



Working conditions and sustainable work  
**Telework and teleworkability during  
COVID: An analysis using LFS data**

[Telework in the EU: Regulatory  
frameworks and prevalence](#)

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# Introduction

One of the most important responses to the COVID-19 pandemic was the mass recourse to remote working that took place starting in March 2020. This was a spontaneous response on the part of businesses and employees confronted with a highly infectious and physically damaging virus. Many businesses were obliged to close workplaces temporarily given public health measures ('social distancing' or 'physical distancing') designed to stem the spread of the virus. Remote working, more specifically working from home (WFH), became the customary mode of working for many workers with hitherto limited experience of working in this way.

This was in particular the case in those service sectors where much work is office-based and reliant on intensive networked computer use. These are sectors where workers already have many labour market advantages – less physically demanding working conditions, higher pay, greater job security (Adams-Prassl et al, 2020). These advantages have become more evident during the crisis as such work – and the businesses and employment relationships that depend on such work – have proved more resilient than much customer- or client-facing service work, e.g., in air travel, tourism and hotels/restaurants sectors. One of the main determinants of this resilience was the fact that work tasks were place-independent and could be carried out in locations other than the employer workplace, and in the exceptional circumstances of the pandemic, in employee homes. The sharp employment shock or decline in worked hours experienced at the outset of the pandemic was much less likely to affect jobs that were flexible as regards location (Eurofound, 2021).

In this working paper, a quantification is made of the extent of teleworking before and during the COVID-19 outbreak based on the best available EU-wide comparable data from the EU-Labour Force survey. Though longer-term time trends are covered, the comparison relates primarily to the years 2019, immediately pre-COVID, and 2020/1, the first two years of the pandemic. The former serves as a baseline for assessing the extent to which the pandemic boosted the incidence of working from home, identifying which groups of workers were most affected.

The paper focuses in particular on the population of dependent employees. While the incidence of working from home / remote working have traditionally been higher amongst the self-employed (who are freer to choose where they work), it has been employees who have experienced the largest increase in teleworking as a result of the COVID-19 outbreak (Sostero et al, 2020).

Dependent employees are the dominant category of worker, accounting for some 5 in 6 of all workers as well as being the category most likely to witness long-lasting changes to their work organisation looking forward as a result of expanded remote working possibilities. Around a third of the self-employed regularly or sometimes worked from home pre-pandemic compared to around one in ten employees.

The paper is structured as follows. In a first section, following a brief survey of recent relevant literature, we present descriptive data on teleworking incidence pre-and post-COVID-19 from the EU-Labour Force survey. This is the most reliable EU-wide data source on labour market indicators, based on large, representative samples with data collection entrusted to the main national statistical agencies. For the purposes of this paper, it has the advantage of including a question on the extent of working from home.

LFS data gives evidence of a doubling in the incidence of remote working in 2021 compared to 2019 even if its estimates are generally lower than those that emerged initially from other “live” survey sources (generally based on non-probabilistic samples) including those of the Foundation’s own COVID e-surveys (Eurofound 2020). What emerges consistently from the LFS as well as the other surveys is the wide variation between member states in working from home incidence. Those countries where it had been more prevalent previously, notably the Nordic and Benelux countries, tended to be those where its incidence increased most in percentage points (ppt) while the relatively marginal incidence of working from home pre-crisis in some East European member states persisted in large part into 2020/1 despite the pandemic. Nonetheless, even in these countries, the incidence of working from home often increased by a multiple compared to previous years.

In a second section, logit models are used to analyse the probability of working from home to the extent that they explore whether the results identified in the descriptive analysis hold in a multivariate framework.

In a third section, indications are given on the potential for growth of remote working based on an occupational classification of teleworkability developed in research published soon after the onset of the pandemic in June 2020 by Eurofound and European Commission Joint Research Centre researchers (Sostero et al, 2020). Based on their task content, this analysis ranks occupations in terms of their feasibility to be worked remotely suggesting which occupations are more likely to avail of expanded remote working possibilities that may arise. The main source for this classification is the detailed occupational task descriptions from the Italian Indagine Campionaria delle Professioni with additional indicators from the European Working Conditions survey.

The fourth section extends the analysis of teleworkability to show how remote working potentially opens up new dimensions of workplace inequality. Jobs that can be teleworked tend to be ‘good jobs’ – well-paid, requiring higher qualifications, offering high levels of work autonomy. Teleworkable jobs were also those in which employment outcomes during the pandemic tended to be better than for those in non-teleworkable jobs – lower likelihood of job loss, reduced work hours and reduced work income. There was then a teleworking “buffer” or protection during the pandemic and one that protected employees who already enjoyed many benefits in terms of intrinsic and extrinsic job quality. This raises the possibility that the capacity to remote work may become a more salient marker of privilege if teleworking does, as predicted, become more widespread post-pandemic.

A concluding section summarises the main findings.

# 1 – Prevalence of working from home during the crisis

## Background

Following the outbreak of the COVID-19 pandemic, with many workplaces in enforced closure, an abrupt and necessary ad-hoc social experiment took place in which remote working became the customary mode of working for many workers. Several 'live' surveys have tried to estimate the extent of working from home in the immediate aftermath of the lockdown measures. According to the Eurofound's Living, Working and COVID-19 survey, in April 2020 around 39% of employees in EU-27 countries were working from home, 48% in July 2020. In Germany, according to Mannheim Corona survey, in March 2020 about 26.5% of German workers were working from home (Mohring et al, 2020). According to a cross-national real-time survey carried out in the USA, China, Japan, South Korea, the UK, and Italy, nearly four in ten employees started to telework when the pandemic started (Belot et al., 2020). Official data based on representative survey samples – for example, the European Labour Forces survey, as presented later in this working paper – arrived later and tended to estimate lower shares of workers working from home in 2020 than the various live surveys indicated above – though still markedly increased shares compared to pre-COVID.

As our societies gradually return to normality, there are many reasons to believe that there will be a lasting legacy from the COVID era working from home experience. When asked in surveys, workers indicate a preference to continue working from home at least two or three days a week, even when the pandemic is over. This is the case in the UK (Taneja et al., 2021), in the EU (Eurofound, 2020) and in the United States (Parker et al, 2020). Not all workers are ready for a full-time return to the office: as indicated in a US survey, if employees were forced to return to the office 5 days a week, over a half of them would consider an offer for a new job as well paid as the one they had, but with the possibility of working from home some days a week (Barrero et al., 2021).

Many companies have already adapted to implement hybrid work schemes. Adrjan et al. (2022) analysed the development of job postings on the platform Indeed in 20 countries in 2020 and 2021, by identifying all the announcements of jobs that gave the possibility of teleworking. Not only in periods of tightening of pandemic-related mobility restrictions, but even when an easing of the pandemic restrictions occurred, the share of 'teleworking' job postings increased considerably.

The issue of who decides when and how much workers work from home or not is still very debated. Central coordination is needed: managers must decide which days workers should work from home, because leadership is required to prevent issues in the workforce of non-cohesion, loss of diversity or the risk of negative career impacts arising from the workplace 'invisibility' of remote workers (Bloom 2021).

The impact of working from home on worker productivity is not well understood. On one hand, low possibility to telework and low flexible working arrangements may reduce worker satisfaction and undermine efficiency. On the other hand, a pervasive use of telework might also be counterproductive. According to survey-based results, several employers believe that their employees work more productively in a teleworking environment, and employees claim that they work better on tasks that require concentration when teleworking (Adrjan et al.,2022). The problem is that measuring homeworkers' productivity is challenging and existing studies are mostly based on

worker self-assessment of their productivity. According to a survey in Japan in 2020 and 2021, telework during the pandemic has had a selection effect: already high-productivity workers increased their productivity, while lower-productivity workers decided to stop working from home (Morikawa 2022).

For those who can telework, the need for physical proximity to the workplace has been considerably reduced. If a job can be performed remotely, it could be performed by lower-paid workers in foreign low-cost countries rather than higher-paid workers in relatively well-off EU member states. Office workers in rich countries may become exposed to foreign competition, mainly in service sector jobs that have hitherto been protected from the forces of international competition. It is what Baldwin and Dingel (2021) refer to as the ‘telemigration’ issue. Not in the near future, but in the long-term, employment in advanced economies may suffer from the increase of trade in teleworkable occupations.

## Introduction and an overview from 2008 to 2021

In this section, we present a descriptive analysis to outline the evidence for the EU-27 countries on the prevalence of working from home in the workforce during the COVID-19 pandemic. Annual data from the 2020 and 2021 European Labour Force Survey has been used<sup>1</sup> and comparisons with the pre-pandemic situation are also presented. While the terms used in the paper – ‘telework’, ‘working from home’, ‘remote working’ – are often used interchangeably in this paper, the question specifically asked in the EU-Labour Force survey, and on which this analysis relies, relates to ‘working from home’. This was undoubtedly the main form of ‘remote work’ or ‘telework’ during the pandemic<sup>2</sup>. The main focus of the analysis is on dependent employees, i.e., the population of workers who generally rely on their employer’s assent to work from home.

Remote working and employment status: it is important to differentiate between telework when it refers to self-employment or dependent employment. For the self-employed, work is not subject to the external authority of an employer and working from home tends to be much more frequent. Over one in three self-employed workers regularly worked from home pre-COVID. Working from home is not atypical for example for self-employed freelance and professional workers. For a dependent employee, on the other hand, in most cases working from home requires the explicit approval of the employer. An employer will often be reluctant to concede such an entitlement because without presence it is more difficult to monitor and control the level of effort of individual employees. For this reason, telework was before the COVID crisis still a relatively marginal phenomenon (accounting for only a fraction of total working hours), notwithstanding the radical improvement in remote communication possibilities since the advent of the internet in the 1990s. Telework remains more frequent for high-skilled professional and managerial jobs, which are generally more autonomous and less subject to effort monitoring and control. The higher prevalence of telework for self-employed workers is also related to this issue

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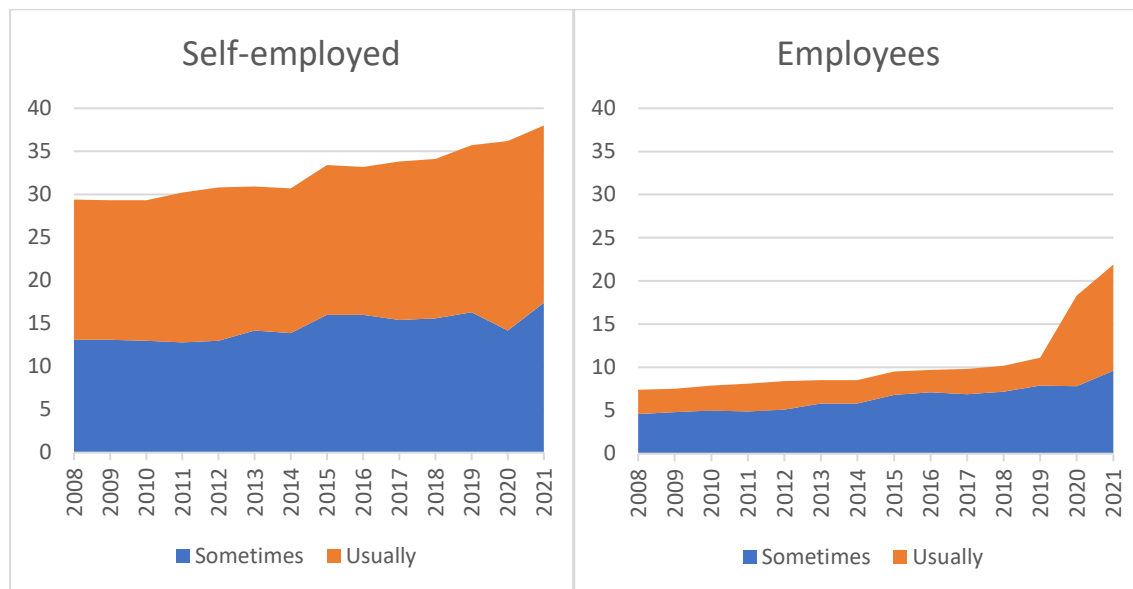
<sup>1</sup> LFS microdata 2020 was used for most of the analysis in this and following section, but it was possible to update some aggregates (in Figs 1 – 9 and 15) with LFS 2021 data published on the Eurostat website as text was being finalised (May 2022).

<sup>2</sup> The analysis does not cover all forms of remote working understood as work carried out by an employee in a location other than the employer workplace, e.g., “on the road”, in a third-party premises.

of autonomy and control, since the (genuinely) self-employed are not subject to any employer oversight and are by default autonomous in the organisation of their own work<sup>3</sup>. From a policy perspective the issue of remote working is more salient for employees as for this group – accounting for five out of six of all EU workers – working from home and the conditions in which it can take place is the subject of agreement between employees, employers and their representatives and more likely to be regulated by labour law.

Before focusing on the evidence during the pandemic, an overview is provided of the evolution of telework among employees in the EU-27 from 2008 to 2021. In 2008 less than 8% of employees were working from home “sometimes” or “usually”<sup>4</sup>. The share has gradually increased over the years to reach 11% in 2019, just before the crisis. Following COVID-19, it increased abruptly to 19% in 2020 and rose further to 22% in 2021. The increase was recorded almost entirely in the category of employees working ‘usually’ from home.

**Figure 1: Share of workers working from home, 2008-21 by employment status**



Source: EU-LFS (lfsa\_ehomp)

<sup>3</sup> The corollary is that many platform workers – self-employed as far as many employers are concerned – are in fact subject to pervasive monitoring and control in the conduct of their job tasks and have limited work autonomy. For this reason, the proposed [Commission Platform Work directive](#) includes a list of control criteria which would allow an objective assessment of whether a platform worker is in dependent employment or self-employment with the onus of proof on firms to show that those working on their platforms are indeed self-employed.

<sup>4</sup> Working at home “usually” in this context means working at home half of the days in a reference period of four weeks preceding the end of the reference week. Working at home “sometimes” means working at home less than half of the days worked, but at least one hour during the four-week reference period.



Working from home has always been much more common among the self-employed. In 2008 the share was 29% and it has increased over time to reach 36% in 2020 and 38% in 2021.

**Box 1: A question of definition: “Teleworking”, “remote working” or “working from home”?**

*“While telework has been around the 1970s [...] even now no consensus exists regarding its exact definition” [ILO, 2016].*

The terms “telework” and “remote working” each relate to the spatial distribution of work (tele = distance) and implicitly juxtapose two locations – the employer’s premises / workplace and some physically separated workspace where a worker can carry out his work. In principle, this could be anywhere outside the employer’s premises and not necessarily in the worker’s home (for eg. in a third-party hub or shared office; while travelling or on the road). “Working from home” therefore is one specific sub-category of remote working / teleworking where work is carried out from the worker’s home. “Telecommuting” / “e-commuting” are cognate terms to “working from home” to the extent that each implies that the regular work commute is eliminated (at least some of the time) and that the worker’s home is the work location when this happens.

The term “homeworking” – as opposed to “working from home” can be potentially problematic as it can refer to optional work from home as defined above but can also refer to artisanal production or industrial piece-rate production carried out from home (ILO, 2016:2 fn).

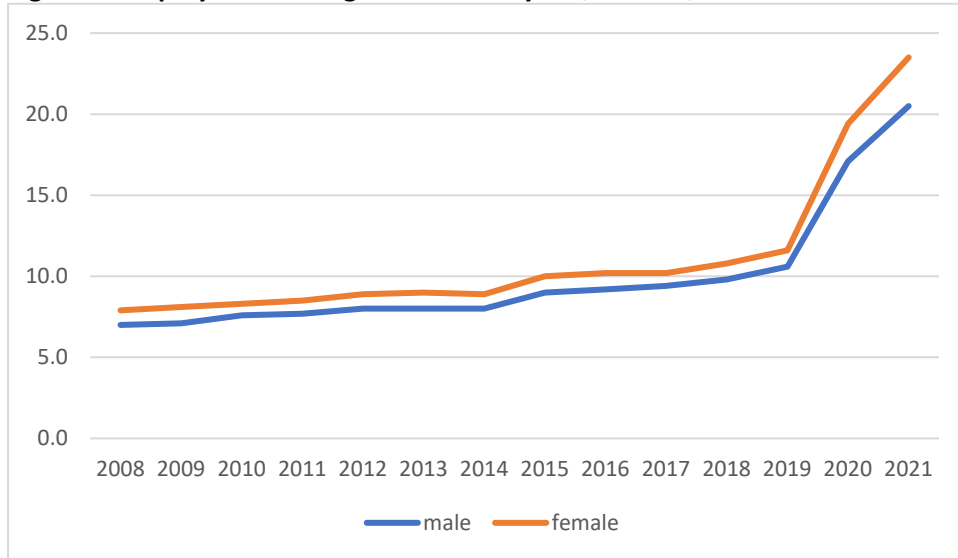
None of the above terms specifically indicates that these forms of work are enabled by developments in information and communication technologies but this is largely the case. And the ICT dimension is a core element for example in the ILO’s approach to telework (Messenger, 2019), in Eurofound’s broader concept of “ICT based mobile work” (Eurofound and ILO, 2017) as well as the EU social partners’ framework agreement on telework (see Eurofound, 2020) where it is defined as “a form of organising and / or performing work, using information technology, in the context of an employment contract / relationship, where work which could also be performed at the employer’s premises is carried out away from those premises, on a regular basis”. Another term which refers implicitly to the technologies allowing remote working is “virtual work”.

In this working paper, we consider telework as the remote provision of labour that would otherwise be carried out within the employer premises. Our main focus of interest is telework of the type that has become common since the advent of the COVID-19 crisis – teleworking where (mainly ICT-enabled) employees work remotely from home as opposed to working from an employer’s workplace, i.e., “working from home” or “WFH” as the acronym has become familiar during the pandemic. For this reason, the terms remote working, working from home and telework are sometimes used interchangeably even though, as indicated above, each term denotes something specific and “working from home” is a subset of the broader phenomenon of “telework” or “remote working”.

It is important to note that the survey source for this analysis (EU-LFS) refers specifically to ‘working from home’, a relatively simple concept, rather than ‘teleworking’ or ‘remote working’, which are broader and more inclusive terms. For the purposes of a cross national survey carried out in many languages like the EU-LFS, the latter terms are also potentially more complex and difficult-to-translate.

We also provide an overview on the evolution of telework by demographic characteristics, gender, and age, among employees. In 2021, 24% of women reported working from home at least some of their time, up from 8% in 2008. 21% of men were working from home in 2021, up from 7% in 2008.

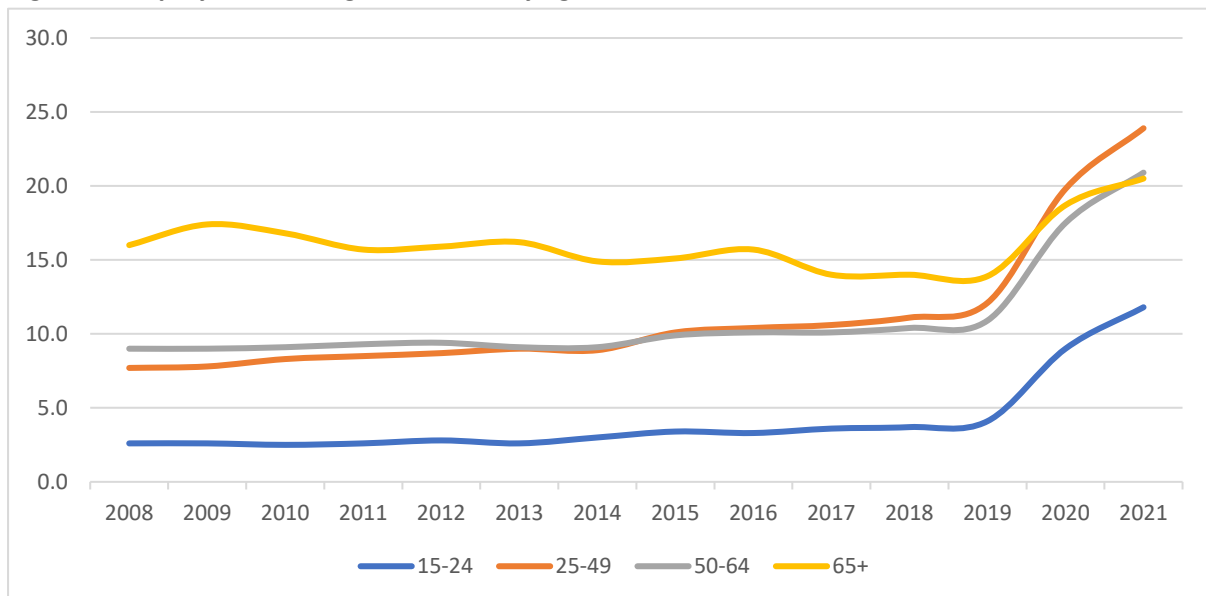
**Figure 2: Employees working from home by sex, % EU27, 2008-21**



Source: EU-LFS (lfsa\_ehomp)

Pre-COVID, the main differentiation in terms of working from home by age cohort was that older, post-retirement workers were much more likely and younger workers much less likely to work from home than the average. Trend increases in incidence over the period 2008-19 were recorded for all age cohorts except those aged 65+. The onset of COVID in 2020 continued this pattern with each of the working age cohorts recording sharp increases in WFH incidence compared to a more modest increase in the case of those aged 65+. The sharpest relative increase was recorded for younger workers (15-24) and core age workers (25-49).

**Figure 3: Employees working from home by age, 2008-21, %**



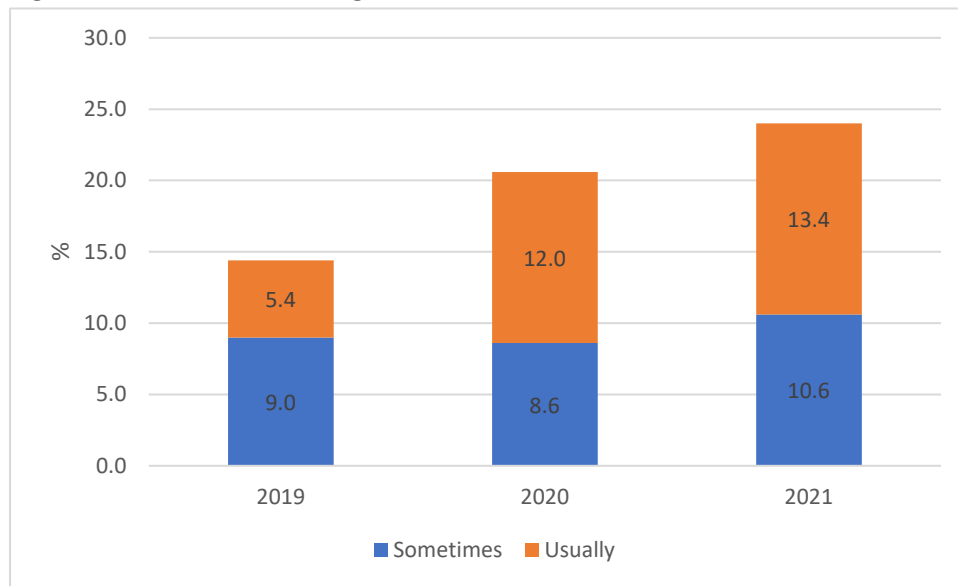
Source: EU-LFS (lfsa\_ehomp)

## Working from home - comparing pre-COVID and COVID periods

In what follows, we investigate the prevalence of working from home during the COVID-19 pandemic according to some variables of interest in the EU Labour Force Survey (LFS). The comparison is with the immediate pre-crisis baseline (2019). While there was a trend of incremental increase over the period 2008-19, the pandemic clearly induced a more dramatic shift upwards in the incidence of working from home<sup>5</sup>.

Before the COVID-19 pandemic, the share of all workers who worked from home at least some of their time was around 14%. During COVID-19, the incidence of working from home increased by 10 pts, mainly due to an increase in those in regular telework.

**Figure 4: All workers working from home, EU27, 2019-2021**



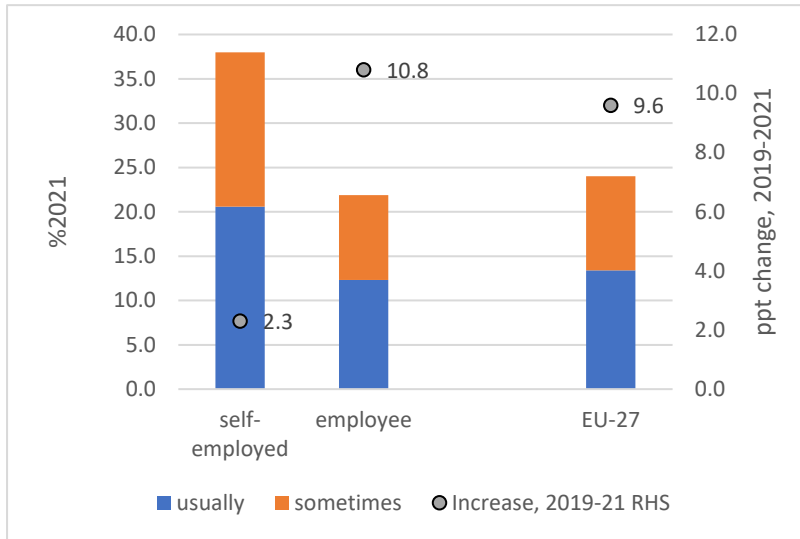
*Note: employees, self-employed and family workers included.*

*Source: EU-LFS (lfsa\_ehomp)*

Before the pandemic, just over one third of the self-employed worked from home. A much smaller share of dependent employees worked from home (11%). During the pandemic, with working from home officially or mandated or encouraged for workers who were in a position to do so, there was a marginal increase in the share of the self-employed working from home (2 pts) but a doubling in the share of employees. In 2021 around 21% of employees were working from home at least some of their time.

<sup>5</sup> The data used for this analysis is a combination of the LFS annual microdata that Eurostat makes available to the research community (data up to year 2020 disseminated in November 2021), updated where possible with LFS 2021 data published on the Eurostat website in May 2022. It is worth noting that the annual values for the main variable of interest in this analysis – HOMEWK, working from home – are based on averaging values over reference week samples collected throughout the year. Given that the pandemic began to impact on European workplaces in mid-March 2020, the annual figures of working from home incidence necessarily under-estimate the actual incidence, especially that occurring during peak lockdown periods such as March-May 2020 and October-December 2020.

**Figure 5: Working from home by professional status, % 2021 and ppt change 2019-2021**

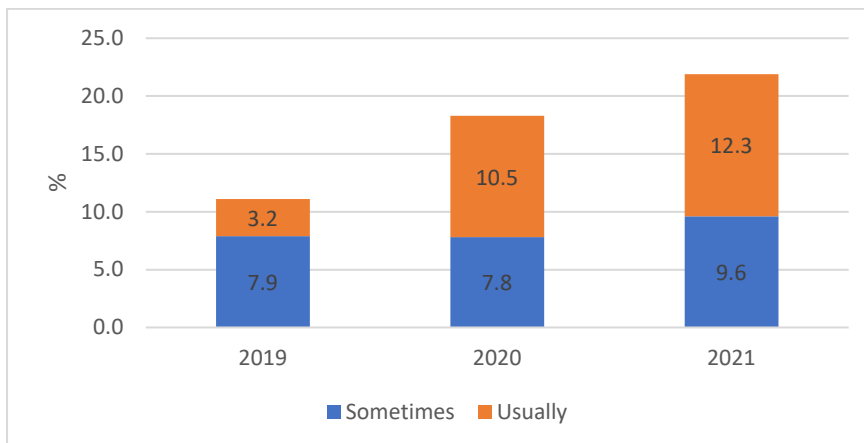


Note: the 'Increase, 2019-21 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.

Source: EU-LFS (lfsa\_ehomp)

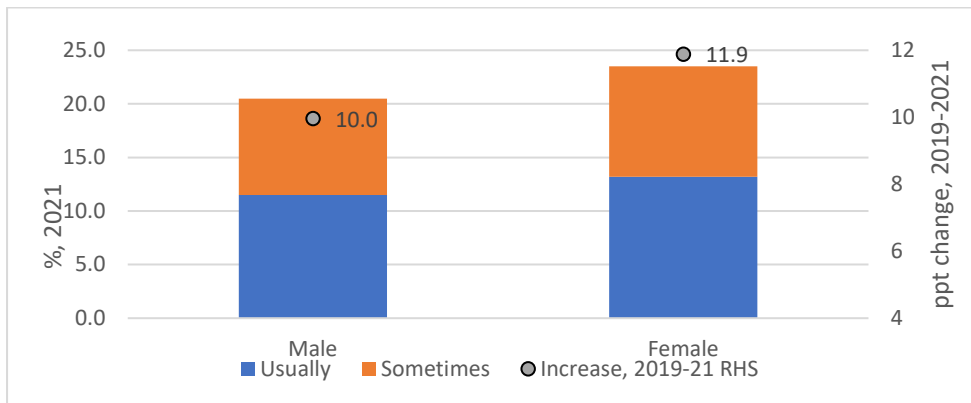
Our focus henceforward is on dependent employees - where the post-covid conditions of working from home will be subject to negotiation and consent between workers, employers, and their representatives. As can be seen from figure 8, the increase in the share of employees working from home was mainly due to employees 'usually' working from home, while the share of those working from home 'occasionally' actually decreased in 2020 before rising somewhat in 2021. National lockdowns encouraged the use of regular telework and presumably pushed some occasional teleworkers to do it more regularly.

**Figure 6: Share of employees working from home, 2019-21**



Source: EU-LFS (lfsa\_ehomp)

According to LFS data, women were more likely to work from home both before and during COVID and the increase 2019-21, largely attributable to the pandemic, was greater for women (11.9 ppts) than for men (10 ppts) (Eurofound, 2022).

**Figure 7: Working from home by sex, EU27, % 2021 and ppt change 2019-21**


*Note: employees only; the 'Increase, 2019-21 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.*

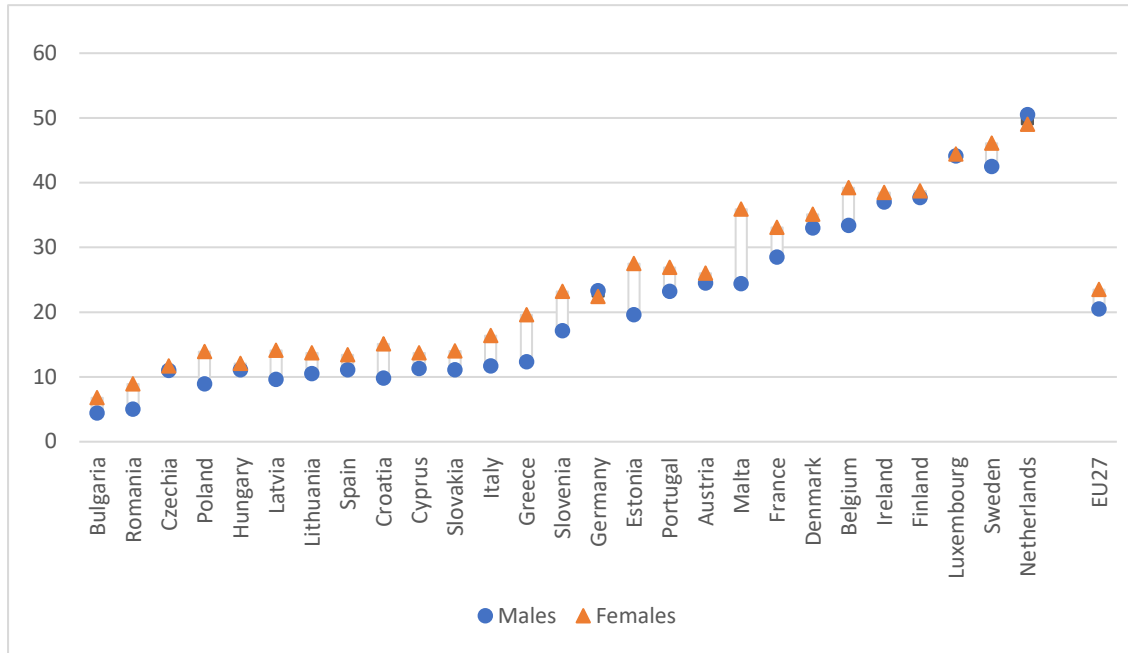
*Source: EU-LFS (author's elaborations).*

In part, this is due to the greater teleworkability of female jobs (see section 3): much female employment is in services and may lend itself more readily to working from home. Instead, a higher male share of employment is in agriculture, construction, manufacturing; sectors with high physical or handling requirements which are place-dependent and cannot so readily be performed remotely.

A contending explanation but arguably less important than the previous one according to the data is that women were more likely to decide to work from home during the pandemic because they (rather than their male partners) “took up the slack” and combined work with domestic caring activities during periods of childcare and school closures. In this way, existing gender disparities in the distribution of unpaid, domestic work may have been exacerbated by the pandemic. Gender pay differentials favouring male earnings could also have predisposed households with dual earners to respond in this way.

So there was a modest positive gender gap in actual teleworking during the pandemic. If we look at the gender breakdown in 2021, we see that women were more likely to be working from home (either usually or sometimes) in all but two member states. Only in Germany and the Netherlands were men more likely to be working from home. More striking in the chart below is the wide variation in working from home by country with very low shares recorded in many East European countries (<10% in BG, RO; <15% in LT, CY, CZ, HU, HR and SK) but much higher shares (>30%) in the Benelux and Nordic member states as well as DK, IE and FR. But in a large majority of countries, the share of remote working was greater for women than for men.

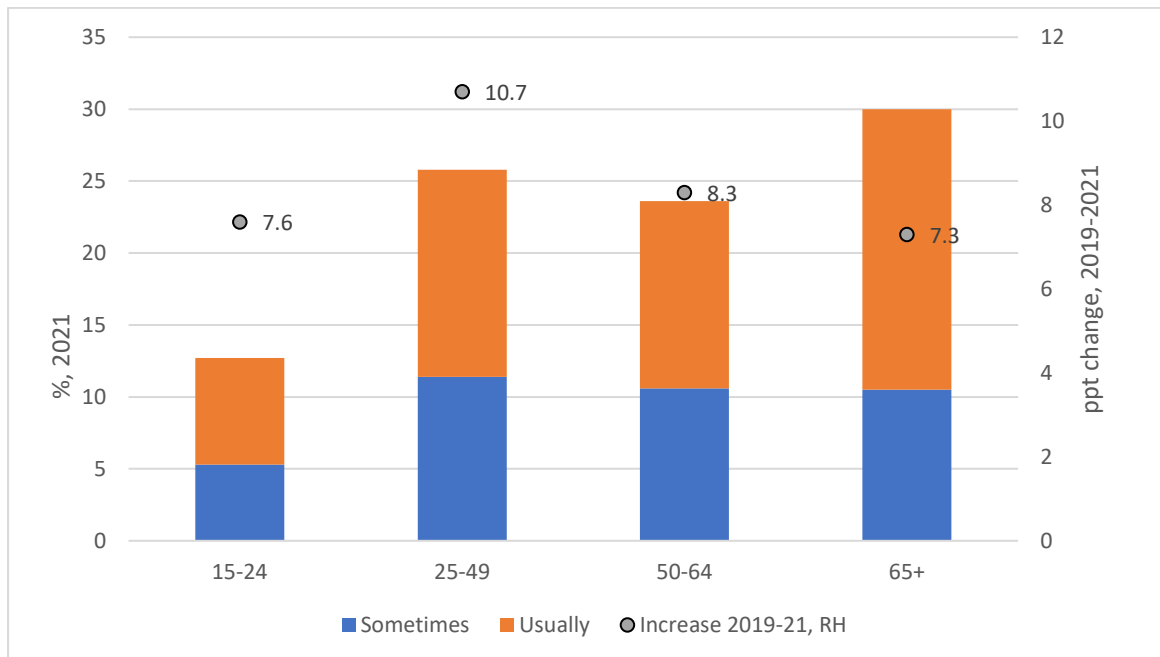
**Figure 8: Employees working from home by sex and country, % 2021**



Source: EU-LFS (lfsa\_ehomp)

During the pandemic, younger workers (<25 years) were less likely to work from home than core age and older workers. The share of those working from home was highest amongst the post-retirement cohort (30%). At the same time, compared to the pre-pandemic period, the biggest rise in incidence of working from home was among core age employees aged 25-49 (>11 pts).

**Figure 9: Working from home by age, % 2021 and ppt change 2019-2021**

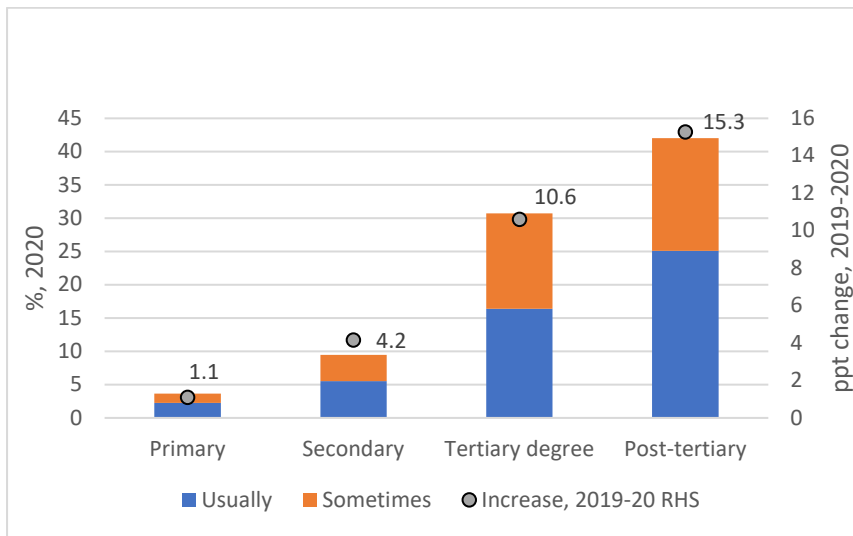


Note: employees only; the 'Increase, 2019-21 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.

Source: EU-LFS (lfsa\_ehomp).

As noted previously in Sostero et al (2020), certain personal or work-related characteristics were strong markers of the likelihood to be working from home before the pandemic. Workers who were higher paid, with third level degrees, working in white collar service occupations and / or working in densely populated, metropolitan areas registered much higher than average incidences of working from home. This was also the case during the pandemic, as we can see from figure 10. More than 40% of employees with post-tertiary level of education reported teleworking in 2020, while around 30% of those who completed tertiary education worked from home at least some of their time, compared to less than 10% of those with secondary education and 4% of those with primary education. The higher the level of education, the more the incidence of teleworking increased during the pandemic.

**Figure 10: Working from home by level of education, % 2020 and ppt change 2019-2020**

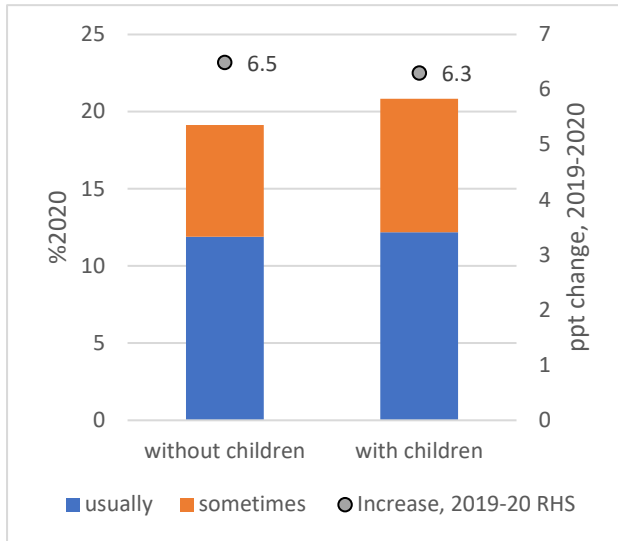


*Note: employees only; the 'Increase, 2019-20 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.*

*Source: EU-LFS (authors' elaboration).*

In 2020, workers with children reported teleworking slightly more than people without them (around 20%). The presence of children in the household made however little difference to the incidence of working from home. Compared to the pre-pandemic period, the rise in the incidence of teleworking was slightly more for households without children (around 6.5 ppts) than those with children (6.3 ppts), and this is mainly due to those who worked from home regularly.

**Figure 11: Working from home by family type, % 2020 and ppt change 2019-2020**



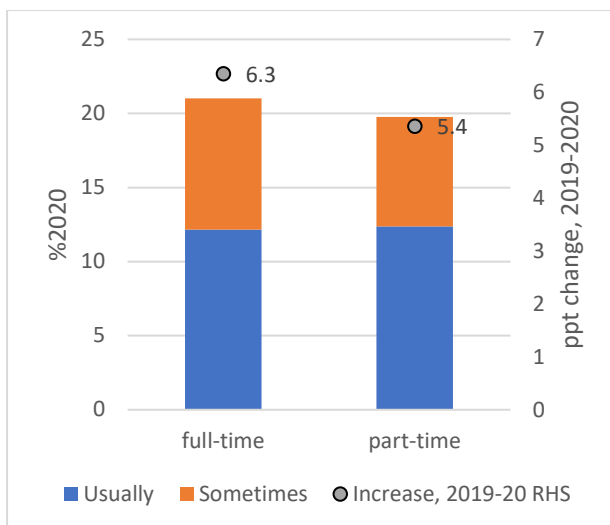
Note: employees only; the 'Increase, 2019-20 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.

Source: EU-LFS (authors' elaboration).

During 2020, around 21% of full-time employees reported working from home. More than 12% of full-timers usually worked from home, while almost 9% occasionally worked from home. Compared to 2019, the incidence of telework increased by over 6 pts.

In 2020 almost 20% of part-time employees worked from home. More than 12% usually worked from home, while almost 7.50% occasionally worked from home. Compared to the pre-pandemic period, the incidence of working from home increased by over 5 pts for part-timers. The increase was mainly attributable to those usually working from home. Full-time workers were marginally more likely to work from home than part-timers and during the pandemic the gap with part timers increased, if only marginally.

**Figure 12: Working from home by work time, % 2020 and ppt change 2019-2020**



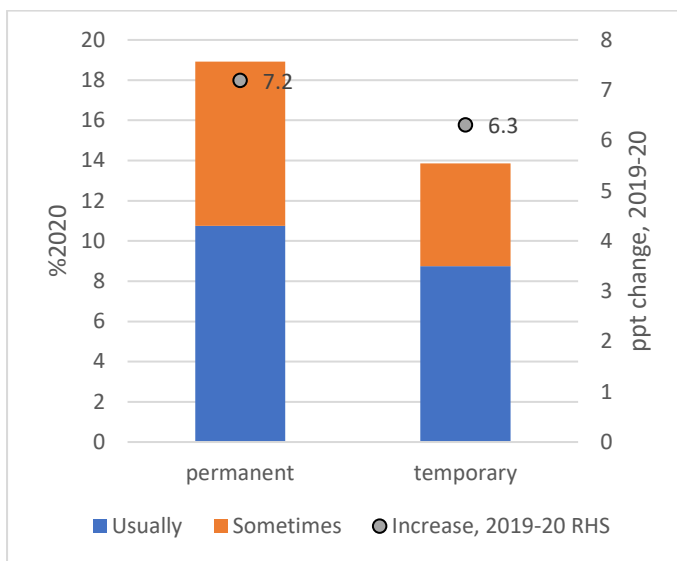
Note: employees only; the 'Increase, 2019-20 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.

Source: EU-LFS (authors' elaboration).



Permanent employees have tended to have greater access to working from home than temporary employees, in part because working from home implies a degree of autonomy more likely to be extended as a privilege to those enjoying “core” employment status. This differential grew somewhat larger during the pandemic, according to figure 13. Among permanent employees, the share of those working from home occasionally remained stable before and during the pandemic (more than 8%), while the share of those usually working from home increased significantly, from 3.3% to 10.7%. Compared to 2019, the incidence of working from home increased by over 7 ppts. Among temporary employees the share of those working from home occasionally remained stable between 2019 and 2020 (around 5%), while the share of those usually working from home increased significantly, from 3% to almost 9%. During the first year of the pandemic, the incidence of working from home among temporary employees increased by over 6 ppts.

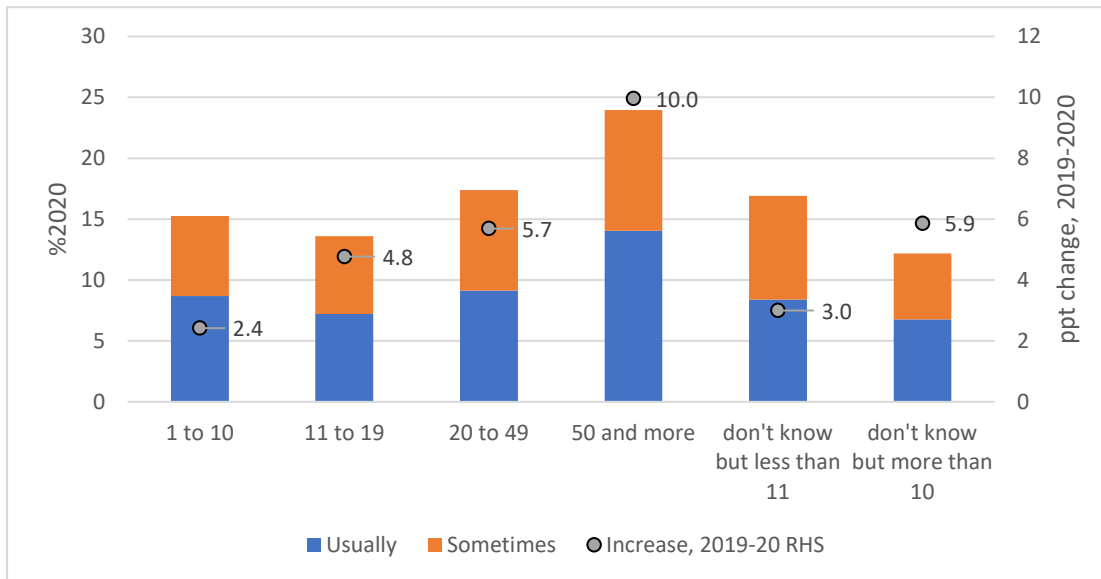
**Figure 13: Working from home by permanency of the job, % 2020 and ppt change 2019-2020**



*Note: employees only; the 'Increase, 2019-20 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.*

*Source: EU-LFS (authors' elaboration).*

Employees in larger establishments are more likely to work from home than those in smaller ones. In 2020 almost 25% of employees in firms with 50 and more workers reported working from home. Compared to 2019, the increase was almost 10 ppts and it was mainly due to a huge increase of employees regularly working from home. In micro companies (1-10 workers) 15% of employees reported teleworking (increase of 5 ppts compared to 2019); in companies with 11-19 workers, less than 14% reported teleworking, in companies with 20-49 workers, more than 17% reported teleworking; compared to 2019, the increase for both the categories was around 5 ppts, mainly due to regular teleworkers. The increase in teleworking for small and medium-sized establishments was more muted than for larger ones, probably due to both the availability of technological infrastructure and more prevalent pre-existing remote working possibilities in larger establishments.

**Figure 14: Working from home by size firm, % 2020 and ppt change 2019-2020**


Note: employees only; overlapping categories are due to different question formulations / answer categories in different member states; the 'Increase, 2019-20 Rpt Change' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.

Source: EU-LFS (authors' elaboration).

Before COVID-19, the incidence of working from home was very different from country to country. In countries like Bulgaria, Romania, Baltic Republics and even Italy it was marginal or almost inexistent. In Denmark, Finland, the Netherlands, Luxembourg, and Sweden over a quarter of employees reported working from home at least some of the time.

During the pandemic, the incidence rose in all countries. In the Benelux and Nordic member states as well as Ireland, between one in three and a half of employees reported working from home at least some of the time in 2021 (see Fig 15). The smallest increases in percentage point terms occurred in countries where telework was still not very prevalent in 2019; but given low starting levels, the rates recorded in Bulgaria and Romania in 2021 (6 and 7% respectively) still represent a five-fold expansion on pre-COVID incidence. The largest increases were recorded in smaller EU-27 countries notably (Malta and Ireland, >20 ppt increase 2019-21).

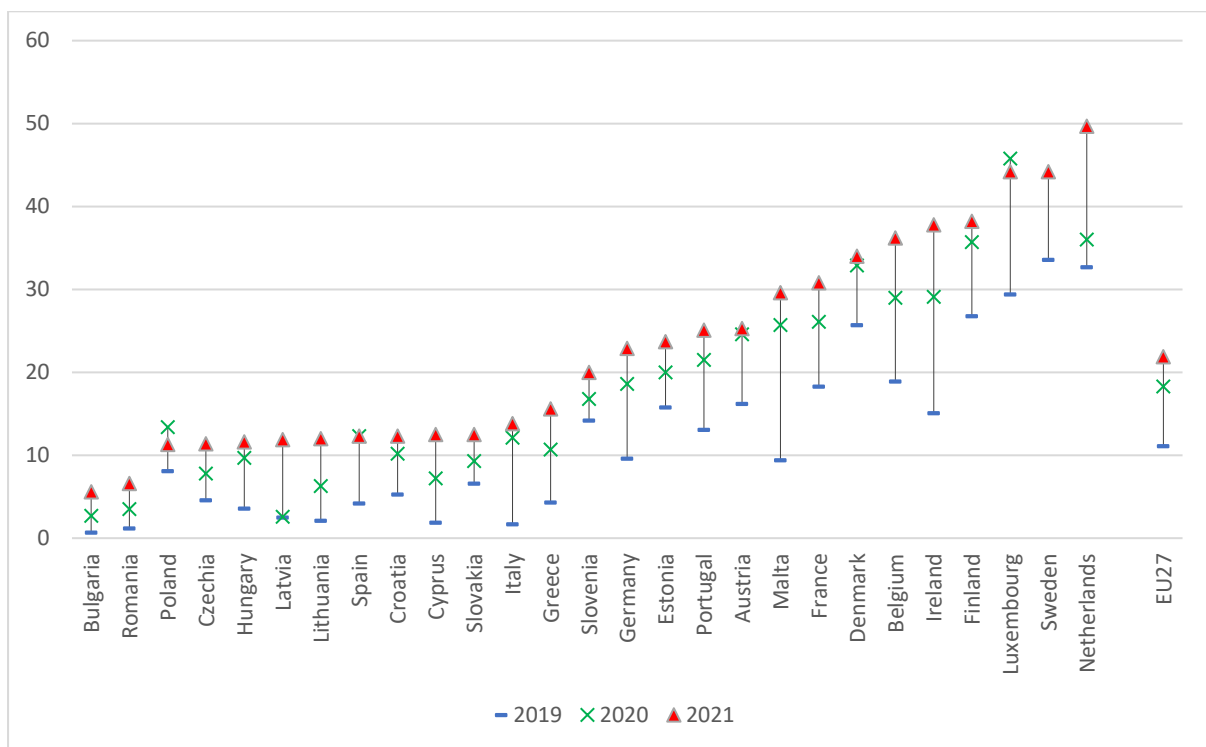
The fact that there was a significant increase in working from home not just between 2019-20 at the outset of the pandemic but one that continued into 2021 is consistent with the extension of physical distancing measures into the second year of the pandemic. The most relevant 'non-pharmaceutical interventions' for the purposes of this analysis were workplace closures as well as advice to work from home where possible. These measures inter alia are integrated in the Oxford COVID-19 government response stringency index (0-100)<sup>6</sup>. An unweighted average of the EU27 member state

<sup>6</sup> The Oxford Coronavirus Government Response Tracker (OxCGRT) project calculated a Stringency Index, a composite measure of nine of the response metrics, aimed to record the strictness of government policies for each country. The nine metrics used are: school closures; workplace closures; cancellation of public events; restrictions on public gatherings; closures of public transport; stay-at-home requirements; public information campaigns; restrictions on internal movements; and international travel controls. A higher score indicates a stricter response. (COVID-19: Stringency Index - Our World in Data, last access 17/06/2022).

averages on this index shows three peaks coinciding with major COVID waves in March-April 2020, December 2020-April 2021 and December 2021-January 2022 (Hale et al, 2022). While of progressively decreasing severity in terms of their peak values, the duration of peak-level restrictions was greater in 2021 than 2020.

Differences in the speed of adaptation to remote working may also be an additional contributor to the increased incidence in 2021 compared to 2020, which was reported in all EU member states with the exception of Poland and Luxembourg. In low incidence countries such as Bulgaria, Romania, Latvia, and Lithuania but also in the country with the highest incidence (the Netherlands), the bulk of the 2019-21 increase in working from home took place in 2021, the second year of the pandemic. By contrast, in Italy - the country with the first and most severe manifestation of COVID in spring 2020 – nearly all of the COVID-period rise took place in 2020 with only a modest increment in 2021.

**Figure 15: Working from home by country, % 2019-21**



Note: employees only.

Source: EU-LFS (lfsa\_ehomp).

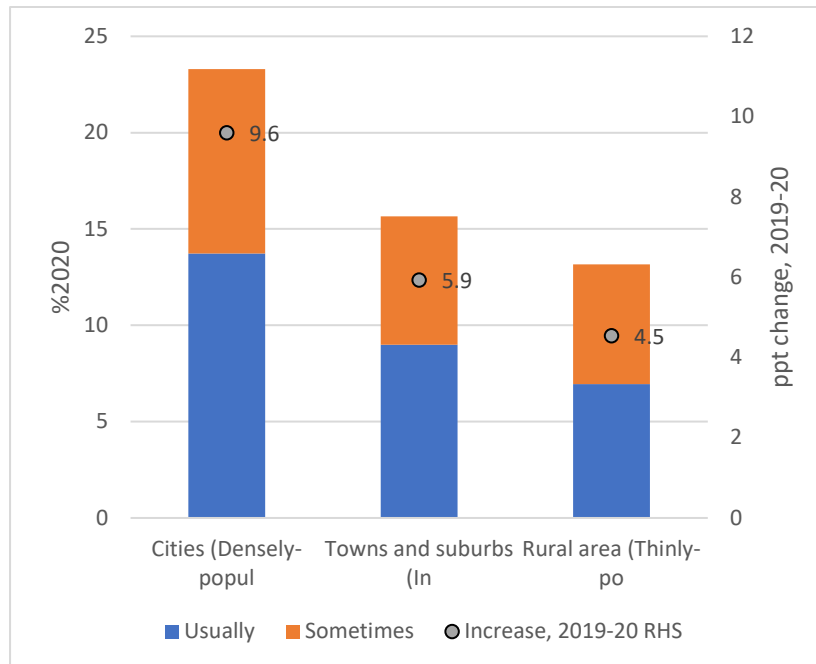
As reported in Sostero et al (2020), before the pandemic working from home was much more likely in more densely populated metropolitan areas, than in suburbs and rural areas. During the pandemic, the share of teleworkers increased more in cities than in other areas (>9 ppt), based on the DEGURBA<sup>7</sup> variable (see figure 16).

This relates on the one hand to differences in employment structure: more densely populated, metropolitan areas are richer in the knowledge-based, white-collar services jobs that lend

<sup>7</sup> DEGURBA, degree of urbanisation. This LFS variable differentiates between three settlement types with respect to their degree of urbanisation based on population density at Local Administrative Unit level. The three categories are “Densely populated / cities”, “Intermediate / towns and cities” and “Thinly populated / rural”.

themselves to remote working, while in other area-types jobs that cannot be performed remotely are more common (e.g., agricultural labour in rural areas). On the other hand, it could also be influenced by the availability of digital infrastructure required for much telework (for example, high speed broadband is more commonly available in cities than in remote rural regions). Moreover, employees working in urban areas usually have higher commuting time than workers working in non-urban areas and are more likely to telework to avoid commuting (Eurofound, 2022).

**Figure 16: Working from home by settlement type, % 2020 and ppt change 2019-2020**



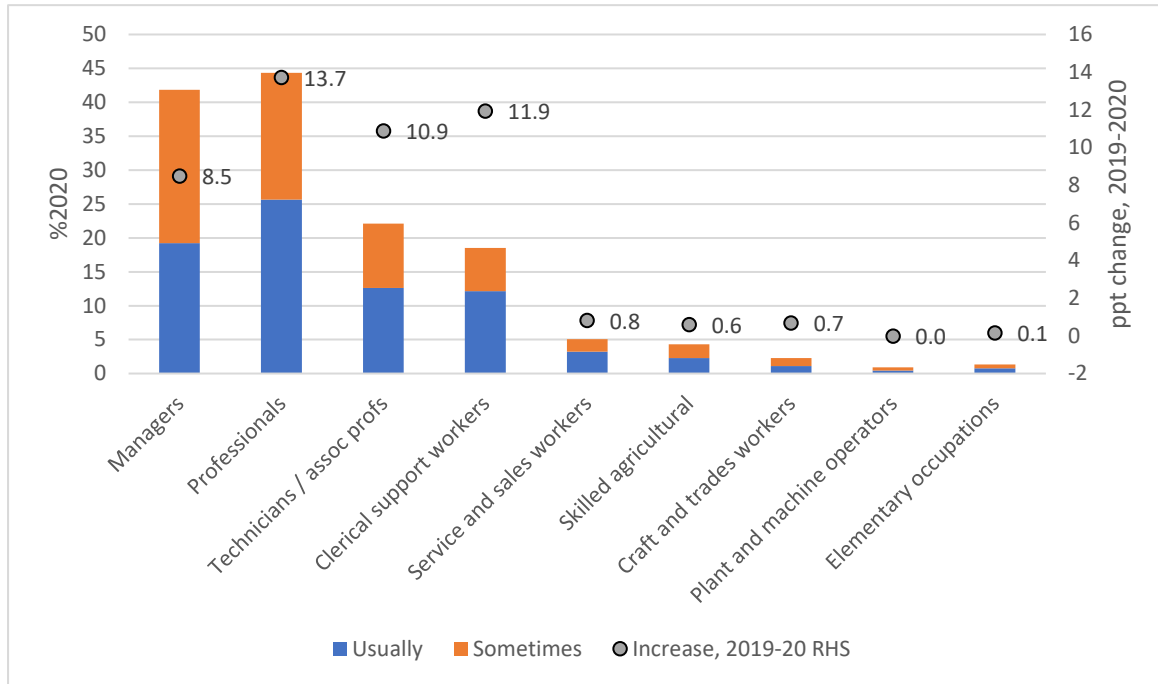
*Note: employees only; the 'Increase, 2019-20 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.*

*Source: EU-LFS (authors' elaboration).*

Working from home and 'teleworkability'- the possibility for some jobs to be potentially carried out remotely- have very strong occupational gradients. In 2019 the share of teleworkers was very low among lower-level blue collar occupations and the situation did not change much during the pandemic: the increase in working from home was marginal. Occupations such as elementary occupations, machine operators, agricultural, services and sales workers tend not to be teleworkable. During the COVID-19, the incidence of working from home increased mainly among white collar occupations, especially among professionals (>13 ppts).

It is worth noting that occupational grades of lower-level white collar occupations also reported big increases in incidence of working from home, even if the pre-pandemic share was lower than for top white-collar occupations. The increase occurred in occupations such as clerical support workers and technicians/associate professionals; these include a majority of jobs that can be worked remotely but which typically employ younger, less tenured workers to whom the 'benefit' or 'privilege' of remote working was less likely to be extended before the crisis.

**Figure 17: Working from home by occupation, % 2020 and ppt change 2019-2020**



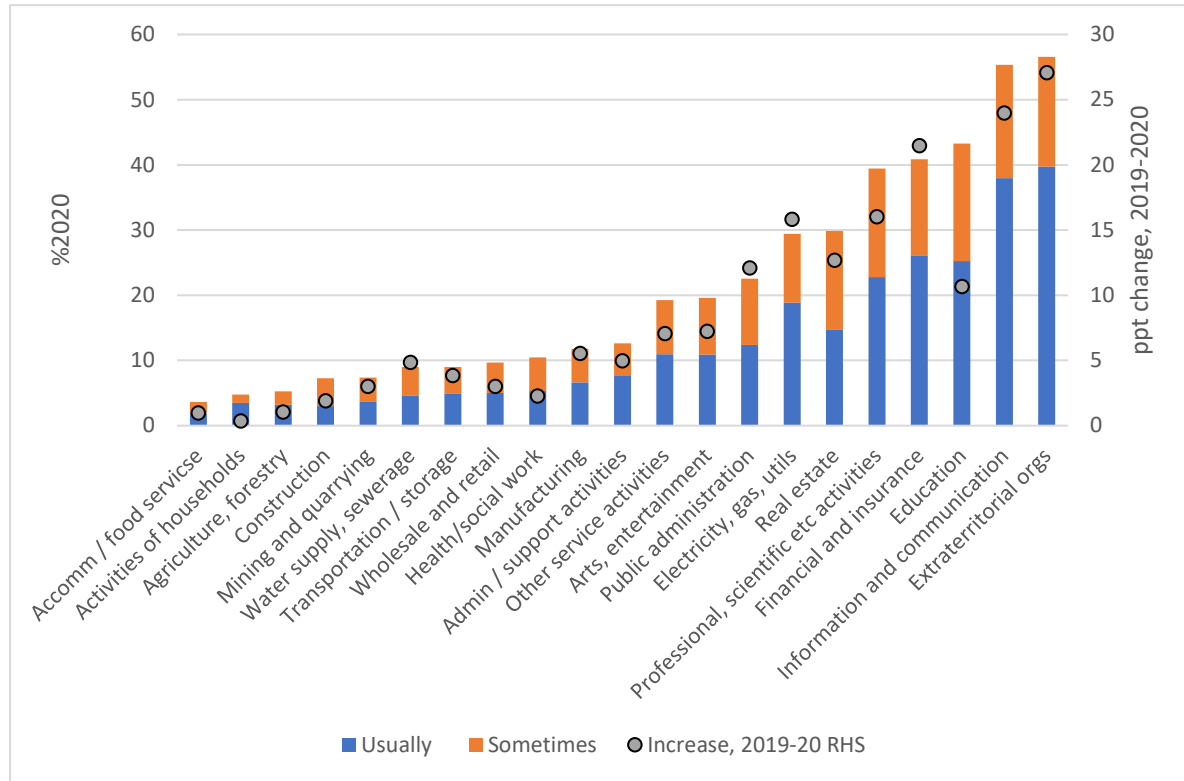
Note: employees only; the 'Increase, 2019-20 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.

Source: EU-LFS (authors' elaboration).

During COVID-19, the incidence of working from home differed from sector to sector though not as markedly as by occupation (see figure 18). The incidence of working from home was very high in service sectors, where the biggest increases 2019-20 were recorded. In the education sector, the share of WFH in 2020 was high but in comparison with other sectors with high incidence of telework the increase has been relatively modest. Working from home was not very common in sectors with high shares of place-dependent work such as accommodation and food services, construction (due to lockdowns / closures) as well as agriculture, manufacturing, and mining (where work the possibilities of working from home are limited to a small share of white-collar occupations).

The type of job you do – as determined by occupation and sector and determined by tasks carried out within such combination of occupation and sector - is an important factor influencing whether you work remotely.

**Figure 18: Working from home by sector, % 2020 and ppt change 2019-2020**



Note: employees only; the 'Increase, 2019-20 RHS' refers to the combined 'usually' and 'sometimes' categories for the variable Working from Home.

Source: EU-LFS (authors' elaboration).

## 2 – Who is more likely to work from home?

The previous section has provided a descriptive overview of the incidence of teleworking in the European Union and argued that the COVID-19 pandemic has led to an overall increase in telework with important differences across relevant worker characteristics. Some explanations are given based on review of the relevant literature. This section builds on the descriptive analysis and seeks to provide additional insights into the main predictors of telework in Europe. The guiding questions of this section are: what are the correlates of telework in Europe and how have they changed in response to the COVID-19 pandemic? Furthermore, how does the incidence of telework vary across Member States? The analysis aims to identify differences in probabilities of working from home between categories over a given period, controlling for a large set of workplace and personal characteristics. The section draws on the annual European Labour Force Survey for 2019 and 2020 and estimates a series of logistic multivariate regression models on three dependent variables: working from home, working from home usually and working from home sometimes. All models are restricted to dependent employees, aged 15-65+. In addition, all interactions are estimated while taking into account the full specifications presented below.

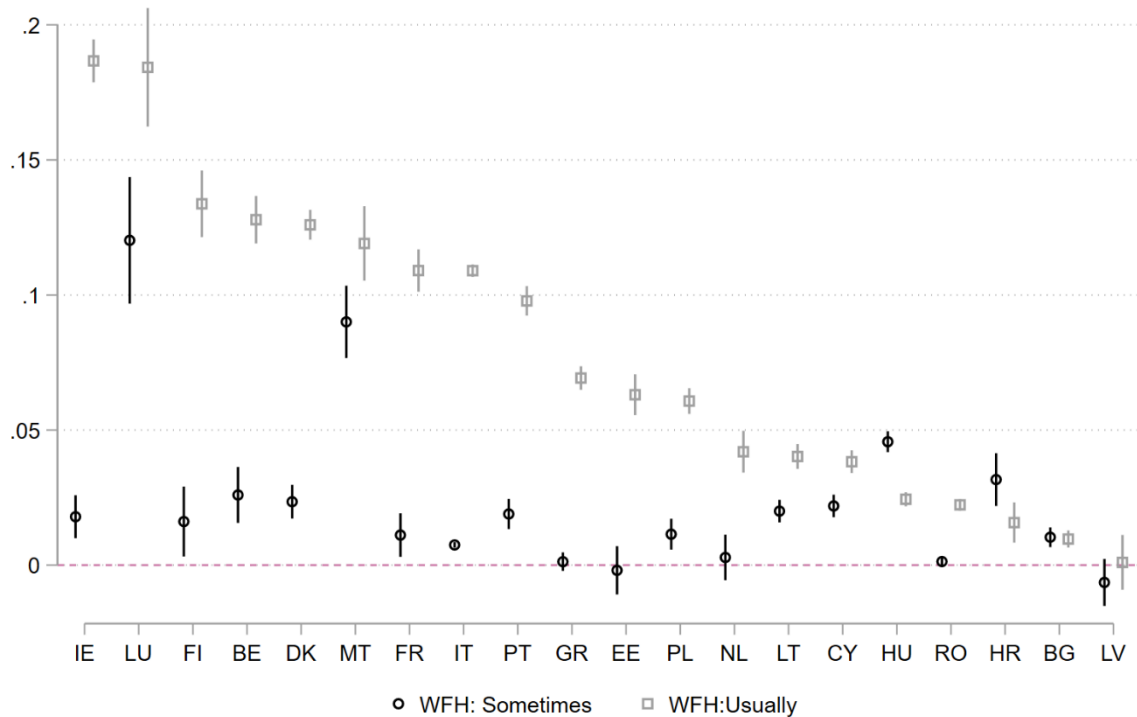
Table A1 in Annex summarizes the results of the main models. The first aspect worth noting is that all year coefficients are significant indicating that, all things being equal, the pandemic has increased the prevalence of teleworking amongst dependent employees in the European Union. Looking at the size of effects, while in 2019 the probability of working from home was about 11.8 percent, in 2020 it increased to 19 percent. Therefore, on average, the pandemic has led to a net increase in the probability of working from home by 7.2 percent in the European Union. This effect was mainly driven by the sizeable increase in the probability of working from home usually. If in 2019, prior to the pandemic, the probability of working from home amongst dependent employees was about 4% in 2020 this increased to 12%. In contrast, the pandemic has led to less substantial increases in the probability of working from home sometimes which increased only by 1.2% from 8.1% in 2019 to 9.3% in 2020.

The results confirm that the lockdowns implemented across Member States in response to the healthcare emergency have led to a significant increase in the prevalence of telework. They also suggest that the pandemic has introduced a break in how European employees experienced telework. If prior to the onset of the pandemic teleworking was mainly performed on an irregular basis, teleworking on a usual basis became the norm in 2020.

Breaking down the change in regular teleworking ('usually'), in Figure 19 four groups of countries can be identified. The first group, which includes Ireland and Luxembourg, are the countries that witnessed very large increases of 19% and 18 % respectively in the probability to usually telework. Employees in Ireland witnessed a very large increase in the probability to usually telework, even though before the prevalence of teleworking amongst Irish employees was relatively low (6%). A second group of countries includes Finland, Belgium, Malta, France, Italy and Portugal. In these countries, employees' probability to usually telework increased between 10 and 15%. Employees in Finland had the highest propensity to usually telework before the onset of the pandemic (15%) which may be explained by the flexible regulatory approach implemented in the country through the 1996 Working Hours Act (see Eurofound 2021). Thirdly, employees in Greece, Estonia, Poland, Netherlands, Lithuania and Cyprus have witnessed moderate increases in the propensity to usually

telework. Finally, employees in Romania, Croatia, Bulgaria and Latvia have seen little or no significant increase in the likelihood to usually engage in telework as a result of the pandemic. In these countries, the probability of employees to engage in telework was low prior to the pandemic and remained so during the healthcare crisis. Several factors contributed to the low incidence and uptake of telework in these countries including: the lack of regulatory certainty around the organisation of telework, a general mistrust of employers around the use of telework, broader negative social perceptions and distrust towards the regular use of telework as well as less developed digital infrastructure (Vallasek and Mélypataki, 2020; Urbāne et al. 2021).

**Figure 19: Working from home sometimes and usually in 2020 in comparison to 2019 by country (average marginal effects<sup>8</sup>)**



Source: EU-LFS (authors' elaboration).

Figure 19 also demonstrates that the COVID-19 pandemic has been less consequential with respect to changes in the propensity of workers to engage in telework on an occasional basis. Except for Luxemburg and Malta, where the probability to occasionally telework has increased by 12% and 9% respectively, in all other countries differences in the probability of teleworking occasionally between 2020 and 2019 are lower than 5 percentage points. Furthermore, in Estonia, Greece, Latvia, Romania and the Netherlands the COVID-19 pandemic did not lead to significant changes in the probability to occasionally telework.

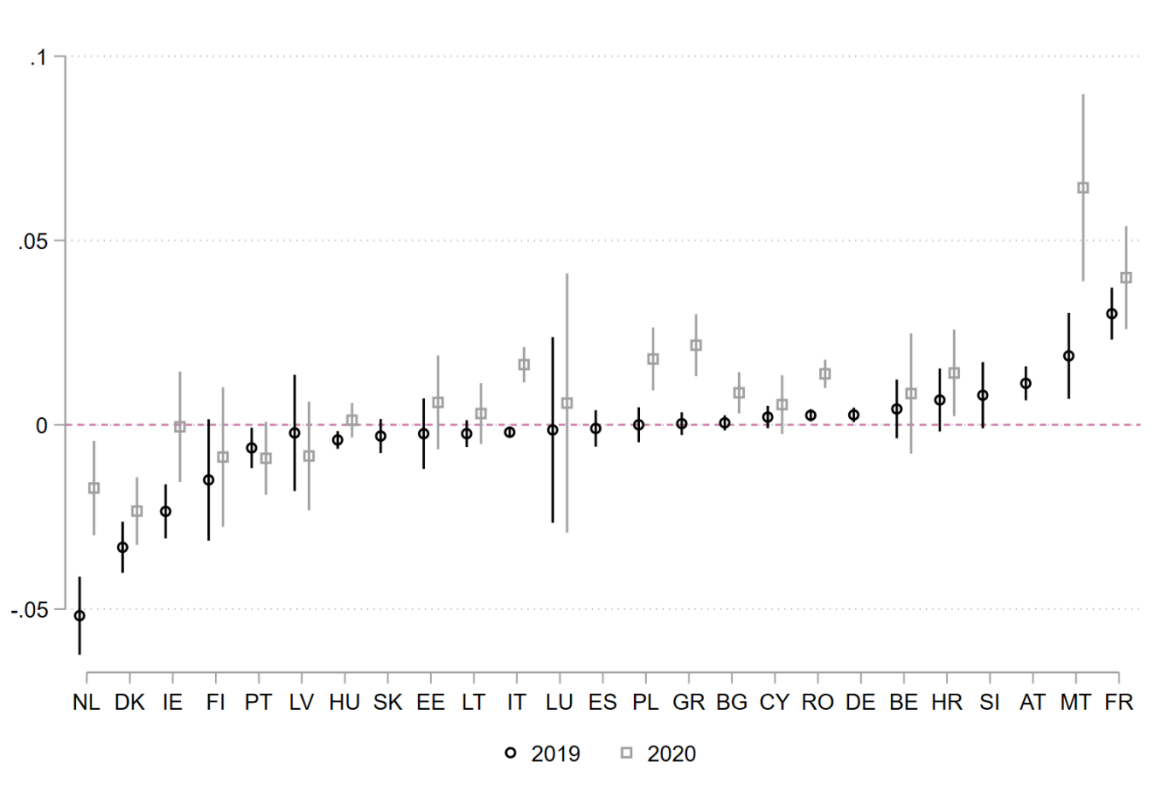
Moving to the impact of gender on telework prevalence, all things being equal, women had higher odds to telework, an effect driven by women having a significantly higher probability of teleworking

<sup>8</sup> An average marginal effect is a change in the predicted value of a dependent variable when the predictor or independent variable increases by one unit while all other variables are held at the mean.



on a usual basis. However, although significant differences do exist between the estimated probabilities of men and women working from home on a usual basis, the size of the effect is small. On average, relative to men, women are 0.7% more likely to usually telework, with the differences between genders being even smaller prior to the pandemic. Furthermore, while the pandemic has indeed increased the likelihood of women to usually telework, it did so only marginally. As Figure 20 shows, even in countries where significant differences between genders do exist, they are small in magnitude. Furthermore, the Figure demonstrates that the pandemic has increased access to telework for women in countries where women were less likely to telework prior to the pandemic (Denmark, Ireland and the Netherlands). At the same time, it has led to a significant increase in the probability to telework for women in several countries including Bulgaria, Greece, Italy, Malta and Romania.

**Figure 20: Average marginal effect of being a female on the probability to usually telework by year and country**

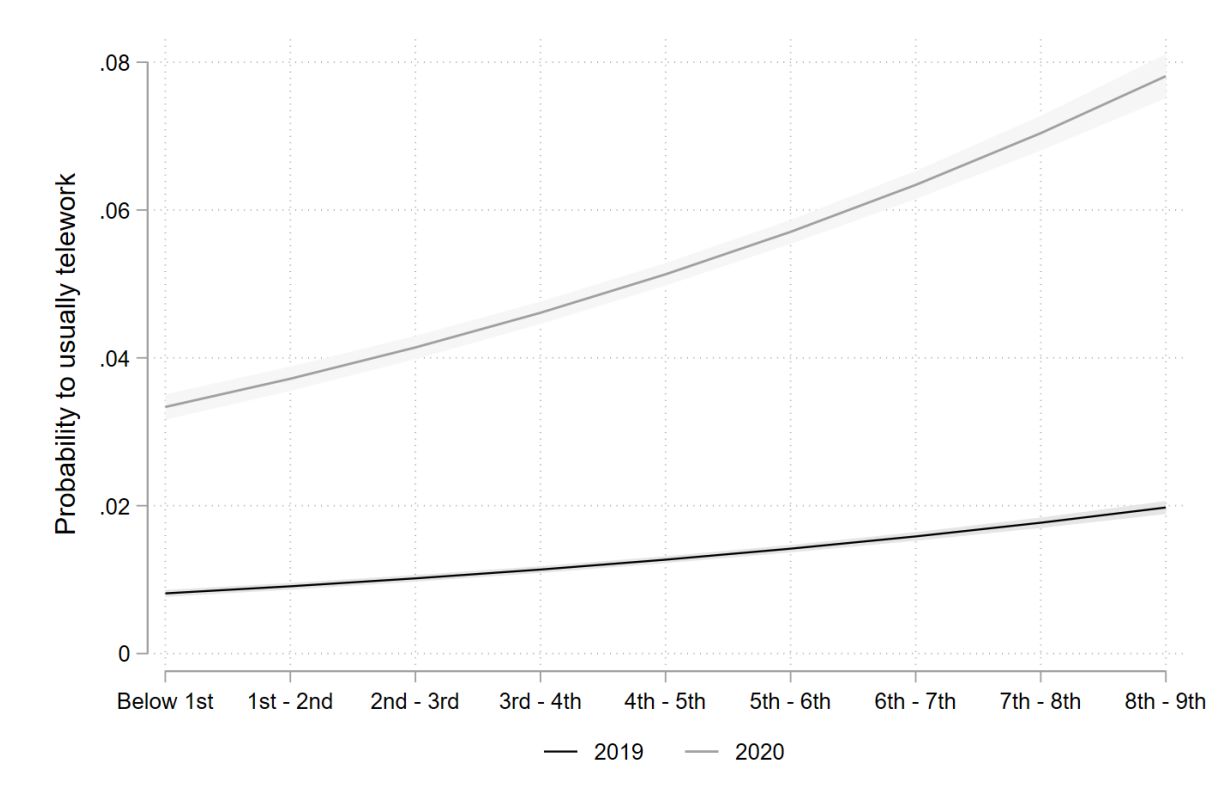


Source: EU-LFS (authors' elaboration).

Looking at the effects of age presented in table A2 in the Annex, relative to prime age workers, young workers remained less likely to telework both before and during the pandemic. The predicted probability to usually telework in 2020 for those aged 15-24 was 9% (a 7-percentage point increase compared to 2019), compared to 13% for those in the 25-54 age category (10 percentage points increase compared to 2019), 14% for those in the 55-64 age group (10 percentage points increase compared to 2019) and 18% for those aged 65 or older (13 percentage points increase compared to 2019). While the pandemic has indeed led to an increase in teleworking amongst young workers, it has also generated the sharpest reductions in employment levels within this age cohort (Eurofound and JRC, 2021).

Education and income have significant and large associations with the probability to telework. Highly educated workers are more likely to engage in telework both before and in the aftermath of the pandemic. The results also confirm earlier evidence from the descriptive analysis that the pandemic has led to a polarisation in telework along the education levels with differences between groups increasing in 2020 compared to 2019. Furthermore, the pandemic has also amplified differences across income deciles<sup>9</sup>. As Figure 21 demonstrates, while the pandemic has indeed made telework more widespread, it has also increased differences along the income distribution with the incidence of working from home being much higher amongst workers in the top income deciles.

**Figure 21: Predicted probability to usually telework by income decile in 2019 and 2020**



Source: EU-LFS (authors' elaboration).

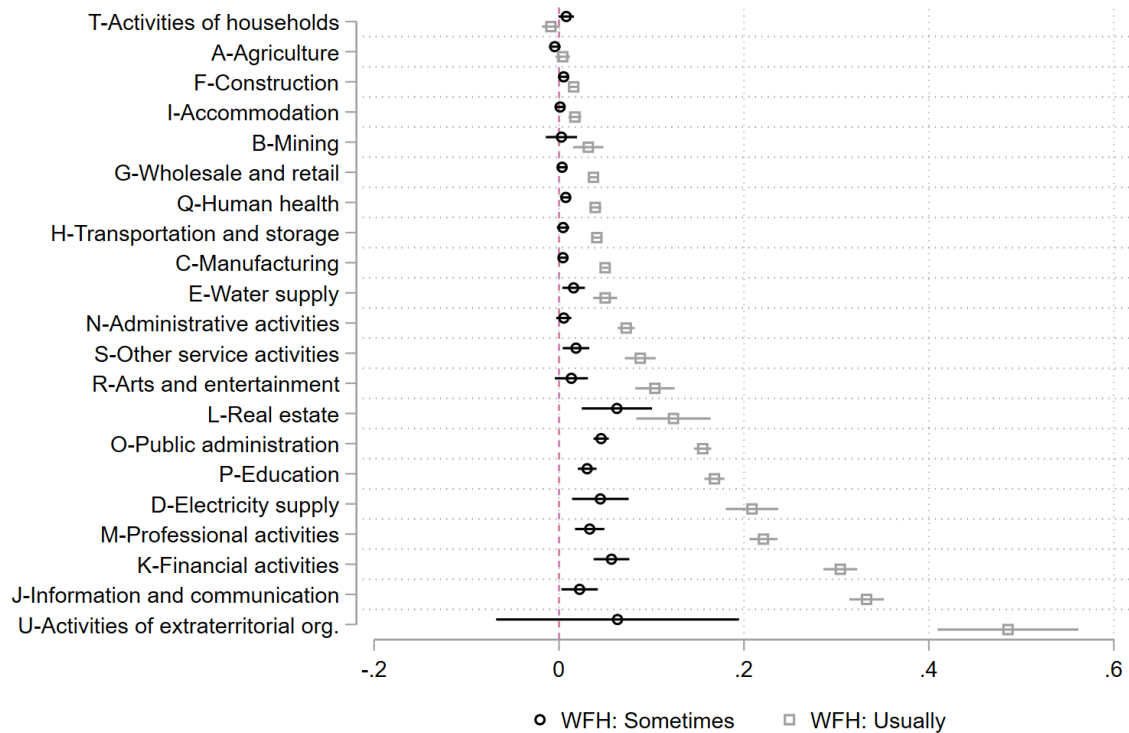
The pandemic has also increased the prevalence of telework in urban areas, with significant differences in the probability to telework between cities and other areas being maintained during the pandemic. Interestingly, significant differences in the probability to usually telework between towns and cities emerged only during the pandemic. With respect to job characteristics, the models indicate that the pandemic has led to a mainstreaming of teleworking amongst employees. As Models 7-9 demonstrate (see table A1 in Annex), differences between employees along contract type and tenure dimensions have vanished in 2020. Furthermore, the pandemic has also mainstreamed telework especially amongst small firms. If prior to the onset of the crisis, teleworking

<sup>9</sup> The income decile groups are 10 equal sized groups arranged so that each group contains 10 per cent of the population in ascending order of work income (gross pay).

tended to be prevalent mainly amongst larger firms, an effect driven by the higher technology uptake amongst such companies, in 2020 small companies have also seen an increase in the probability of workers to engage in telework on a usual basis.

Differences in teleworking also exist between industries and occupations. As Figure 22 shows, in 2020 telework became much more prevalent especially amongst private and public service sectors. Financial activities, information and communication and the activities of extraterritorial organizations have witnessed the largest increases in teleworking on an occasional basis. In contrast, the pandemic did not impact on the likelihood to telework of employees in sectors such as agriculture, construction, accommodation, or mining and has led to very small increases in the propensity to occasionally telework for employees in sectors such as retail, manufacturing or administrative activities.

**Figure 22: Working from home sometimes and usually in 2020 in comparison to 2019 by sector (average marginal effects)**

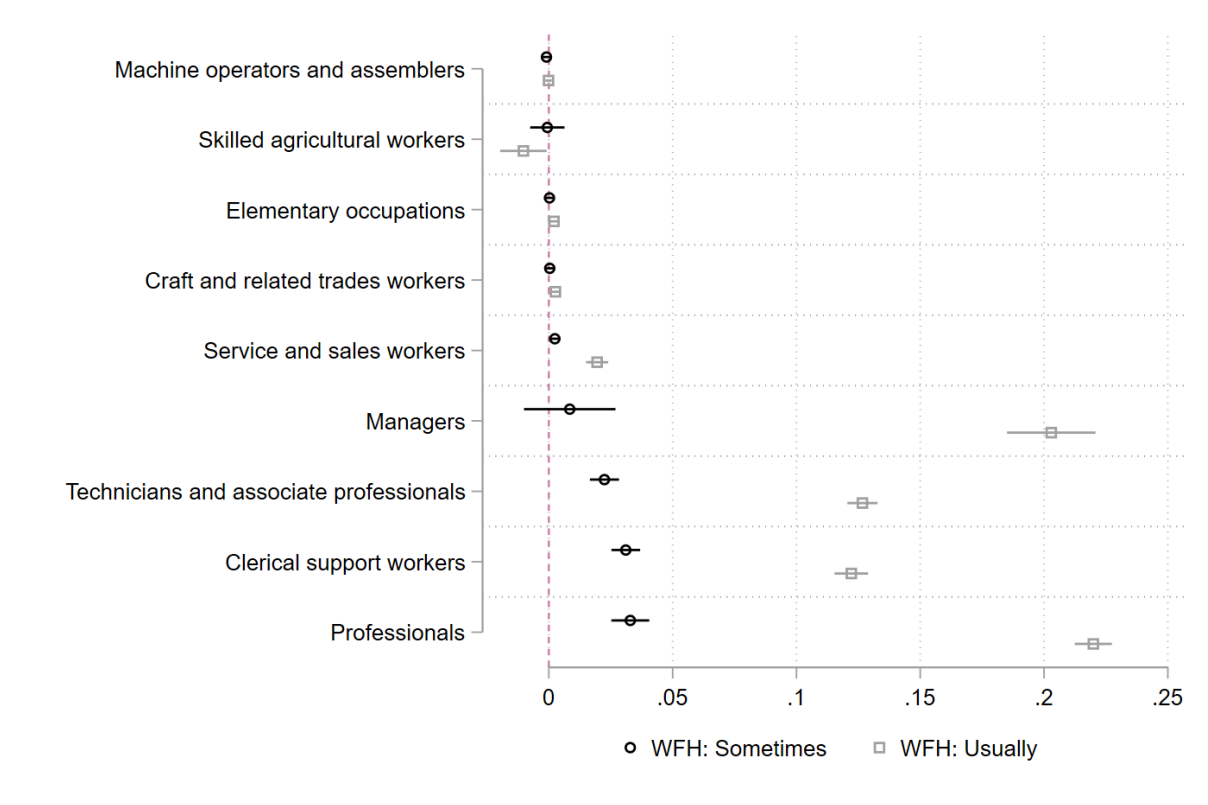


Source: EU-LFS (authors' elaboration).

Looking at telework by occupation, Figure 23 indicates a clear divide between blue- and white-collar occupations. While the pandemic did not lead to significant changes in the propensity to telework for machine operators and assemblers, skilled agricultural workers and elementary or craft occupations it led to very high increases in the likelihood to usually telework for managers, professionals, technicians, and clerical support workers. The size of the estimates also suggests that beyond the teleworkability of some occupations which makes them more or less suitable to telework, the level of authority as well as the degree of autonomy and control that employees have

also matter for the likelihood to engage in telework. Overall, occupations with higher level of autonomy such as managers or professionals were 20 % more likely to usually telework in 2020, a level that is 8 percentage points higher when compared to technicians and clerical support workers.

**Figure 23: Working from home sometimes and usually in 2020 in comparison to 2019 by occupation (average marginal effects)**



Source: EU-LFS (authors' elaboration).

### 3 – Teleworkability: what jobs and occupations can be carried out remotely?

The outset of the COVID pandemic in March 2020 was marked by a widespread unanticipated and ad-hoc recourse to working from home, as presented in earlier sections. The rise in incidence of remote working triggered many reflections on what jobs and occupations could potentially be worked remotely and what job or task characteristics determined such ‘teleworkability’.

The first, much-cited assessment by Dingel and Neiman (2020) developed a binary ‘work-from-home’ or teleworkability indicator based on US O\*NET survey data for occupational task descriptions<sup>10</sup>. Each of over a thousand detailed occupational categories was classified as capable or not capable of being worked remotely based on its task components. Based on this the employment share in the US working in teleworkable occupations was estimated at 37%. For the EU27, Sostero et al. (2020) arrived at a similar estimate for the share of dependent employment in the EU that was ‘technically feasible’ to be carried out remotely.

This EU analysis of teleworkable employment in Sostero et al. (2020) used an explicit theoretical foundation for the assessment of teleworkability of occupations based on the occupational tasks framework developed by researchers in the Eurofound and the European Commission Joint Research Centre (Fernández-Macías and Bisello 2022). In this section, we will summarise this framework in so far as it is relevant for an analysis of remote working based on Sostero et al. (2020) and compare its predictions on the employment share in teleworkable occupations compared to what occurred in 2020, the first year of the pandemic based on LFS annual data for the year.

According to this conceptual framework, work activity can be characterised along three different axes:

- First, **the contents of work** which classifies tasks according to the object on which they operate and the type of transformation process involved, and at the highest level it differentiates between intellectual tasks (operating on information or ideas), social tasks (operating on social relations) and physical tasks (operating on things).
- Second, **the methods of work** which reflect the forms of work organisation used to coordinate a particular productive process, and which can be broadly characterised by the levels of teamwork, autonomy, and routine in the work process.
- Finally, **the tools of work** which refer to the technologies used in the production processes.

From this task perspective, **teleworkability** is defined as the material possibility of providing labour input remotely into a given economic process. The phrase "material possibility" emphasizes that teleworkability is a technical feasibility, which depends on what types of task content can be remotely provided with the available technology. The sections below summarise the extent to which the three broad task types are amenable to remote performance.

Intellectual tasks: The possibilities for the remote transmission, manipulation and storage of information have been vastly expanded by the digitalisation of work (Fernandez-Macías, 2018). Any information that can be digitally encoded without loss can be perfectly transmitted to any part of

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<sup>10</sup> [O\\*NET OnLine \(ononline.org\)](https://ononline.org)

the world almost instantly, which means that any task aimed at operating with encoded information (verbal, numeric or of any other type) can be performed remotely without any loss in a technical sense. Therefore, from the three categories of task content previously presented, we can already say that intellectual tasks (work which essentially involve operating with ideas or information) are the most susceptible to telework. Since nowadays information processing tasks are almost always performed with computers, the intensity of use of computers at work can be a good proxy for teleworkability.

Social tasks: Digital communications have also expanded massively the possibilities for remote social interaction. Before the digital revolution, analogue forms of remote communication such as mail or landline telephones allowed long-distance verbal interaction, but the very significant limitations in the amount of information that could be transmitted made them a very inefficient form of social interaction compared to face-to-face communication. In contrast, digitally encoded visual and auditory information transmitted via the internet (as in a videoconference) allow for a more efficient remote social interaction (as long as it does not require actual physical contact). There is nonetheless significant information loss compared to face-to-face social interaction. Even in the most flawless videoconference, there are small lags or informational noise that can be quite disruptive, and many non-verbal cues or signals are likely to be missed (Schoenenberg et al. 2014). Therefore, we can say that social interaction tasks that do not require physical contact can nowadays be provided remotely but with some loss of quality in the service. An example would be the occupation of school teacher, not ideal to be carried out remotely but technically feasible as the COVID experience demonstrated.

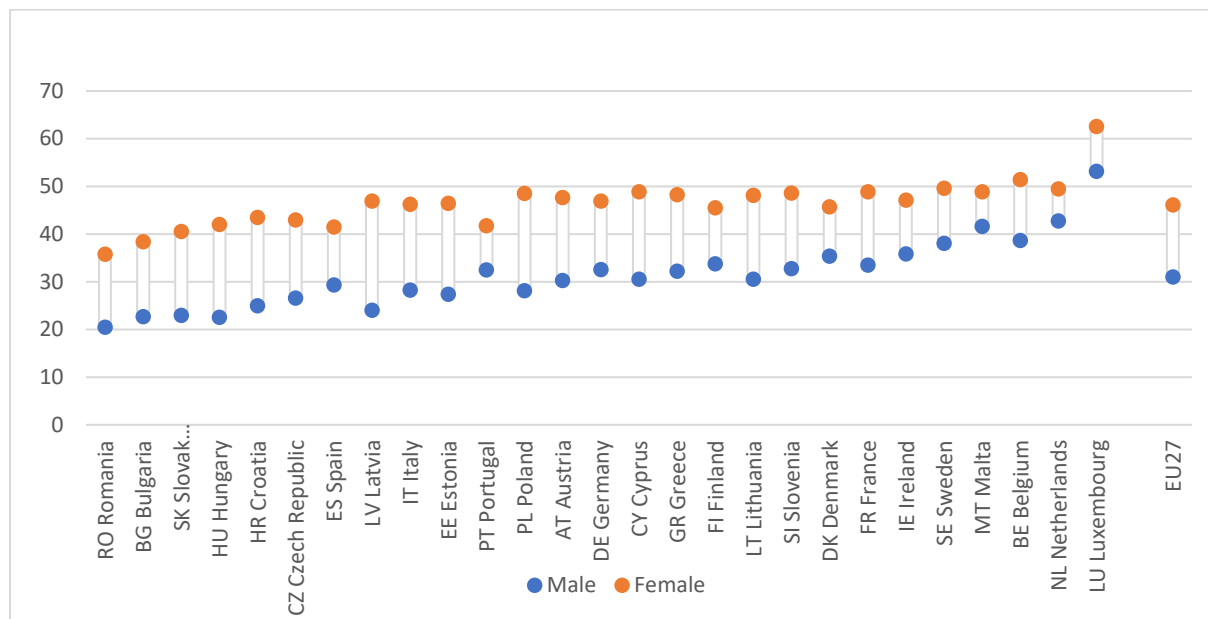
Physical tasks: tasks which involve physical operation with things (or people) are the ones where remote labour input remains most difficult. Although there have been important advances in recent years in the fields of telepresence and telerobotics (for a discussion, see Baldwin 2019), being able to remotely manipulate objects with a level of precision similar to actual presence is still beyond the capabilities of even the most advanced technologies. Therefore, in practice, the real bottleneck determining the telework possibilities of a job is its physical task content. Any job that requires to a significant extent the physical manipulation of (or operation with) things or people will not be susceptible to telework.

In summary, information processing tasks can in general be provided remotely with hardly any loss of quality and can be easily identified by their use of computers. Social interaction tasks not requiring physical contact can also be provided remotely but with a potential loss of quality. Physical tasks however can generally not be provided remotely with existing technologies and thus are the real bottleneck for the teleworkability of occupations. For the purposes of the occupational teleworkable index developed in Sostero et al. (2020), therefore, the sole determinant selected is the absence of tasks requiring physical operation. The main technical teleworkability index is therefore negatively determined, i.e., by the absence of physical task content in an occupation. The extent to which jobs are information processing intensive has no bearing on their main teleworkability index score (though of course it is precisely these types of tasks that lend themselves most to remote working and, in practice, there is a high correlation between intensity of computer use – a good proxy of information processing task intensity – and teleworkability). Similarly, the extent to which jobs involve social tasks is also of no account in determining its technical teleworkability.

Based on the simple, binary indicator of technical teleworkability, Sostero et al. (2020) estimated that occupations accounting for 37% of EU dependent employment could be teleworked based on 2018 LFS data. Updating this assessment with 2020 LFS data, a small increase in overall teleworkable employment is observed (38.5%). This small increase reflects the persistent impacts of the pandemic on employment levels in sectors most affected by social distancing measures. These include many sectors where most employment is not teleworkable (retail, accommodation, food / beverages) (Eurofound and Commission-JRC, 2021). It also relates to the resilience and growth of employment share in white-collar, knowledge intensive sectors where most employment is teleworkable. The fastest growing ISCO2d occupation during 2018-20 was that of information and communication professional, an archetypally teleworkable job. While marginal in percentage terms, the shift in employment structure between 2018 and 2020 resulted in over 1.75 million net new teleworkable jobs in the EU27.

The task profile of female employment by occupation lends itself much more readily to remote working than that of male employment and women account for a significantly larger share of teleworkable employment than men (Sostero et al., 2020). In part, this reflects both the physical demands and the strongly place-dependent nature of some male-dominated jobs. Jobs for example in the agriculture, construction and manufacturing sectors tend not to be teleworkable for these reasons, while being largely male-employing.

**Figure 24: teleworkable employment by gender, EU27 (2020) %**



*Note: dependent employment only.*

*Source: Sostero et al. (2020) and EU-LFS (author's elaboration).*

As noted in section 1, women have been somewhat more likely (+2 pts) to work from home during the pandemic than men. This was also the case pre-pandemic. But as the chart above confirms, 31% of male employees in the EU27 are in teleworkable jobs compared to 46% of women; so there is a much larger gender difference in technical teleworkability than in actual working from home. In all countries, the gender gap is positive. The largest gaps are observed in Poland and the Baltic countries.

## Some jobs are more teleworkable than others

The estimate of 38.5% of teleworkable dependent employment in the EU can be considered an upper-bound estimate. It includes many occupations which may have a high share of social interaction tasks and where remote provision may be less than ideal. Digital communications have expanded massively the possibilities for remote social interaction. For example, encoded visual and auditory information transmitted via the internet (as in a videoconference) allow for efficient remote social interaction (as long as it is a form of social interaction not requiring actual physical contact). Advances in these technologies during the COVID lockdowns – exemplified by the spread of software tools such as MS Teams, Zoom – are what has enabled much work to transition with limited disruption from workplace to employees’ homes. There is still however significant information loss compared to face-to-face social interaction. There are for example small lags or informational noise that may be disruptive; gestures and other forms of physical communication are likely to get lost (Schoenenberg et al, 2014).

We can take from the taxonomy of social interaction tasks of Fernández-Macías and Bisello (2022) some examples of social tasks that can be remotely performed but with a loss of quality: teaching, selling, negotiating, caring, coordinating. Examples of occupations that fall into this category include that of a school teacher or a psychotherapist. In both, social interaction task content is very high with no “requirement” for physical contact.

Where an occupation is teleworkable and involves only limited social interaction, it should in principle be capable of being carried out with no or limited loss of quality. Prospectively, it is in these latter occupations where, if there is a general increase in teleworking post-COVID, it could be expected to occur earliest and fastest. Conversely, in occupations such as those of secondary school teachers, rich in social interaction tasks, the expectation would be that in ‘normal times’ most work while technically teleworkable would take place in its traditional locus in schools and classrooms – as indeed has occurred as COVID restrictions have abated.

In order to distinguish between jobs that are teleworkable with little or no loss of quality (i.e., predominantly dealing with intellectual task content, involving intensive computer use and with limited social interaction requirements; for example, a statistician or financial analyst) and those that are capable of being worked remotely but whose higher share of social task content means that remote provision is not ideal, Sostero et al.(2020) developed a secondary axis measuring the social task intensity of each ISCO 3-digit occupation. With this additional distinction, we can discriminate between jobs that are ‘highly teleworkable’, i.e., technically teleworkable and involving limited social interaction tasks and those that are technically teleworkable but only with a loss of quality given extensive social task requirements. A full chart showing both physical teleworkability index values and social interaction index values for all 120 ISCO 3d categories is included in Annex (see figure A1), but the table below provides a simple summary with selected occupation titles. A country breakdown for the three tables is included in Annex (Table A2).

**Table 1: teleworkable shares of employment, EU27 (%), 2020**

Teleworkability	Share of EU27 employment, %	Sample occupations
Highly teleworkable	17.2	Numerical clerks



		Database and network professionals Finance professionals General office clerks Authors, journalists and linguists Information and comms tech operators
Teleworkable but with difficulty due to social task content	21.3	Secondary education teachers Managing directors and chief executives Professional services managers Social and religious professionals Sales, marketing and PR professionals Regulatory govt associate professionals
Not teleworkable	61.8	Child-care workers Cooks Heavy truck and bus drivers Manufacturing labourers Veterinarians Nursing and mid-wivery associate professionals

*Note: “highly teleworkable” = physically teleworkable and  $\leq 0.5$  on the social interaction task scale. “Teleworkable but with difficulty” = physically teleworkable and  $> 0.5$  on the social interaction task scale. See Annex for relevant index scales. See Sostero et al. (2020) for the original data sources and details on the elaboration of the indices.*

*Source: EU-LFS and Sostero et al (2020), author’s calculations.*

The highly teleworkable jobs include those of clerks, ICT professionals, authors and secretaries. It is a mix of jobs with relatively high levels of pre-crisis teleworking incidence (ICT professionals, finance professionals) but also some with relatively low levels (clerical workers). This highlights that access to teleworking has been driven as much by work hierarchy as by technical feasibility with access to occasional remote working pre-crisis a ‘perk’ of managerial and professional occupations.

The second category in the table above includes jobs which are physically teleworkable but which require a lot of social interaction. Remote provision is likely to be less than optimal (both for the worker and the public or client). This accounts for a majority of technically teleworkable employment (and just over 1 in five of all jobs). This category includes many managerial jobs – generally rich in social interaction tasks – as well as other people-facing professions such as teachers.

The third category of non-teleworkable occupations accounts for the majority of employment (61.5%). Due to their physical task requirements, jobs such as those of a plumber, a nurse, a cook or a vet must be provided in place and cannot be carried out remotely.

Most jobs then are not currently teleworkable and even within the category of teleworkable jobs, a majority are less than ideal to be performed remotely due to their high social interaction content. In addition to the gender teleworkability gap already described, there are other stark differences in the share of teleworkable employment by education level and occupational category.

**Table 2: highest achieved education level and teleworkable share of employment (%), EU27**

Education level	Not teleworkable	Technically teleworkable			Working from home 'usually' or 'sometimes', 2020
		Teleworkable but with difficulty / loss of quality	Highly teleworkable	Total	
High: Third level	37.4	40.4	22.2	62.6	36.3
Medium: Upper secondary	71.1	12.4	16.5	28.9	9.5
Low: Lower secondary	87.8	4.8	7.5	12.2	3.6
EU27	61.5	21.3	17.2	38.5	18.3

Source: EU-LFS and Sostero et al (2020), author's calculations.

Nearly three quarters of employees with a third-level qualification (73%) worked in teleworkable occupations in 2020 compared to less than a third of those with completed secondary education (28%) and 12% of those with more basic qualifications. This is reflected in the occupational breakdown below.

**Table 3: teleworkable share of employment (%) by occupation, EU27**

Occupation	Not teleworkable	Technically teleworkable		Working from home 'usually' or 'sometimes', 2020
		Teleworkable but with difficulty / loss of quality	Highly teleworkable	
Managers	22.0	78.0	0.0	41.9
Professionals	28.1	49.2	22.7	44.4
Associate professionals	47.9	38.8	13.2	22.1
Clerical support workers	13.3	0.0	86.7	18.5
Services and sales workers	91.1	7.8	1.1	5.1
Skilled agricultural etc workers	100.0	0.0	0.0	4.3
Craft and related trades workers	99.2	0.0	0.8	2.3
Plant and machine operators	98.6	0.0	1.4	0.9
Elementary occupations	97.8	0.0	2.2	1.3
EU27	61.5	21.3	17.2	18.3

Source: EU-LFS and Sostero et al (2020), author's calculations.

White-collar occupations tend to have a much higher share of teleworkable employment than blue collar occupations where only very marginal shares of employment (0-2%) are feasible to be worked remotely given their physical requirements.

These shares of teleworkable employment correspond well to the relative incidence of teleworking during 2020 where three occupational ‘clusters’ can be observed – higher-skilled white-collar workers where 40-45% were working from home in 2020, lower-skilled white-collar workers where the incidence was around 20% (except in the social task intensive occupation of services / sales workers) and blue-collar workers with very limited incidence of working from home.

Whether teleworkability translates into practice or not in a given work process will also depend on organisational issues, which are not a technical but a social aspect of work. For example, telework was more frequent for managers / professionals than for secretaries or clerical workers pre-crisis, but this is likely less a reflection of technical feasibility than of hierarchical position. In Sostero et al. (2020), it was conjectured that remote working during the pandemic would probably be less determined by occupational hierarchy than had been the case prior to the crisis as jobs that could be remotely worked would be worked from home in a context of social distancing and widespread work closures. The “privilege” of working from home would in other words be extended by force of circumstance to employees who have previously had limited access to this working arrangement. This would apply in particular to lower-level white collar occupations such as clerical support workers where the job task content is such that all employment in the category is considered highly teleworkable.

EU-Labour Force survey data for the first year of the pandemic (2020) tends only to give very partial support to this conjecture. The hierarchical bias in the incidence of working from home was quite persistent and the share of lower-skilled white-collar employees working from home – while it rose considerably - was less than half that observed for higher-skilled white collar employees. This occurred despite all employment in managerial occupations being assessed as ‘teleworkable but with difficulty’ in our extended teleworkability categorisation as a result of their high share of social interaction tasks. Occupational hierarchy remained a strong determinant of the likelihood to be working from home even during the pandemic.

**Table 4: teleworkable share of employment (%) by settlement type, EU27**

Settlement type / degree of urbanisation	Not teleworkable	Technically teleworkable			Working from home 'usually' or 'sometimes', 2020
		Teleworkable but with difficulty / loss of quality	Highly teleworkable	Total	
Cities (Densely-populated area)	54.6	25.3	20.1	45.4	23.4
Towns and suburbs (Intermediate density)	64.3	19.3	16.4	35.7	15.7
Rural area (Thinly-populated area)	69.4	17.4	13.2	30.6	13.2
EU27	61.5	21.3	17.2	38.5	18.5

Note: based on respondent residence.

Source: EU-LFS and Sostero et al (2020), author’s calculations.

Another important vector of teleworkability relates to where work is carried out. Knowledge-intensive work tends to cluster in densely populated, metropolitan areas and in particular in capital

city regions (Eurofound and Commission Joint Research Centre 2019). Work outside large metropolitan areas tends to have a higher share of non-teleworkable employment – notably because of higher shares of manufacturing employment in intermediate type settlements (towns/suburbs) and of agricultural employment in rural areas. Again, the relative ordering of actual working from home in 2020 by settlement type tends to correspond with that of teleworkability. Nearly a quarter of employees (23%) resident in cities worked from home during 2020 compared to 13% of those resident in rural areas. This probably reflects not just the different composition of occupational employment but also the more pressing public health requirements in densely populated areas during the pandemic. Incentives to work from home may also have been stronger for those with relatively long or costly commutes working in cities.

Another conclusion based on the above descriptive analysis is that the actual incidence of working from home in 2020 represented only around a half of the employment that was technically feasible to be worked remotely. Even during the pandemic with much enforced working from home, the potential for remote working was much greater than what in practice took place.

In Table 1 above, there is a close correspondence between the “highly teleworkable” employment share and the 2020 incidence of working from home. This suggests that it is appropriate to consider occupational teleworkability both in a binary perspective (based on the physical task requirement, as in Sostero et al. (2020) and in Dingel and Neiman (2020)) but also as a continuum based on additional dimensions such as the social task content. Some teleworkable jobs lend themselves more readily to remote working than others. Viewed in this perspective, there is a ‘band’ of teleworkable employment with an upper bound accounting for nearly two in five EU jobs and a lower bound of around one in five jobs.

Structurally, compositional changes in employment, notably the ongoing services shift and occupational upgrading, imply that this band of teleworkable employment is expanding. The pandemic as already noted has given further impetus to these shifts. This means that a growing share of employees will be doing work that is amenable to remote working.

## 4 – Teleworkability, wages and employment outcomes

The pandemic has had a notable impact on European labour markets. Its most important immediate effects in 2020 were declining activity and employment while telework increased massively against the background of state-decreed confinements and lockdowns.

These developments and their possible consequences on employment levels, hours worked and earnings are not however homogeneous across the workforce affecting wage and income disparities differently among different groups of employees. Empirical studies have pointed out that the burden of the pandemic was largely borne by the most disadvantaged European workers, who were more likely to lose their jobs or suffer reductions in working hours and related income (Eurofound 2021).

As noted in previous sections, the growth in telework as a result of the pandemic has been very skewed towards employees in the most privileged employment position, highly-paid white-collar workers. The pandemic has resulted in a divide between those who can telework and those who cannot, the former being better prepared to keep their employment, working hours and income levels during hardship (JRC 2020). In Germany, regression studies have identified a very significant wage premium among those able to work from home (Irlacher and Koch 2020). Microsimulation exercises have pointed out that lockdowns would result in growing wage disparities within the workforce (Brunori et al. 2020; Palomino et al 2020).

Although available data does not permit yet an empirical analysis of actual wage disparities across EU countries in 2020, the results presented in this section show that employees in more teleworkable occupations are characterised by much better pay levels and were much better placed to weather the negative impact of the COVID-19 pandemic in European labour markets. This implies the recent shock brought about by the pandemic had an uneven impact within the workforce and could have resulted in growing disparities. These should be monitored once EU-level microdata on wages covering the years of the pandemic becomes available.

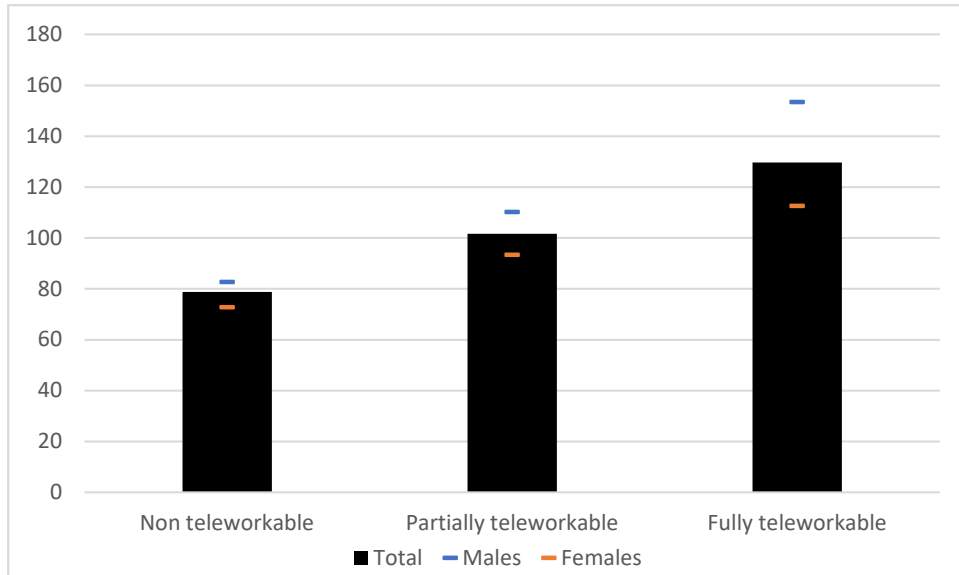
The empirical approach presented here relies on the teleworkability index introduced in the previous section, by which it is possible to classify occupations (at the ISCO 3-digit level) into three categories: non teleworkable at all, somewhat teleworkable and fully teleworkable. Once employees are classified into one of these three categories depending on their occupation, the analysis conducted explores how their wages compare and how their employment levels were affected during the economic downturn in 2020.

### More teleworkable occupations are associated with higher wages

This section presents data on wage levels across the EU employee workforce depending on the degree of teleworkability of the occupational categories in which employees work. The analysis relies on wage microdata from the year 2018, the latest available round of Structure of Earnings survey made available to researchers in late 2021. There is as yet no more updated data able to cover the labour market dynamics in terms of teleworkability and wage levels for the COVID pandemic period starting in 2020.

Figure 25 presents data for the EU as a whole and shows how employees working in fully teleworkable occupations earn on average the highest wages, while employees working in occupational categories which are not teleworkable at all earn on average the lowest wages. This is true for both male and female employees, although somewhat more strongly among males, as illustrated by the larger wage gap between males and females occurring among those employees working in the most teleworkable jobs.

**Figure 25: Average wage levels by degree of teleworkability, by gender (EU, 2018)**



*Note: Wage levels are expressed as a ratio dividing the wage of each employee by the respective mean hourly gross wage at national level, so that a value of 100 would equal the average wage in each country. The EU-27 aggregate excludes Belgium, Germany, Spain, Finland, Croatia, Hungary, Netherlands, Portugal, Romania, Sweden, and Slovenia, which do not have wage data at the 3-digit ISCO level. The sample includes all employees working in occupations for which information on the teleworkability index is available (ISCO at the 3-digit level).*

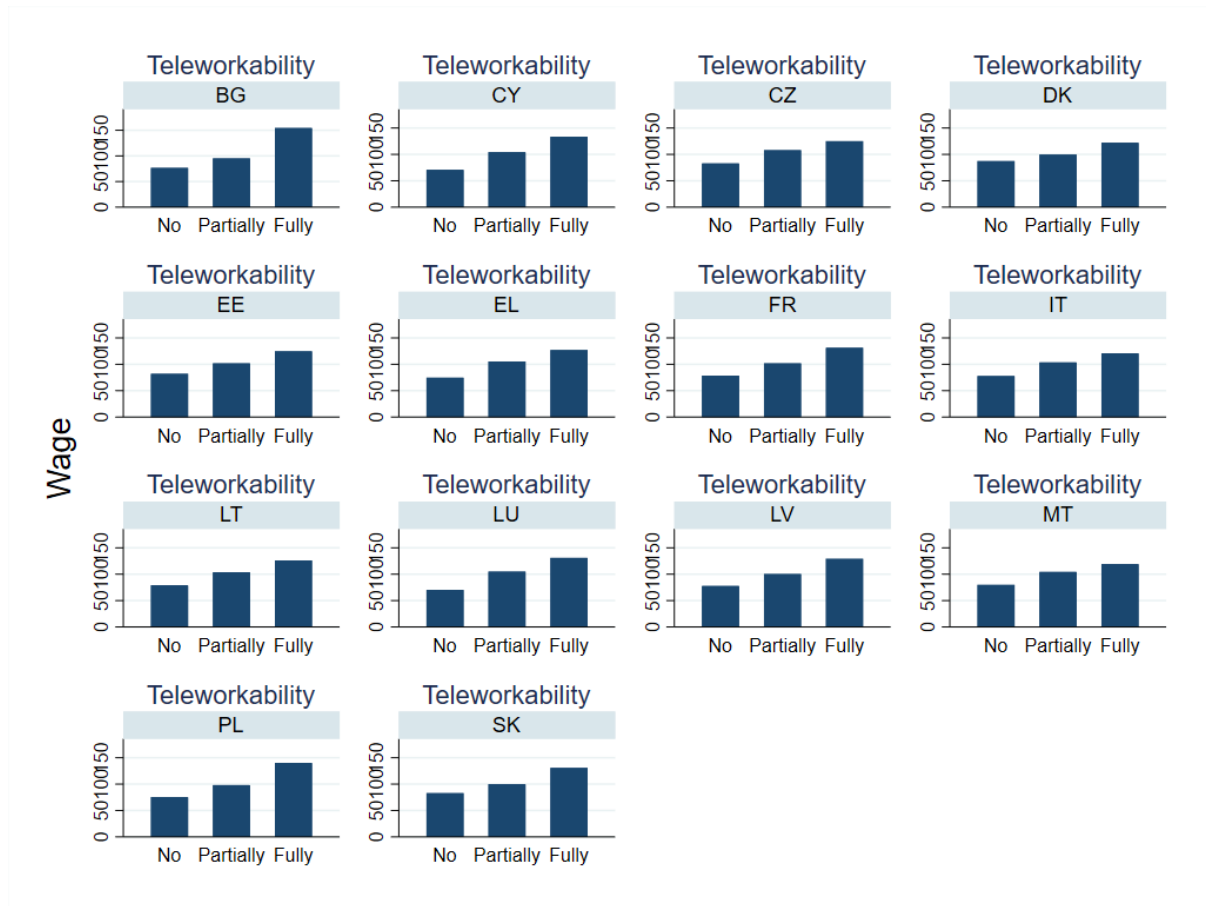
*Source: SES 2018 data (authors' elaboration).*

Results at the country level reinforce the robustness of this association between teleworkability and average wage levels. It is the case across all EU countries that employees working in the most teleworkable occupations earn the highest wages, followed by those working in partially teleworkable occupations, while the lowest wages are earned by those employees working at non teleworkable occupations. The intensity of this association varies across countries (where data is available at the 3-digit ISCO level) but exists across all of them (see figure 26).

Information cannot be provided for each member state as many do not provide wage information at the required level of occupational detail (ISCO 3-digit level, which is the one used by the teleworkability index). Nevertheless, a picture of the relationship between teleworkability and wage levels across most EU countries is possible by using a more aggregated occupational classification

(ISCO at the 2-digit level). Results for both the EU aggregate and each of the EU countries are consistent with the picture presented here (see figures A2 and A3 in the Annex for details)<sup>11</sup>.

**Figure 26: Average wage levels by degree of teleworkability across EU countries (2018)**



*Notes: Wage levels are expressed as a ratio dividing the wage of each employee by the respective mean hourly gross wage at national level, so that a value of 100 would equal the average wage in each country. Figure excludes Belgium, Germany, Spain, Finland, Croatia, Hungary, Netherlands, Portugal, Romania, Sweden, and Slovenia, which do not have ISCO data at the 3-digit level. The sample includes all employees working in occupations for which information on the teleworkability index is available (ISCO at the 3-digit level).*

*Source: SES 2018 data (authors' elaboration).*

The results suggest the pandemic may have indirectly led to a new dimension of wage disparity within European labour markets. Since the more teleworkable occupations are already characterised by much higher wages, the relatively privileged position of these employees would be reinforced as compared to that of their counterparts working in non teleworkable occupations in case the former had fared better during the pandemic. The next section explores their differential employment trends during the pandemic and shows this was indeed the case.

<sup>11</sup> There are only two countries (Belgium and Italy) where wages levels are higher among employees working in partially teleworkable occupations than among those working in fully teleworkable occupations. This may happen because the number of occupational categories considered fully teleworkable becomes much smaller when clustering information of the teleworkability indicator from the ISCO 3-digit to the 2-digit level.

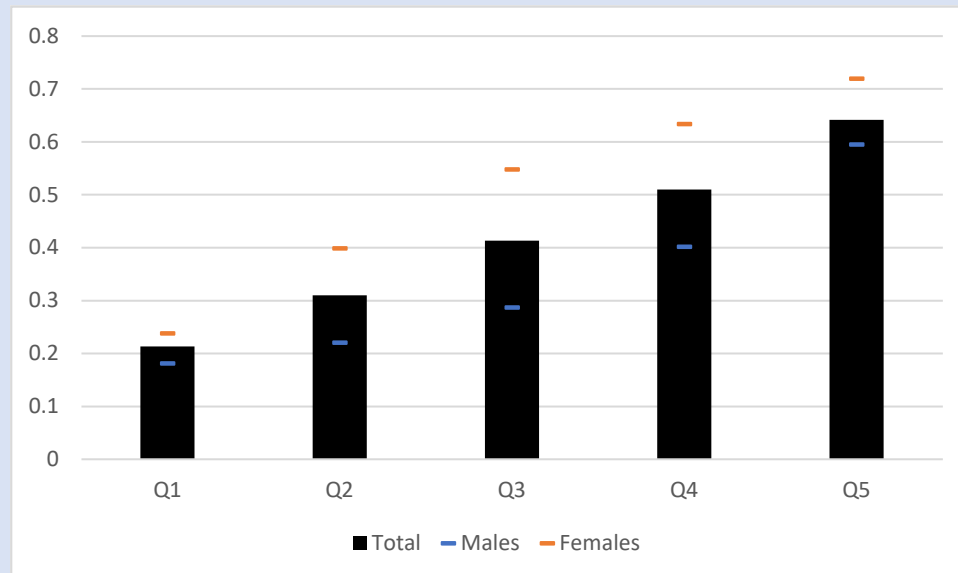
**Box 2. Better paid occupations are more teleworkable**

A mirror picture confirming the strong association between wage levels and teleworkability is provided here. In this case, the analysis is conducted using the teleworkability index at the 2-digit occupational level so that all EU countries are included in the analysis. Results are similar when using the teleworkability index at the 3-digit occupational level.

Employees are classified into five wage quintiles depending on the wages they earn (from lower to higher wages, left to right, in Figure 27). A very strong association emerges: jobs in the bottom wage quintile tend to have very low teleworkability index values while the index reaches levels of 65% in the top wage quintile.

There is a gender divide in teleworkability with women recording higher average index values than men in each quintile. This reflects the fact that female employees are over-represented in occupations characterised by relatively high levels of teleworkability, as shown in the previous section. This gender difference is greatest in mid-paying jobs and is related to the concentration of male-dominated and non-teleworkable jobs in the middle of the wage distribution (in construction and manufacturing, for example).

**Figure 27: Average teleworkability index by wage quintile, by gender (EU, 2018)**



*Notes: The EU-27 aggregate excludes Austria and Germany, not available in SES 2018 data. The sample includes all employees working in occupations for which information on the teleworkability index is available (ISCO at the 2-digit level). Information on teleworkability at the ISCO 2-digit level is obtained by clustering information from the teleworkability indicator at the ISCO 3-digit level.*

*Source: SES 2018 data (authors' elaboration).*

**Teleworkable occupations fared much better during the pandemic**

This section presents recent employment changes across the EU employee workforce depending on the degree of teleworkability of the occupational categories they work at. The results clearly indicate those employees in teleworkable occupations fared much better in terms of employment outcome in weathering the negative consequences of the pandemic.



Data for the EU-27 is presented in Figure 28 below, comparing the employment evolution in 2018-19 (upper panel of the figure), with that during the first year in which the lockdown effects are recorded in 2019-2020 (bottom panel of the figure). Data clearly reflects the change in trends caused by the pandemic.

Between 2018 and 2019, against a background of employment expansion in EU labour markets, employment growth was larger among employees working in non teleworkable and, to a lower extent, fully teleworkable occupations, than among those working in partially teleworkable ones.

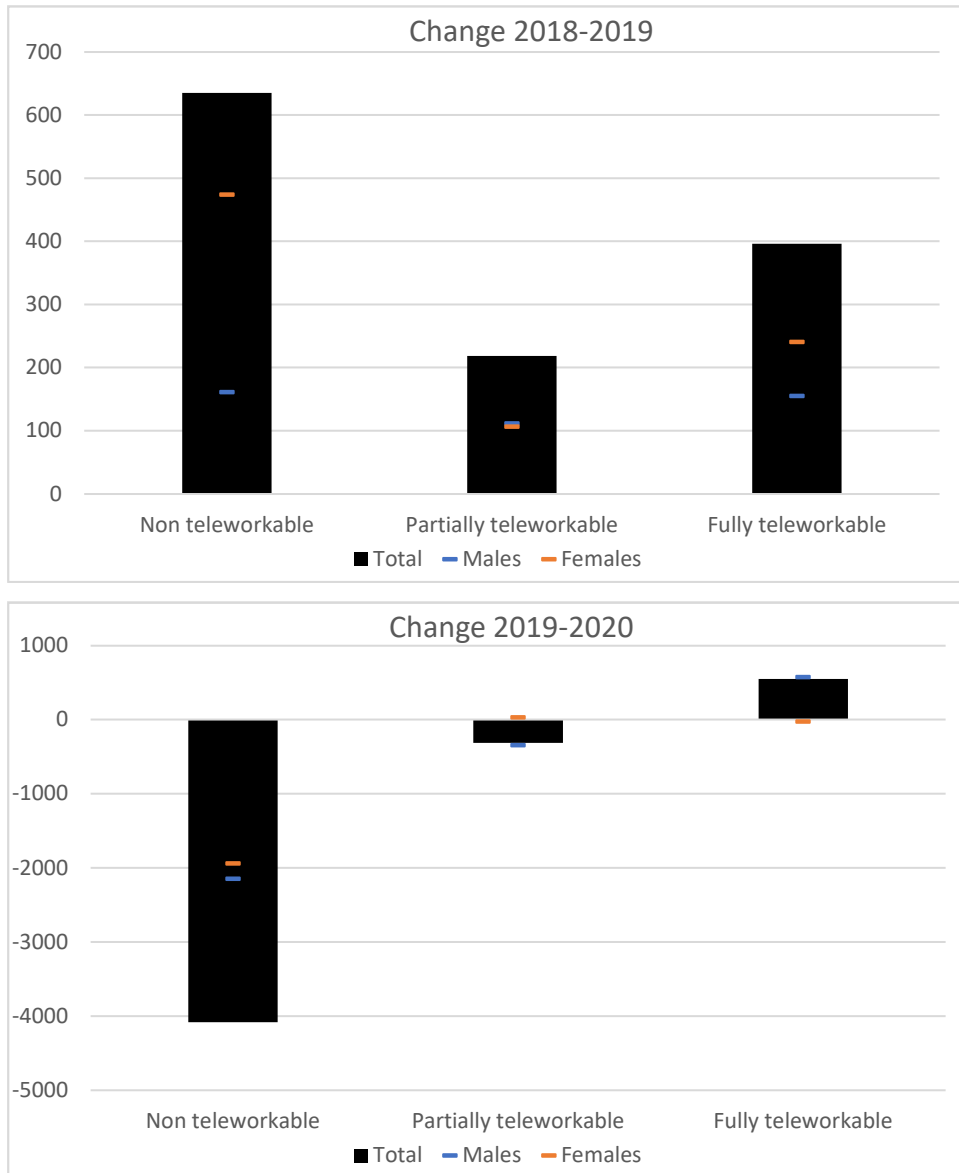
These employment dynamics were greatly modified by the effects of the COVID-19 outbreak. The pandemic's negative employment impact in European labour markets was not evenly distributed across the workforce: the net job losses registered between 2019 and 2020 occurred almost exclusively among employees working in non-teleworkable occupations (and to a much lower extent among those employees working in partially teleworkable occupations, mainly those with very low degrees of teleworkability). Employees in fully teleworkable occupations weathered the impact of the pandemic much better and their employment levels continued expanding, though to a lesser extent than before the crisis.

Moreover, the figure reveals an interesting gender dimension in the employment evolution. In 2019, the very large expansion among employees in non teleworkable occupations (and to a lower extent among those in fully teleworkable occupations) was more explained by women, who registered larger gains in employment levels.

In 2020, despite the strong impact of the pandemic in service activities where women are more likely to work, overall levels of employment did not decrease more among females than among males, as it has shown in the previous section. Nevertheless, the data shows employment losses among those employees in non teleworkable occupations were almost as large for males than for females, despite the latter representing a smaller share of the workforce. This reflects the strong impact of the pandemic on the employment levels of low-paid females, many of them working in non-teleworkable jobs such as accommodation, retail or cleaning services, most affected by the closures caused by COVID-19 in 2020 (Eurofound and European Commission, 2021).

On the other hand, the employment expansion registered among those employees in fully teleworkable occupations in 2020 is exclusively due to net employment gains among male employees.

**Figure 28a and 28b: Absolute change (thousands) in employment levels by occupations' degree of teleworkability (EU)**



*Notes: Figure on the top shows employment change between 2018 and 2019; figure on the bottom, between 2019 and 2020. EU aggregate excluded. The sample includes all employees working in occupations for which information on the teleworkability index is available (ISCO at the 3-digit level), which means the employment changes depicted do not capture the full extent of European labour market developments. EU aggregate excludes Bulgaria, Malta, Poland, and Slovenia, due to data unavailability.*

*Source: EU-LFS (authors' elaboration).*

Country level data shows the abovementioned uneven impact of the pandemic across the workforce was generalised across EU countries (see figure A4 in Annex). Employees in non-teleworkable occupations are the group carrying the burden of the employment losses across virtually all EU countries. While trends in employment change among employees working in partially teleworkable occupations are mixed, employees working in fully teleworkable occupations continued registering net employment gains as well during 2020 in most EU countries.

Data on employment dynamics reinforces the idea that the pandemic had an uneven impact across the workforce. Employees in more teleworkable occupations, which are already characterised by higher wage levels, were much better able to avoid the job losses caused by the crisis and continued enjoying net employment gains across most EU countries in 2020. Employees more able to telework, already occupying privileged employment positions, were able to keep their jobs (and maintain working hours, for example, in the context of short-time working / furlough schemes) to a much larger extent, reinforcing their privileged positions.

The extent to which this will translate into higher wage disparities in European labour markets remains to be seen. Paradoxically, the fact that employment losses were heavily concentrated among employees in non teleworkable occupations likely resulted in a reduction in wage inequality due to the compositional effect caused by the exit of the lowest-paid employees from the sample. If and when these employees return to employment, wage disparities may widen again.

However, post-COVID labour shortages have been particularly acute in many hospitality and service sectors where wages have been traditionally low and where the social interaction requirements of the job make them less amenable to remote working. This is one manifestation of what has been referred to as the 'great resignation', the higher share of voluntary quits by workers in the United States, which has generated upward wage pressures in low-paid jobs. In the US, for example, which has been characterised by stagnant wages for the low-paid for a generation, recent evidence (Gould and Kandra, 2021) points to unusually robust wage growth in 2019-20 for those in the bottom two wage deciles.

This could be part of a revalorisation of the tasks which cannot be conducted remotely and proved essential during the pandemic – front-line services in health, caring, retail etc. Increasing wages for those in non-teleworkable jobs may also arise as a form of 'compensating differential' for their lack of teleworkability. Using US survey data, Barrero et al. (2021) estimate that employees attach a 'perk' value to the ability to work from home equivalent to around 8% of wages; to the extent that access to remote working becomes more widespread and a desirable attribute of employment, those for whom the nature of their jobs makes it difficult or impossible for them to work remotely may request compensation.

At the same time, broader structural trends (e.g., skill-biased technological change) point to relatively greater employment demand (and wage increases) for those with higher level skills in teleworkable employment. The impacts of increased teleworking on wage inequality are therefore not possible to predict in advance. The final effect of such trends is a matter of empirical analysis which will be possible only when wage microdata covering the pandemic years and their aftermath become available.

## Conclusions

The COVID-19 pandemic has changed the contours of work organisation in a way that is likely to endure. For the purposes of this working paper, the focus has been on how the pandemic induced abrupt and largely unplanned changes in the location of work. In a space of few short weeks in the spring of 2020, the implementation of virus-combating physical distancing requirements led to the partial or total closure of many workplaces. Much work that could be worked remotely ended up transferring into individual homes. A new acronym was born – “WFH” for ‘working from home’. Successive waves of lockdown were one of the principal public policy responses to arising new variants of COVID-19. These limited mobility and “normal” workplace operation in varying levels of constraint for over two years. Even at the time of writing, in June 2022, when there has been a significant lifting of restrictions in most member states as newer variants represent a reduced public health threat due to lighter symptoms and decreased likelihood of severe illness, most workplaces continue to operate in hybrid mode.

The large-scale ad-hoc experiment in remote working induced by COVID-19 can be considered positively on a number of grounds:

- It sustained economic activity and employment relationships that might otherwise have been lost.
- It demonstrated the flexibility and responsiveness of all labour market actors to a largely unforeseen crisis.
- It minimised productivity losses based on the ad-hoc adoption of existing or new technologies facilitating remote work.

This relatively positive outcome was in large part conditional on two fortuitous prior developments: a/ technological improvements (video conferencing, document sharing, virtual project management tools, virtual servers etc) that came of age or matured rapidly in the circumstances wrought by COVID-19 and were themselves prompted by widespread access to broadband internet in the preceding decade and b/ the growing share of employment in services, especially computer-facing rather than client-facing knowledge-based service activities, and which can be worked remotely.

To make this positive assessment is not to understate the challenges or potential downsides of more remote working – in terms of isolation, work intrusion and blurring boundaries of work and non-work life, work intensification, lack of suitability of home workspaces etc. These issues are being addressed in the growing body of remote working legislation and collective accords. But the very fact that social partners and legislators are addressing these issues reflects the consensus that remote working is “here to stay”, primarily in hybrid work format and that hours worked remotely post-crisis will be a multiple of the relatively marginal share that they accounted for pre-crisis. Estimates from the US based on employer surveys suggest a four-fold increase in hours worked remotely post-crisis (Barrero et al, 2021).

In this working paper, the European Labour Force survey has been the main source of data on the prevalence and distribution of remote working during the COVID-19 crisis. Using a combination of the LFS microdata 2020 and the Eurostat web-published data from 2021 allows an estimate of the share of workers working from home in the first years of the pandemic. One important finding is that while the incidence of working from home (a proxy for ‘remote working’, in the absence of

more detailed questions about the location of work in the LFS) expanded in all countries in 2020/1 compared to 2019, the share of employees reporting working from home was notably lower than that reported in some 'live' COVID surveys, including those conducted by Eurofound. Around one in five EU27 employees (18% in 2020, 22% in 2021) reported working from home sometimes or usually during the pandemic, around double the levels of the previous years. Depending on the population covered, estimates of remote working from live surveys were often twice as high. In Eurofound Living, Working and COVID-19 e-survey of July 2020, 34% of respondents were working from home exclusively.

It is important to point out that there had been a trend increase in working from home prior to the pandemic. For this reason, COVID can be considered as an 'accelerator' of an underlying trend. The introduction of physical distancing decrees leveraged pre-existing changes in work organisation, work equipment notably IT equipment, and employment composition that were already increasing the possibility of remote working.

Both before and during the crisis, the take-up of remote work differed widely across member states with higher levels reported in the Benelux and Nordic member states but much lower levels especially in Eastern European member states such as Bulgaria, Romania and the Baltic republics. The countries in which the incidence increased most during the crisis were Luxembourg, Ireland and Malta. Differences in sectoral composition of employment, in severity and timing of lockdowns and in technical infrastructure (e.g., broadband accessibility) were all likely factors in explaining these between-country differences. The continued increase in working from home in 2021 observed in nearly all member states suggests that an increasing number of workplaces have adapted to remote or hybrid working arrangements as the pandemic has persisted.

One of the main points to emerge from this working paper is that the incidence of working from home is heavily skewed. The type of work you do is an important factor influencing whether you work remotely. Those employed in higher managerial and professional grades in knowledge-intensive service sectors are much more likely to have worked from home both pre- and post-covid than those in blue-collar occupations or with basic levels of education. The sharp rise in incidence recorded 2019-20 was concentrated in better paid, higher-level occupations and amongst those with third level qualifications. Working from home remained a marginal phenomenon for those with lower levels of education (<4%). These differences were observed both in the descriptive analysis but held good also when controlling for a host of other labour market and personal characteristics.

The incidence of working from home was also somewhat higher among women in most countries both pre- and post-COVID, though the difference (3 pts in 2021) was modest compared to the difference in the teleworkable share of employment (15 pts). Male-dominated occupations and sectors – notably manufacturing and construction but also agriculture – tend to be place-dependent, to have high physical task requirements which makes them less amenable to remote working.

Working from home is also skewed in terms of geographical distribution. The types of occupations that lend themselves to teleworking are over-represented by employment share in large metropolitan areas. It is these more densely populated zones that have traditionally suffered more from congestion and related mobility problems, resulting in longer commuting times – the impetus for the original push to remote working in 1970s America (Nilles, 1976). During the crisis, densely populated areas tended to suffer more negative health outcomes from the COVID-19 outbreak. Encouraging working from home became an important policy tool in protecting public health.

The working paper also extends earlier analysis (Sostero et al., 2020) on teleworkability. Some jobs are highly teleworkable – e.g., statistician, some are not teleworkable at all – e.g., restaurant waiter, while there are many that can be worked remotely in exceptional circumstances but where this leads to some shortfall in quality due to the social task content of the jobs and the fact that virtual contact still represents a less than ideal substitute for face-to-face contact e.g., teachers, medical general practitioners.

Applying a detailed occupational task analysis using Italian survey data to the EU27 employment structure, we estimate that just over one third of employment (38.5%) was feasible to be carried out remotely in 2020, though the share of ‘highly teleworkable’ employment was a lot lower (17%).

The pandemic itself induced an increase in the share of teleworkable employment; by protecting employment in jobs that could be worked remotely as well as leading to job loss disproportionately in jobs, especially customer facing jobs, that could not be worked remotely. The fact that the estimate of teleworkable employment is nearly double, the actual reported incidence of working from home in 2020/1 tells us that there was still a significant untapped potential for remote working, even during the pandemic.

In the analysis of occupational teleworkability, similar skews were evident as those identified in the data on prevalence. Managerial and professional occupational grades, those with third-level qualifications, women, city-based workers, those with ‘core’ employment characteristics (full-time, permanent) are all more likely to have jobs that lend themselves to remote working. Many of these characteristics are associated with higher pay and the analysis of occupational pay levels and teleworkability showed that in all member states occupations that can be worked remotely enjoy a large wage premium over those that cannot. The ability to work remotely can itself be considered an additional ‘amenity’, over and above pre-existing privileges in terms of pay, job security and work autonomy.

The contrasting experiences of ‘remote’ and ‘essential’ workers during the pandemic may not be as stark post-COVID but they will likely persist to the extent that remote and hybrid working possibilities open up for some types of workers but not for others. The ability to work from home or remotely may in this way become a new ‘digital divide’ and an additional dimension of inequality in the post-COVID workplace and labour market (Sostero et al., 2020).

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# Annexes

**Table A1: Determinants of telework in EU27, Logit estimates.**

	Full Sample			2019			2020		
	M1 WFH	M2 Sometim es	M3 Usually	M4 WFH	M5 Sometim es	M6 Usually	M7 WFH	M8 Sometim es	M9 Usually
<i>Ref: male</i>									
Female	1.066*** (0.0141)	0.980 (0.0170)	1.148*** (0.0206)	1.014 (0.0170)	0.970 (0.0197)	1.082** (0.0272)	1.132*** (0.0241)	0.999 (0.0315)	1.198*** (0.0301)
<i>Ref: 25-54</i>									
15-24	0.605*** (0.0217)	0.636*** (0.0293)	0.608*** (0.0317)	0.599*** (0.0233)	0.651*** (0.0310)	0.573*** (0.0361)	0.622*** (0.0382)	0.626*** (0.0560)	0.634*** (0.0487)
55-64	0.921*** (0.0140)	0.815*** (0.0161)	1.041 (0.0216)	0.895*** (0.0169)	0.808*** (0.0185)	1.065* (0.0298)	0.955 (0.0239)	0.830*** (0.0300)	1.024 (0.0307)
65+	1.351*** (0.0636)	0.959 (0.0630)	1.723*** (0.101)	1.379*** (0.0779)	0.885 (0.0704)	2.107*** (0.143)	1.290** (0.103)	1.084 (0.121)	1.320** (0.123)
<i>Ref: Upper secondary</i>									
Low: Lower secondary	0.742*** (0.0231)	0.677*** (0.0314)	0.794*** (0.0315)	0.845*** (0.0353)	0.706*** (0.0439)	1.004 (0.0533)	0.651*** (0.0300)	0.629*** (0.0429)	0.679*** (0.0394)
High: Third level	1.703*** (0.0252)	1.738*** (0.0330)	1.649*** (0.0342)	1.718*** (0.0309)	1.748*** (0.0380)	1.643*** (0.0442)	1.687*** (0.0411)	1.706*** (0.0609)	1.666*** (0.0490)
Income	1.156*** (0.00378)	1.196*** (0.00506)	1.119*** (0.00510)	1.174*** (0.00488)	1.221*** (0.00630)	1.096*** (0.00680)	1.138*** (0.00585)	1.161*** (0.00834)	1.129*** (0.00714)
<i>Ref: towns</i>									
Rural area	0.969 (0.0165)	0.965 (0.0211)	0.980 (0.0234)	0.973 (0.0200)	0.942* (0.0237)	1.041 (0.0314)	0.992 (0.0287)	1.019 (0.0420)	0.957 (0.0340)
Cities	1.144*** (0.0150)	1.127*** (0.0190)	1.145*** (0.0207)	1.066*** (0.0175)	1.104*** (0.0214)	0.978 (0.0248)	1.258*** (0.0270)	1.186*** (0.0378)	1.270*** (0.0324)
<i>Ref: full- time</i>									
Part-time	1.146*** (0.0220)	1.201*** (0.0277)	1.076** (0.0292)	1.276*** (0.0288)	1.327*** (0.0351)	1.120*** (0.0381)	1.002 (0.0331)	1.035 (0.0449)	0.980 (0.0396)
<i>Ref: permanent</i>									
Temporary	1.040 (0.0251)	1.048 (0.0327)	1.032 (0.0347)	1.081** (0.0316)	1.122** (0.0400)	1.047 (0.0461)	0.995 (0.0407)	0.927 (0.0547)	1.041 (0.0516)
<i>Ref: less than 5 years</i>									
Less than 1 year	0.896*** (0.0207)	0.903*** (0.0263)	0.882*** (0.0294)	0.839*** (0.0233)	0.847*** (0.0282)	0.810*** (0.0341)	0.964 (0.0379)	1.011 (0.0560)	0.929 (0.0454)
5 years or more	1.006 (0.0152)	0.986 (0.0186)	1.038 (0.0222)	0.992 (0.0187)	0.954* (0.0212)	1.115*** (0.0327)	1.022 (0.0252)	1.038 (0.0354)	1.003 (0.0301)
<i>Ref: 11-49</i>									
1-10	1.299*** (0.0252)	1.088** (0.0282)	1.460*** (0.0377)	1.495*** (0.0358)	1.100** (0.0331)	2.147*** (0.0706)	1.110*** (0.0351)	1.068 (0.0497)	1.097* (0.0419)
50 or more	1.116*** (0.0154)	1.056** (0.0190)	1.186*** (0.0230)	1.047** (0.0183)	1.058** (0.0225)	0.992 (0.0262)	1.217*** (0.0270)	1.050 (0.0340)	1.353*** (0.0367)
<i>Ref:</i>									

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<i>primary</i>									
Mainly private services	1.419*** (0.0254)	1.424*** (0.0318)	1.482*** (0.0385)	1.305*** (0.0292)	1.420*** (0.0363)	1.167*** (0.0447)	1.592*** (0.0463)	1.440*** (0.0607)	1.751*** (0.0620)
Mainly public services	1.281*** (0.0236)	1.144*** (0.0264)	1.514*** (0.0394)	1.314*** (0.0294)	1.130*** (0.0295)	1.932*** (0.0697)	1.256*** (0.0384)	1.173*** (0.0513)	1.301*** (0.0481)
<i>Ref:</i>									
<i>Clerical support workers</i>									
Managers	2.322*** (0.0640)	2.782*** (0.0959)	1.757*** (0.0705)	3.139*** (0.103)	3.314*** (0.126)	2.443*** (0.128)	1.712*** (0.0803)	2.126*** (0.139)	1.478*** (0.0845)
Professionals	2.654*** (0.0551)	2.837*** (0.0802)	2.468*** (0.0685)	3.386*** (0.0892)	3.253*** (0.104)	3.526*** (0.140)	2.165*** (0.0709)	2.307*** (0.119)	2.097*** (0.0798)
Technicians and ass. profs.	1.023 (0.0217)	1.181*** (0.0341)	0.889*** (0.0257)	1.177*** (0.0320)	1.329*** (0.0431)	0.870** (0.0383)	0.915** (0.0299)	0.996 (0.0523)	0.881*** (0.0335)
Service and sales workers	0.523*** (0.0144)	0.430*** (0.0163)	0.600*** (0.0218)	0.771*** (0.0267)	0.517*** (0.0233)	1.149** (0.0576)	0.364*** (0.0158)	0.328*** (0.0215)	0.396*** (0.0210)
Skilled agricultural workers	0.401*** (0.0353)	0.305*** (0.0413)	0.499*** (0.0547)	0.719** (0.0725)	0.391*** (0.0664)	1.216 (0.147)	0.211*** (0.0336)	0.213*** (0.0471)	0.215*** (0.0461)
Craft and related trades workers	0.192*** (0.00779)	0.244*** (0.0125)	0.146*** (0.00940)	0.299*** (0.0144)	0.301*** (0.0167)	0.310*** (0.0276)	0.123*** (0.00877)	0.177*** (0.0180)	0.0863** (0.00832)
Plant and machine operators	0.102*** (0.00588)	0.118*** (0.00929)	0.0881*** (0.00711)	0.188*** (0.0127)	0.159*** (0.0144)	0.261*** (0.0254)	0.0526** (0.00553)	0.0754*** (0.0111)	0.0373** (0.00546)
Elementary occupations	0.176*** (0.00959)	0.185*** (0.0152)	0.167*** (0.0120)	0.287*** (0.0195)	0.229*** (0.0233)	0.366*** (0.0334)	0.108*** (0.00969)	0.134*** (0.0184)	0.0957** (0.0113)
2020	2.171*** (0.0310)	1.227*** (0.0229)	4.215*** (0.0848)						
Constant	0.0454** (0.00167)	0.0246*** (0.00117)	0.0182*** (0.000927)	0.0347** (0.00160)	0.0189*** (0.00105)	0.0150** (0.00109)	0.0984** (0.00584)	0.0497*** (0.00423)	0.0487** (0.00343)
Observations	1353680	1280148	1263343	871341	843998	813829	482339	436150	449514
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	No	No	No	No	No
Pseudo R <sup>2</sup>	0.313	0.334	0.276	0.297	0.329	0.203	0.321	0.344	0.286

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Exponentiated coefficients; Standard errors in parentheses \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

*Source: EU-LFS, authors' elaboration.*

Figure A1: Technical teleworkability vs. social interaction indices



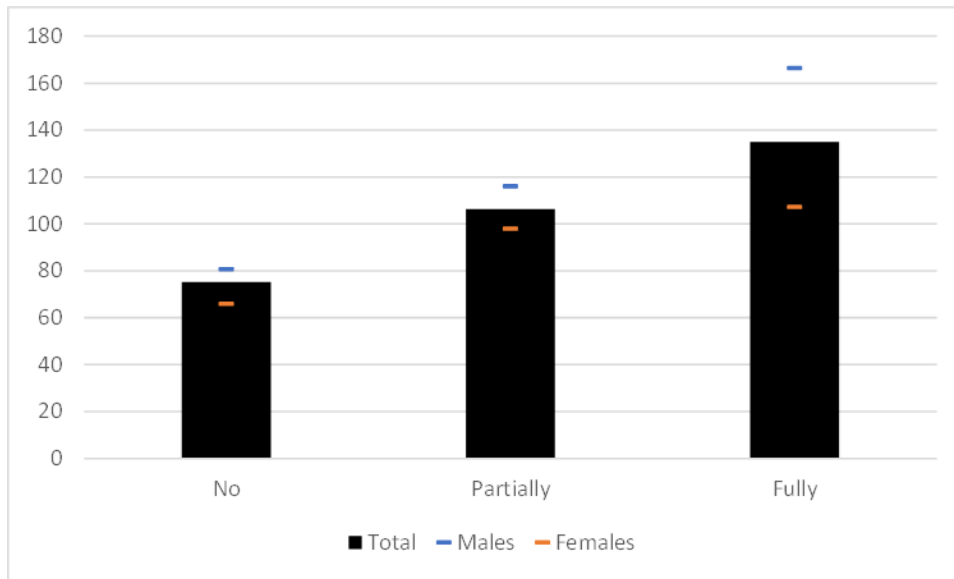
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**Table A2: Share of employment, %, in different occupational teleworkable categories**

Country	Not teleworkable	Technically teleworkable	
		<i>Teleworkable but with difficulty / loss of quality</i>	<i>Highly teleworkable</i>
AT	61.3	21.3	17.4
BE	54.9	25.5	19.6
BG	69.6	20.8	9.6
CY	59.8	17.2	23.0
CZ	65.8	17.9	16.3
DE	60.3	20.3	19.4
DK	59.4	23.7	17.0
EE	62.4	23.4	14.2
ES	64.6	18.4	17.0
FI	60.1	23.7	16.2
FR	58.4	26.0	15.6
GR	59.6	17.4	22.9
HR	66.0	16.7	17.3
HU	68.3	16.9	14.7
IE	58.5	20.6	20.9
IT	63.2	15.4	21.4
LT	60.0	27.4	12.6
LU	42.4	29.8	27.8
LV	63.5	23.6	12.9
MT	54.9	33.6	11.4
NL	53.8	26.9	19.3
PL	62.0	27.9	10.1
PT	62.5	19.4	18.1
RO	72.6	13.8	13.6
SE	56.1	28.0	15.9
SI	59.8	28.4	11.8
SK	68.5	15.5	16.0
<b>EU</b>	61.5	21.3	17.2

Source: EU-LFS and Sostero et al. (2020), authors' elaboration.

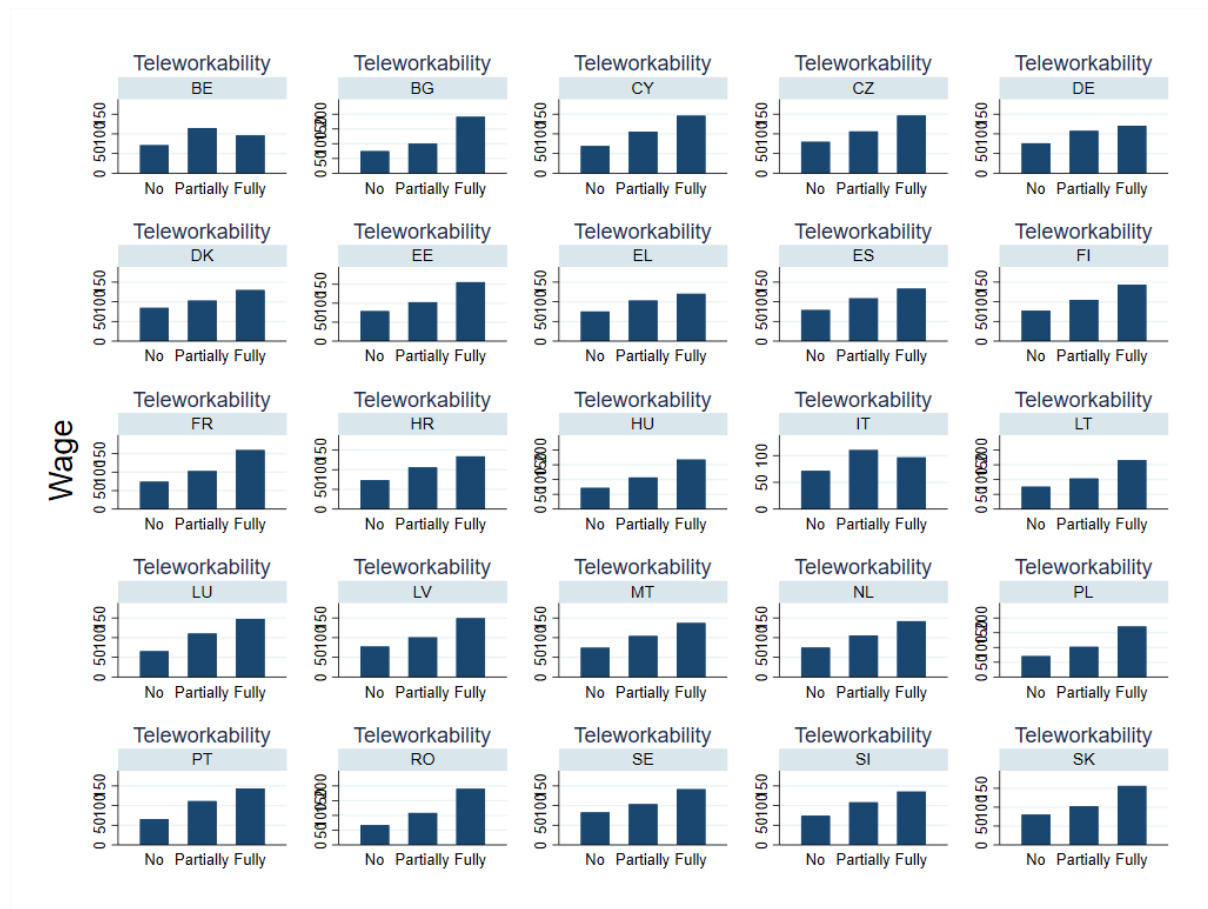
**Figure A2: Average wage levels by degree of teleworkability, by gender (EU, 2018)**



*Notes: Wage levels are expressed as a ratio dividing the wage of each employee by the respective mean hourly gross wage at national level, so that a value of 100 would equal the average wage across countries. The EU-27 aggregate excludes Austria and Germany, not available in SES 2018 data. The sample includes all employees working in occupations for which information on the teleworkability index is available (ISCO at the 2-digit level). Information on teleworkability at the ISCO 2-digit level is obtained by clustering information from the teleworkability indicator at the ISCO 3-digit level.*

*Source: SES 2018 data (authors' elaboration).*

Figure A3: Average wage levels by degree of teleworkability across EU countries (2018)



Notes: Wage levels are expressed as a ratio dividing the wage of each employee by the respective mean hourly gross wage at national level, so that a value of 100 would equal the average wage across countries. Figure excludes Austria and Germany, not available in SES 2018 data. The sample includes all employees working in occupations for which information on the teleworkability index is available (ISCO at the 2-digit level). Information on teleworkability at the ISCO 2-digit level is obtained by clustering information from the teleworkability indicator at the ISCO 3-digit level.

Source: Source: SES 2018 data (authors' elaboration).



**Figure A4: Absolute change (thousands) in employment levels by occupations' degree of teleworkability in 2020 (EU countries)**



*Notes: Figure shows employment change between 2019 and 2020. The sample includes all employees working in occupations for which information on the teleworkability index is available (ISCO at the 3-digit level), which means the employment changes depicted do not capture the full extent of European labour market developments. Bulgaria, Malta, Poland, and Slovenia are not included due to data unavailability.*

*Source: EU-LFS (authors' elaboration).*

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