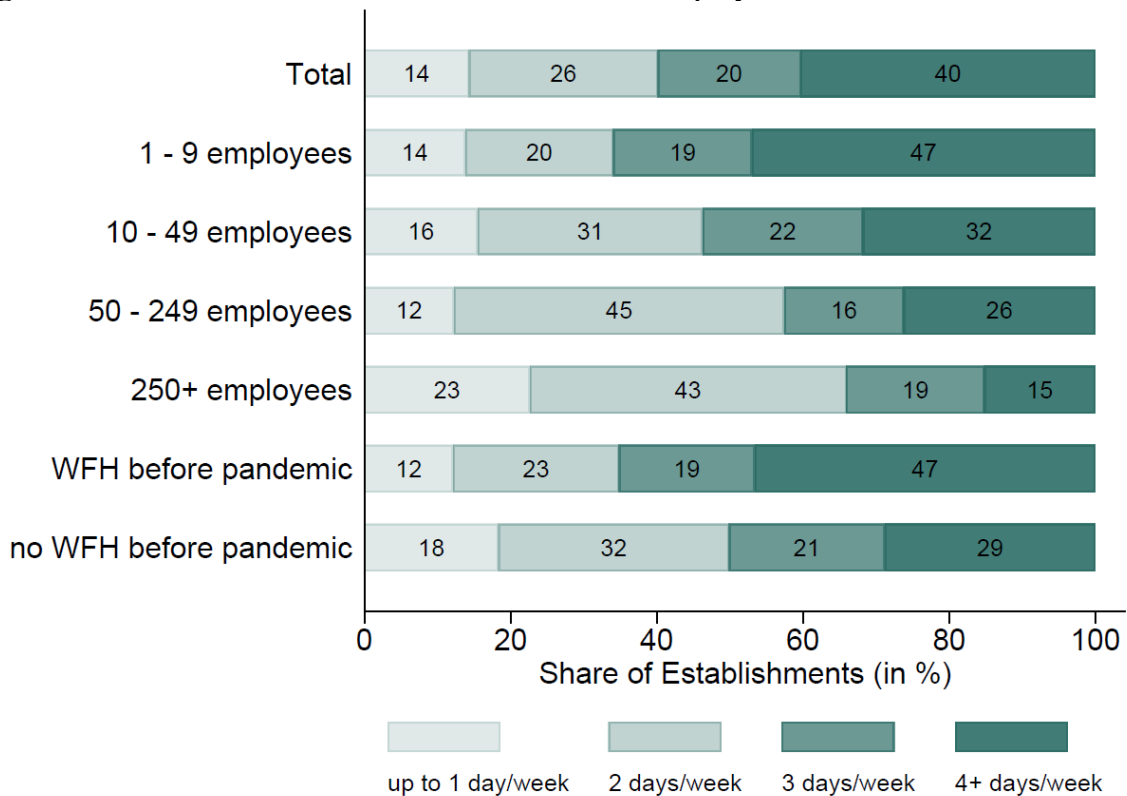
On the contrary, larger companies predominantly prefer that employees spend a major part of their working time at their actual place of work again in the future (two thirds of firms with more than 250 employees want to limit planned future maximum WFH hours for employees to 2 days per week). Only 15% of these companies could imagine their employees to WFH for more than or equal to 4 days per week in the future. This observation can be connected to the



previously discussed communication difficulties that were more likely to be reported by larger firms. While it will probably still be possible to stay in touch with each other and exchange information in small companies via digital communication technologies, this will become increasingly difficult as the company and/or team size grows. The same is probably true for the on-boarding process of new employees which might be another factor explaining the desire for relatively more attendance times of rather large establishments.

When dividing establishments by whether they used WFH prior to the pandemic, it can be observed that companies that have used WFH before the crisis are more open towards WFH on a large scale (4+ days/week: 47%), but even among companies without WFH experience, almost 30% can imagine their employees to WFH for 4 days per week or more.

**Figure 14:** Planned future maximum WFH hours for employees



*Notes: Shares are weighted to be representative of all private-sector establishments in Germany. Answers from November 2021, N = 1.097 establishments.*

## 7. Conclusion

In this paper, we address the topic of WFH in different phases of the Covid-19 pandemic based on a unique establishment survey conducted by the Institute for Employment Research in Germany. The onset of the pandemic has led to a sharp increase in WFH, which was particularly evident in large companies (more than 250 employees), ICT sector companies and companies with a high proportion of highly complex occupations. The results, which are representative of all privately owned establishments in Germany, show a WFH potential of 25% to 30% which was almost completely exhausted by companies, especially in periods characterized by high case numbers. Relevant barriers preventing establishments to introduce WFH were a lack of suitability of the tasks being performed within their establishment, a lack of technical equipment as well as data security and data protection concerns.

Regarding the experiences made with WFH and the effects this changed way of working had on establishments, we find that WFH use is negatively related to reporting negative consequences due to the pandemic, to having liquidity issues, to experiencing a revenue decrease relative to the same month of the preceding year, and to sending employees into short-time work. These associations were particularly pronounced during the long lockdown phase in winter/spring 2021. In terms of mechanisms explaining this crisis-mitigating role of WFH, we discuss and present evidence that the prevention of personnel shortages and general productivity increases by employees as well as productivity increases made possible by investments in digital technologies are channels through which WFH might impact business success.

Finally, we consider how companies are planning their WFH for a time after the pandemic when social distancing rules are no longer considered necessary. Overall, it is evident that many companies, especially larger ones (54% in October 2020 and 57% in November 2021 of companies with more than 250 employees), are planning to expand their WFH offering after the pandemic as compared to the time before the crisis. The most frequently mentioned reasons for these plans are to permit a better reconciliation of work and family life, to give their employees more flexibility, and to being considered an attractive employer. Among the reasons not to expand WFH were, next to the fact that jobs are not considered suitable for WFH, especially interpersonal challenges such as cooperation difficulties, non-suitability for corporate culture and fear of unequal treatment of employees. It appears that technical barriers have already been reduced in many cases through targeted investments in hardware and software as well as in IT training and IT support. While, according to the companies' assessment, WFH has worked well

in many respects (e.g., work ethic/team spirit, productivity of employees, quality of work performed), there are other factors which caused difficulties for the companies that enabled WFH (e.g., communication, on-boarding of new employees). Also in light with these experiences, so-called “hybrid working arrangements” (Bloom 2021) seem to be an option that exploit the advantages of WFH and mitigate its disadvantages. According to our results, it is the case that 66% of companies with more than 250 employees want to limit planned future maximum WFH hours for employees to 2 days per week. However, almost every second small firm (with fewer than 50 employees) that wants to continue remote work could imagine their employees WFH for a major part of the week (three or more days per week).

Closing this paper, it is important to note that, next to the descriptive survey evidence, we analyze conditional correlations which we do not claim to be causal. However, due to the scope of questions queried at different points in time and the fact that the dataset is considered representative of all privately owned establishments in Germany, we provide interesting early-stage evidence on the experiences with and ramifications of WFH from the firm perspective during the pandemic. Beyond this, it will certainly be interesting to see what the long-term effects on workplace autonomy will be and whether the firms’ plans for future remote work will change. Moreover, we assume that, as time goes on, the greater availability of data might allow informative comparisons between before, during, and after the pandemic, which will also improve the methodological possibilities for analysis, identification and thus, explanatory power of results. While our goal was to provide an overview of WFH during the Covid-19 pandemic in Germany from a business perspective, specific effects related to WFH mentioned in the course of the paper (e.g. collaboration, communication, motivation, mental health) may constitute fruitful avenues for further research.

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## Appendix

Table A1: Correlates of WFH Adoption

Dependent variable = 1 if WFH is possible in establishment	
	(1)
	WFH (binary)
<i>Sector</i> , Ref: non-knowledge intensive production	
knowledge intensive production	0.0554* (0.0292)
non-knowledge intensive services	0.0280** (0.0132)
knowledge intensive services	0.189*** (0.0175)
ICT (information and communic. tech.)	0.307*** (0.0352)
<i>Size</i> , Ref: 1 - 9 Employees	
10 - 49 Employees	0.109*** (0.0141)
50 - 249 Employees	0.306*** (0.0157)
250+ Employees	0.416*** (0.0215)
Exporter	0.161*** (0.0116)
Works Council	0.0871*** (0.0150)
Non-German Ownership	0.0589** (0.0256)
<i>Type</i> , Ref: Single-Plant Establishment	
Headquarters	0.0807*** (0.0150)
Branch	-0.0288* (0.0156)
<i>Age</i> , Ref: <10 years	
>=10 and <25 years	-0.0216 (0.0136)
>25 years	-0.0253* (0.0136)
East Germany	-0.0464*** (0.0141)



*Region, Ref: Urban Counties*

Semi-Urban Counties	-0.0518*** (0.0128)
Semi-Rural Counties	-0.0669*** (0.0148)
Rural Counties	-0.0556*** (0.0153)

*Tasks, Ref: share specialist occupations*

share unskilled/semi-skilled	-0.0107 (0.0220)
share complex specialist	0.183*** (0.0310)
share highly complex	0.565*** (0.0492)
Share German	0.102*** (0.0293)
Share Women	-0.0863*** (0.0180)
Share Minor Employed	-0.0869*** (0.0271)
Share in vocational training	-0.0325 (0.0564)
Mean Age (in years)	0.00179** (0.000776)

*Time, Ref: October 2020*

January 2021	0.0237* (0.0134)
March 2021	0.0453*** (0.0139)
March/April 2021	0.0536*** (0.0141)
April 2021	0.0409*** (0.0140)
July 2021	0.0712*** (0.0141)
November 2021	0.0240* (0.0143)
N	12.411

*Notes: Average marginal effects are shown. Standard errors (clustered on the establishment level) in parentheses. Significance levels: \*=10%, \*\*=5%, \*\*\*=1%. See text for more details.*

Table A2: Mechanisms (Robustness)

	Dep var: Liquidity Issues			
	(1)	(2)	(3)	(4)
	All Firms	Firms >9 empl.	All Firms	Firms >9 empl.
AME if personnel short- age ( $\beta + \tau$ )	-0.41 (0.70)	-1.07 (0.68)		
AME if no personnel shortage ( $\beta$ )	-1.90*** (0.58)	-1.76** (0.70)		
AME if invested ( $\beta + \tau$ )			-1.39** (0.67)	-1.63* (0.84)
AME if not invested ( $\beta$ )			-0.47 (0.97)	-0.91 (1.29)
N	1.668	1.320	831	650

*Notes: AME abbreviates average marginal effect. Percentage point effects on of increasing the WFH share of the work force by 10 percentage points on the probability of having liquidity issues are shown. Results come from multinomial logit regressions (categories are: liquidity issues, no liquidity issues and don't know about liquidity situation). All specifications fully interact the WFH share with the respective dummy variable of interest (personnel shortage, digitalization investments) and contain the full set of controls, also see equation (2). In contrast to Table 1, personnel shortages are captured here through a question that asked whether there were Covid19-related shortages at the time of the survey. Since this question was filtered on the existence of reported negative effects, the dependent variable concerns liquidity. Columns 1 and 2 use data from the survey wave in January 2021; columns 3 and 4 use data from March 2021 with the investment decisions surveyed in February 2021. Robust standard errors are reported in parentheses. Stars denote significance levels: \*=10%, \*\*=5%, \*\*\*=1%.*