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ORIGINAL ARTICLE

Working from home in European countries before and during the COVID-19 pandemic

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Abstract
We use data from the representative EU Labour Force Survey for 28 countries and document the levels of working from home in 2011–2022. This period is relevant as it includes the years of the COVID-19 pandemic. We show significant differences in working from home across countries, industries, and occupations. Working from home has increased in several sample countries and almost all industries and occupations in the 2011–2019 period and more significantly in the years affected by the pandemic. Although there is a general decline in working from home in 2022, the prevalence of working from home remains generally well above the pre-pandemic levels. We show that the rise in working from home is associated with lower employment losses during the pandemic years. We also compute a measure of working from home capacity for the sample countries using the observed working from home levels.

Keywords Working from home · Pandemic · Occupations · Industries · Capacity

JEL Classification J23 · J24

1 Introduction

The share of employees who work from home has sharply increased during the COVID-19 pandemic. Lockdown policies, production restrictions, social-distancing measures, and the fear of infection have impelled employees and firms to learn and invest in technologies that allow them to work from home. Many employees have adapted a space at home to work remotely and might continue doing so long after the pandemic (Barrero et al. 2021).

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In this paper, we use data from the representative EU Labour Force Survey and provide a descriptive analysis of the evolution of the share of employees who work from home in 28 European countries in the 2011–2022 period, a period encompassing the significant impact of the pandemic in 2020 and 2021. We show the evolution of working from home in all countries, industries, and occupations before and during the pandemic. We find a positive correlation between changes in working from home and non-medical policies implemented during the pandemic. We also show that working from home helped prevent employment loss during the pandemic using cross-industry–country and cross-occupation–country differences. Finally, we compute a measure of working from home capacity for each country.

We show that there are significant differences in working from home across countries, industries, and occupations in the 2011–2019 period and that working from home has notably increased in several sample countries in this period.

Working from home has increased in all industries in the 2011–2019 period. In general, industries that have higher levels of utilization of information and communication technologies (ICT) have higher levels of working from home and have experienced larger increases in it as compared to industries with lower levels of ICT utilization (see Jerbashian and Vilalta-Bufí 2024; Oettinger 2011, for evidence on the association between working from home and ICT). Working from home has also increased in many occupations in the 2011–2019 period. Managerial and professional occupations tend to have the highest levels of working from home and have experienced the largest increases in it.[1]

Working from home has sharply increased in 2020 and 2021 in almost all countries. This increase tends to be much larger than the cumulative increase in working from home in sample countries during the 2011–2019 period. Working from home has also increased more in 2020 and 2021 than during the entire 2011–2019 period in most industries and all managerial, professional, and clerical occupations. Although we observe a decline in working from home in most countries in 2022, the level of working from home remains above the pre-pandemic levels. The decline in working from home is visible in all industries and occupations, except for those where working from home did not increase substantially during the pandemic years.

The large increase in working from home in 2020 was partly due to non-medical intervention policies such as lockdowns, production restrictions, and workplace safety measures aimed at reducing contagion. We obtain country-level indicators measuring the stringency of the non-medical intervention policies implemented during the first year of the pandemic from Hale et al. (2021). The stringency of the implemented policies varies significantly across sample countries. We find that the growth in working from home in 2020 in sample countries was strongly correlated with all these indicators.

We further correlate the levels of and changes in working from home in sample industries and occupations with changes in employment. The rise in working from home is strongly and positively correlated with lower employment losses during the

[1] Oettinger (2011) shows that working from home has increased more in occupations that use ICT more intensively in the USA in the 1980–2000 period.

COVID-19 pandemic. This association suggests that working from home has saved employment during the pandemic.

Finally, we compute the frontier capacity of working from home in sample countries for the years most significantly affected by the COVID-19 pandemic, 2020 and 2021. To do so, we use the observed 95th percentile level of working from home in each occupation–industry pair across sample countries during the pandemic years and adjust it to the employment composition in each country. The frontier capacity has grown significantly in the period 2020–2021 in all sample countries. In the majority of the sample countries, this growth is almost entirely because of growth in the observed levels of working from home and not because of changes in employment structure in industries and occupations. The gap between the frontier capacity and the actual level of working from home may reflect the existence of different barriers to working from home such as access to technology and lack of the required expertise for its use and appropriate work conditions and regulations.

This paper contributes to the growing literature that studies the patterns of working from home and the economic impact of the COVID-19 pandemic (e.g., Alipour et al. 2023; Bakalova et al. 2020; Bick et al. 2023; Katz and Krueger 2019; Martin et al. 2022; Oettinger 2011,). Oettinger (2011), Mateyka et al. (2012), Katz and Krueger (2019), Jerbashian and Vilalta-Bufí (2024) have documented an increase in working from home and other alternative work arrangements in the USA and EU before the COVID-19 pandemic. (Mas and Pallais 2020 offer a recent review of the literature on alternative work arrangements in the USA.) The measurement and analysis of working from home have become especially important because of the pandemic. Dingel and Neiman (2020) were the first to propose and utilize a task-based method for evaluating the capacity of working from home in the USA. This method relies on determining tasks that are (in)compatible with working from home. Gottlieb et al. (2021) utilize a similar approach for several developing countries. Data limitations and the different assumptions on which tasks can (not) be done from home lead to significant differences in predictions regarding working from home capacity across studies that use such methods. Nevertheless, according to Alipour et al. (2023) and Gottlieb et al. (2021) these task-based measures can somewhat accurately capture the variation in the working from home capacity when direct measures are not easily available. Several studies find significant differences in working from home across industries and occupations in Germany, the UK, and the USA, using data from administrative employment statistics and surveys (e.g., Adams-Prassl et al. 2022; Alipour et al. 2023; Brynjolfsson et al. 2020). Bick et al. (2023) compute working from home levels during the pandemic and compare it with a reference year before the pandemic using a survey in the USA.

Our paper contributes to this literature in several ways. It utilizes data and, particularly, the responses to the question about working from home from the representative EU Labour Force Survey. This allows us to consistently document the levels of working from home and their changes in 28 European countries during the 2011–2022 period, which includes the years significantly affected by the COVID-19 pandemic. We also report the evolution of working from home across industries and occupations in sample countries and compute working from home frontier capacities in sample countries using the observed levels of working from home. When Bick et al. (2023) document a fall in working from home in 2021 as compared to 2020 in the USA, we observe a per-

sistent increase in it in the 2020–2021 period in almost all sample countries. Working from home declined in the sample European countries in 2022. We also show that the measures developed and used by Dingel and Neiman (2020) and Gottlieb et al. (2021) are strongly correlated with the observed working from home levels across European countries. However, their levels can deviate from the observed levels of working from home and changes in 2020–2021 do not capture the significant changes in working from home observed over these years. Finally, we provide insights into the relationship between working from home and non-medical intervention policies in 2020 and the change in employment during the pandemic years.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 presents differences and evolution of working from home at country, industry, and occupation level. Section 4 explores the relationship between working from home and employment. Section 5 proposes a measure to compute the working from home frontier capacity. Finally, Sect. 6 concludes.

2 Data

The data for working from home are from the nationally representative EU Labour Force Survey (EU-LFS). In the EU-LFS, working from home means doing any productive work related to the person's current job(s) at home. The answer is codified as "Usually" when the respondent reports working at home during at least half of the days worked in a reference period, "Sometimes" when the respondent reports working at home less than half of the days worked and at least one hour in a reference period, and "Never" when the respondent reports working at home on no occasion in the reference period. The reference period is usually the four preceding weeks. We compute the share of employed individuals who report that they work from home either sometimes or usually in each sample country, industry, occupation, and year, using as weights the number of hours of work together with the sample weights from the survey.[2] Industries have 1-digit NACE Rev. 2 coding, and occupations have 2-digit ISCO-08 coding. We exclude from the sample self-employed, family workers, and individuals who are older than 65. More information on the working from home variable is available in Sects. A and B in the Online Appendix—Further Results.[3]

[2] The EU-LFS has moved from a mix of face-to-face and telephone interviews to fully remote collection methods in 2020 due to the COVID-19 pandemic. The levels of non-response rates increased by 41 percentage points in Germany and 7 percentage points in France because of this but remained comparable to 2019 in the remainder of sample countries (see Eurostat 2022, for more details).

[3] The UK is not in our sample because we do not have data from the UK for 2020 and after. We use data starting from 2011 because of changes in the occupational classification in the EU-LFS.

3 Analysis of working from home

3.1 Country level

There are significant differences in the share of employees who report that they at least sometimes work from home across sample countries and years. Country-level differences account for about 70% of the variation and year-level variation accounts for 17%. (Table I in the Online Appendix—Further Results, reports the results from an ANOVA exercise.) The largest part of the variation over time happened during the COVID-19 pandemic in 2020.

Figure 1 shows the evolution of the share of employees who report that they at least sometimes work from home during the sample years. We have grouped countries into high-, medium-, and low-working from home levels and taken averages within each of these groups. (Sect. C.A of the Online Appendix—Further Results, offers additional details about the levels and changes in the WFH variable in sample countries.)

Belgium, Denmark, the Netherlands, Finland, and Sweden are among the countries with the highest levels of working from home. The share of employees who work from home ranges from 15 percent in Belgium to 29 percent in Denmark in 2011. This share has increased to 20 percent in Belgium by 2019 though it has remained almost steady in Denmark in the same period. The largest increases in this period happened in Finland and Sweden. Among the countries with medium levels of working from home, Slovakia had the lowest level in 2011, at 5 percent, and Ireland had the highest at 9 percent. Except for Croatia, Portugal, Estonia, and Ireland, the share of employees who work from home did not increase significantly in the period 2011–2019 in these countries. In turn, Bulgaria, Italy, Spain, Romania, Croatia, Greece, and most of the small Eastern European countries have the lowest levels of working from home during the entire sample period. The share of employees who work from home at least sometimes ranged from 1 to 4 percent in these countries in 2011. It has slightly grown in a few of these countries in 2011–2019. It remained virtually constant in Spain, Italy, Bulgaria, and Romania during this period.

In almost all countries, the increase in working from home in the two years significantly affected by the pandemic, 2020 and 2021, is larger than its cumulative increase during the 8 pre-pandemic years. For example, working from home has increased by 1 percentage point in the 2011–2019 period in Austria, while it has increased by 9 percentage points in the 2019–2021 period.

The significant increase in working from home in 2020 in the sample countries can be partly attributed to non-medical intervention policies such as lockdowns, production restrictions, and workplace safety measures. We correlate the changes in working from home in the 2019–2020 period with the indices that measure the stringency of non-medical intervention policies compiled by Hale et al. (2021). We have three indices. One refers to the general stringency index, the second one refers to the workplace closures, and the third one refers to the stay-at-home policies. We estimate the following specification:

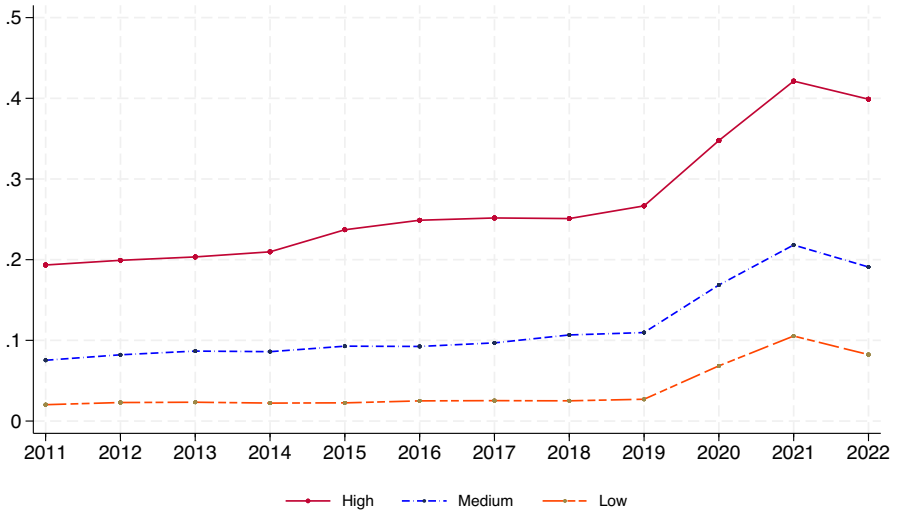

Fig. 1 The evolution of working from home in countries grouped by level. *Note* This figure illustrates the levels of and changes in working from home (WFH) during the sample years where we have grouped countries into high-, medium-, and low-working from home levels and taken averages within each of these groups. See Table 5 in the Data Appendix for complete descriptions and sources of variables

$$\begin{aligned}\Delta\,\mathrm{WFH}_{2020-2019,c} = {} & \beta_0 + \beta_1 \mathrm{Stringency\ Index}_{2020,c} + \beta_2 \mathrm{Workplace\ Closures}_{2020,c} \\ & + \beta_3 \mathrm{Stay\ Home}_{2020,c} + \beta_4 \mathrm{Working\ from\ Home\ Capacity}_{2019,c} \\ & + \epsilon_c, \end{aligned} \tag{1}$$

where c indexes countries and we control for various measures of working from home capacity to rule out the possibility that the countries with preexisting occupation mix that enabled higher capacity of working from home implemented more stringent policies.[4]

We find that all the non-medical intervention policies are positively correlated with the rise in working from home in the 2019–2020 period. A one standard deviation increase in the stringency of the non-medical intervention policies is associated with a 1–2 percentage points increase in working from home.[5] These indices are highly correlated (with minimum pairwise correlation at 0.5), and the individual coefficient significance vanishes when we introduce the three indices at once, but the three coefficients remain jointly significant. The results are similar if one considers usually working from home.

Finally, working from home declined in 2022, yet it remained higher than the levels in 2019 in nearly all sample countries. The majority of European countries

[4] Panel B of Table II in the Online Appendix—Further Results, reports the values of non-medical intervention policy indices.

[5] Table III in the Online Appendix—Further Results, reports the detailed results for the share of employees who work from home at least some times. Table IV offers the results for the share of employees who report that they usually work from home.

completely lifted pandemic-related restrictions in 2022. Additionally, large-scale vaccination campaigns against COVID-19 were conducted in the second half of 2021. Poland and Portugal are exceptions, as working from home returned to almost 2019 levels in 2022. This cross-sectional pattern suggests a stabilization after the pandemic. It complements the findings of Barrero et al. (2023) and Bick et al. (2023), based on US data, indicating that working from home is here to stay (see also Barrero et al. 2021).

3.2 Industry level

Nearly one-third of working from home differences across industry–country–year observations can be explained by industry differences, another third by differences across countries, and only ten percent by time variation (see Table V in the Online Appendix—Further Results).

Figure 2 shows the evolution of the share of employees who report that they at least sometimes work from home in sample industries during 2011–2022. We have grouped industries into high-, medium-, and low-working from home levels and have taken averages within each of these groups. (Table VI and Figs. IV, V and VI in the Online Appendix–Further Results, report the level of working from home in industries averaged across sample countries during 2011–2022.)

The group of industries that have a high level of working from home include, for example, Information and Communication and Education industries. The industries with a middle level of working from home include the Electricity, Gas, and Water Supply industries, the Wholesale and Retail Trade industries, and the Public Administration and Defence. In turn, the Construction, Transport and Storage, and Accommodation and Food Services industries have the lowest working from home levels in almost all countries and years.

The share of employees who at least sometimes work from home has grown in all industries in 2011–2019 and 2019–2021. The average change in working from home across industries in 2019–2021 is 12 percentage points, while its cumulative change over the 2011–2019 period is about 4 percentage points. In 2021–2022, as the pandemic weakened, the share of employees working from home decreased in most industries, although the level is still higher than in 2019.

Several other papers have studied the prevalence of working from home across industries. Barrero et al. (2023) report the average number of full days worked from home by employees in each industry. They use the 2023 US Survey of Working Arrangements and Attitudes (SWAA). Although the numbers are not directly comparable to our measure of working from home, the correlation between their measure and our measure of working from home in 2022 is 0.81.

3.3 Occupation level

More than 40% of the variation in working from home in country–year–occupation cells can be attributed to differences across occupations. Country- and year-level dif-

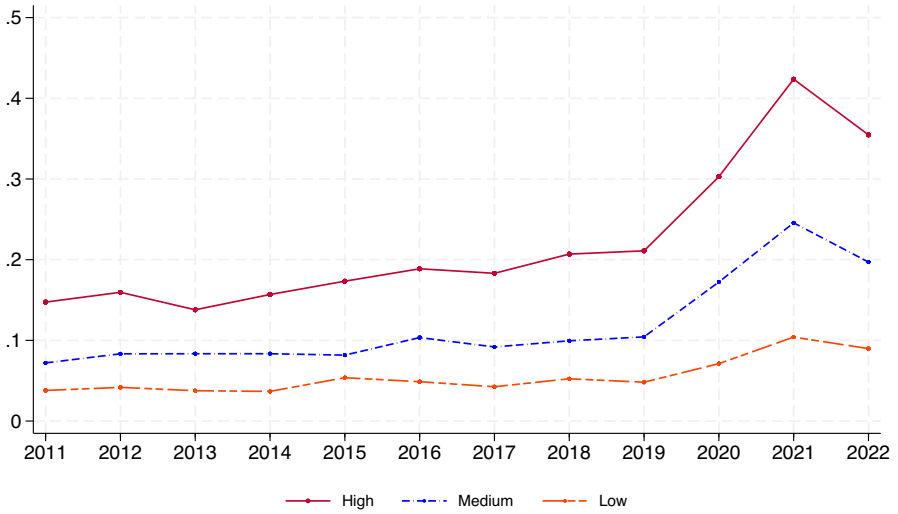

Fig. 2 The evolution of working from home in industries grouped by level. *Note* This figure illustrates the levels of and changes in working from home (WFH) during the sample years in 1-digit NACE Rev. 2 industries where we have grouped industries into high-, medium-, and low-working from home levels and taken averages within each of these groups across industries and countries. See Table 5 in the Data Appendix for complete descriptions and sources of variables

ferences explain 20% and 5% of the variation, correspondingly (see Table VII in the Online Appendix—Further Results).

We use the 2-digit ISCO-08 occupation classification in most of our analysis but we use the 1-digit classification in Fig. 3 to illustrate the evolution of working from home across occupations. We have averaged the working from home measure across countries in this figure. Managerial and Professional occupations (ISCO-08 major groups 1 and 2) have the highest levels of working from home. About 30% of workers report that they at least sometimes work from home in these occupations in 2019. Health Professionals, a subgroup of Professional occupations, is an exception in this group with only around 10% working from home.[6] About 14% and 8% of workers reported that they at least sometimes worked from home in 2019 in Technical and Associate Professionals and Clerical occupations, respectively (ISCO-08 major groups 3 and 4). The exceptions among the Associate Professionals occupations are the Information and Communications Technicians and Business Associate Professionals occupations that tend to have high levels of working from home. The Services and Sales and Skilled Agricultural occupations (ISCO-08 major groups 5 and 6) frequently have a medium–low level of working from home (between 5 and 6% in 2019). In turn, most of the crafts, building, and assembling occupations specific to the Manufacturing industry and elementary occupations (ISCO-08 major groups 7, 8, and 9) frequently have a low level of working from home. Between 1 and 3% of employees reported working from home at least sometimes in these occupations in 2019. The Electrical and Electronic

[6] Table VIII in the Online Appendix—Further Results, reports the levels of working from home in 2-digit occupations.

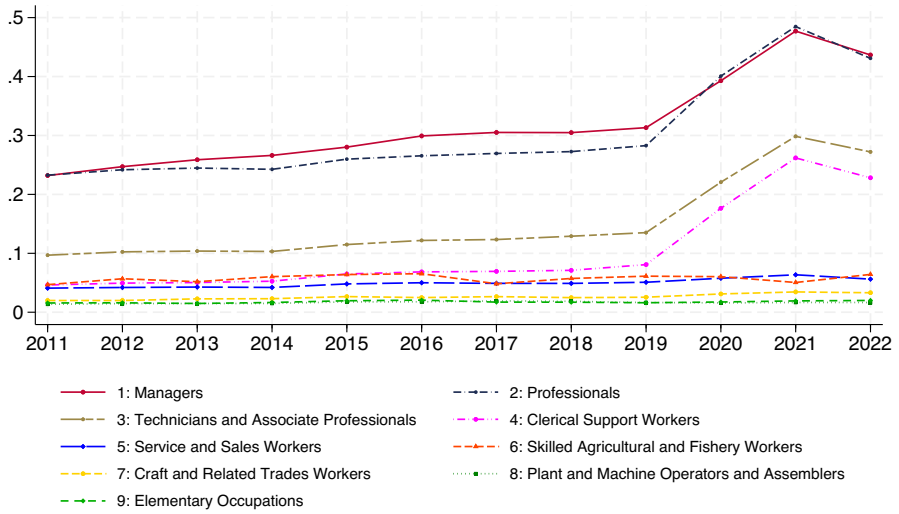

Fig. 3 The evolution of working from home in occupations. *Note* This figure illustrates the levels of and changes in working from home (WFH) in 1-digit ISCO-08 occupations. We take averages across sample countries for each occupation. See Table 5 in the Data Appendix for complete descriptions and sources of variables

Trades Workers occupation is the exception among the occupations specific to the Manufacturing industry. It frequently has a medium level of working from home.

Working from home has increased in all managerial, professional, and clerical occupations in 2019–2021. Similarly to industries, the increase in working from home during the COVID-19 years in these occupations is larger than the accumulated increase in the entire 2011–2019 period. The largest percentage point changes in working from home have happened in Managerial and Professional occupations that tend to use ICT more intensively in their core tasks (e.g., see Oettinger 2011, for similar evidence from the USA). There has been a decline in working from home in 2022, but it remains above the level in 2019 in all these occupations. The exception is Teaching Professionals, whose level goes back to similar levels as in 2019, and Health Professionals, who have a rather constant level of working from home throughout the whole period (see Table VIII in the Online Appendix—Further Results).

The pink and blue-collar occupations have experienced negligible increases in working from home. Between 1 and 6% of employees in these occupations work from home during the period under study, except for Personal Care Workers which have around 10% of working from home. These occupations have a high share of manual and routine tasks, which makes working from home difficult.

4 Working from home and employment

Is there an association between working from home and employment during the years strongly affected by the COVID-19 pandemic? We estimate the following specification

to study this question:

$$\text{Employment Growth}_{\text{i,c},t} = \gamma_0 + \gamma_1 \text{Pandemic}_t \times \text{WFH}_{\text{i,c},t-1} + \gamma_2 \text{Pandemic}_t + \gamma_3 \text{WFH}_{\text{i,c},t-1} + \gamma_4 \text{t} + \eta_{\text{i,c},t} \quad (2)$$

where the dependent variable is the annual growth rate in employment, i corresponds to either industries or occupations, c indexes countries, t indexes years, Pandemic_t is a dummy for the years 2020 and 2021, and $\eta_{\text{i,c},t}$ is an error term. The coefficient γ_1 in this specification shows the association between the changes in employment and working from home in the years strongly affected by the pandemic relative to the years before the pandemic.

Panel A of Table 1 reports the industry-level results. The first column shows the results from the estimation of the specification (2). The estimate of γ_1 is positive, and the estimate of γ_2 is negative. Both estimates are statistically significant. In turn, the estimate of the coefficient on the working from home variable is not significant. These results indicate that industries with a higher share of workers who worked from home had lower losses in employment during the pandemic years. In column (2), we add industry-level fixed effects to control for fixed industry characteristics, such as high demand for its output and the industry intensity in tasks that can be performed from home. The estimate of the γ_1 is not affected suggesting that the correlation is not due to industry-level fixed differences. It could be also that this correlation is because of country-level fixed characteristics, such as more lenient working from home policies and labor market regulations. We control for country-level fixed effects in column (3). The estimate of the γ_1 is virtually not affected by the inclusion of country-level fixed effects suggesting that the correlation is not due to country-level fixed differences. However, the estimate of the parameter on the working from home measure is positive and significant in this regression. This means that higher levels of working from home are positively correlated with employment growth within countries and within and between industries. Finally, we control for industry- and country-level fixed effects in column (4). The estimate of the γ_1 is the same as in column (1). This shows that the correlation identified in column (1) does not arise because of industry- and country-level fixed differences. Moreover, the coefficient on the working from home variable loses its significance in column (4). This suggests that the correlation between employment growth and working from home in normal times is driven by between-industry and within-country differences.

One way to gauge the magnitude of this estimated association is as follows. We compute the average level of working from home in 2019 in industry–country pairs where working from home is below the 25th percentile of its distribution in 2019 (e.g., the Accommodation and Food Services industry in Slovakia). We also compute the average level of working from home in 2019 in industry–country pairs where working from home is above the 75th percentile of its distribution in 2019 (e.g., the Professional and Support Service Activities industry in Austria). We multiply the difference between these averages by the estimate of γ_1 in column 4 of Panel A and get 0.022. This number implies that moving from the first group of industry–country pairs to the second is associated with a nearly 2.2 percentage points lower fall in

employment during the years heavily affected by the pandemic, 2020 and 2021. To give a reference point, employment has fallen by about 7 percentage points more in the first group of industry–country pairs as compared to the second group during these years.

Panel B of Table 1 reports the results from the estimation of the specification (2) using data for employment growth and working from home shares in occupations. The estimate of γ_1 is positive and the estimate of γ_2 is negative and both estimates are statistically significant in column (1). This suggests that occupations with a higher share of workers who worked from home had lower losses in employment during the pandemic years. The same results hold in columns (2), (3), and (4) where we introduce occupation-level fixed effects, country-level fixed effects, and occupation- and country-level fixed effects, correspondingly. Occupation fixed effects can capture fixed occupational characteristics related to both the employment in an occupation and working from home opportunities in it. For example, some non-routine occupational tasks can be in high demand and at the same time easy to perform from home. These effects seem to matter as the coefficient of working from home is positive and significant when the occupation-fixed effects are not included. The results in columns (2), (3), and (4) show that the correlation identified in column (1) of Panel B is not driven by occupation- and country-level fixed differences.[7]

To quantify the estimated association, on average 0.5 percent of employees reported that they at least sometimes work from home in occupation–country pairs where working from home is below the 25th percentile of its distribution in 2019 (e.g., the Numerical and Material Recording Clerks occupation in Romania). In turn, on average 18 percent of employees reported that they at least sometimes work from home in occupation–country pairs where working from home is above the 75th percentile of its distribution in 2019 (e.g., the Chief Executives, Senior Officials, and Legislators occupation in Greece). The estimate of γ_1 in column 4 of Panel B implies that moving from the first group of occupation–country pairs to the second is associated with a nearly 1.1 percentage points lower fall in employment during the years heavily affected by the pandemic, 2020 and 2021. For comparison, employment has fallen by about 6 percentage points more in the first group of occupation–country pairs as compared to the second group during these years.

Next, we analyze whether the results are driven by usually working from home or whether sometimes working from home is also correlated with a lower fall in employment. We estimate the equation separating those who usually work from home from those who sometimes work from home. Results are reported in Tables IX and X in the Online Appendix—Further Results. The coefficients γ_1 and γ_2 are significant and with the expected sign. These results suggest that working from home is related to a lower fall in employment during the pandemic years, no matter the intensity of working from home.[8]

Finally, we estimate the specification (2) using lagged annual changes in the working from home instead of its levels. The coefficient on the interaction term γ_1, in this case,

[7] The estimates in Table 1 are robust to using the period 2011–2022 instead of 2011–2021, and to using the 2-period lags in the working from home instead of a 1-period lag.

[8] We also analyzed whether results hold for part-time employees and full-time employees separately. The coefficient estimates from these estimations are close to those reported in Table 1.

Table 1 Working from home and changes in employment

	A. Industries				B. Occupations			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Pandemic $\times$WFH$_{t-1}$	0.13***	0.13***	0.12***	0.12***	0.07***	0.07**	0.07**	0.07**
	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Pandemic	−0.04***	−0.04***	−0.04***	−0.04***	−0.03***	−0.03***	−0.03***	−0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
WFH$_{t-1}$	0.01	−0.01	0.04***	0.00	0.04***	−0.00	0.06***	0.02
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
Constant	−0.01	−0.00	−0.01*	−0.01	−0.01**	−0.01	−0.01***	−0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Industry FE	No	Yes	No	Yes				
Occupation FE					No	Yes	No	Yes
Country FE	No	No	Yes	Yes	No	No	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	4166	4166	4166	4166	9078	9078	9078	9078
$R2$	0.02	0.02	0.02	0.02	0.01	0.00	0.01	0.01

Panel A reports the results from the estimation of the specification (2) for industries. The dependent variable is the yearly growth rate in employment in industries in sample countries and years. The main independent variable is the interaction between the 1-period lagged share of employees who report that they at least sometimes work from home (WFH$_{t-1}$) and pandemic, a dummy variable that takes values 1 for the years 2020 and 2021 and 0 otherwise. The sample years are from 2011 to 2021. Panel B reports the results from the estimation of the specification (2) for occupations. The industry–year–country cells and occupation–year–country cells with less than 30 observations are excluded when computing the working from home variable. FE stands for fixed effects. All regressions are estimated using the least-squares method and include a time trend. Standard errors are bootstrapped and two-way clustered at industry or occupation and country level and are presented in parenthesis. The fixed effects have been partialled out in the computation of R-squared ($R2$). *** Indicates significance at the 1% level, ** at the 5% level and * at the 10% level. See Table 5 in the Data Appendix for complete descriptions and sources of variables

Table 2 Changes in working from home and employment

	A. Industries				B. Occupations			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Pandemic $\times \Delta \text{WFH}_{t-1}$	0.24**	0.21*	0.26**	0.23**	0.32***	0.27***	0.33***	0.28***
	(0.11)	(0.11)	(0.11)	(0.11)	(0.09)	(0.10)	(0.10)	(0.10)
Pandemic	−0.03***	−0.03***	−0.03***	−0.03***	−0.03***	−0.03***	−0.03***	−0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
ΔWFH_{t-1}	−0.07	−0.09	−0.09	−0.11	−0.04	−0.06	−0.05	−0.07
	(0.09)	(0.09)	(0.09)	(0.10)	(0.07)	(0.07)	(0.06)	(0.07)
Constant	−0.01*	−0.01**	−0.01**	−0.01**	−0.00	−0.00	−0.00	−0.00
	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Industry FE	No	Yes	No	Yes				
Occupation FE					No	Yes	No	Yes
Country FE	No	No	Yes	Yes	No	No	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3743	3743	3743	3743	8149	8149	8149	8149
*R*2	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00

This table offers results from the estimation of specification (2) using annual changes in working from home instead of its levels. The dependent variable is the yearly growth rate in employment in industries in sample countries and years. The main independent variable is the interaction between the 1-period lagged annual change in the share of employees who report that they at least sometimes work from home (ΔWFH_{t-1}) and Pandemic, a dummy that takes values 1 for the years 2020 and 2021 and 0 otherwise. The sample years are from 2011 to 2021. Panel A reports the results from the estimation for industries. Panel B reports the results from the estimation for occupations. The industry–year–country cells and occupation–year–country cells with less than 30 observations are excluded when computing the working from home variable. FE stands for fixed effects. All regressions are estimated using the least-squares method and include a time trend. Standard errors are bootstrapped and two-way clustered at industry or occupation and country level and are presented in parenthesis. The fixed effects have been partialled out in the computation of *R*-squared (*R*2). *** Indicates significance at the 1% level, ** at the 5% level and * at the 10% level. See Table 5 in the Data Appendix for complete descriptions and sources of variables

shows if industries (or occupations) with larger changes in working from home also had lower losses in employment during the pandemic relative to the normal times, i.e., before the pandemic. Panel A of Table 2 reports the results for industries and Panel B for occupations. According to the estimates of γ_1 and γ_2, higher changes in working from home are positively correlated with lower losses in employment during the pandemic years in industries as well as in occupation groups. According to these estimates, moving from the industry–country (occupation–country) pair below the 25th percentile of the distribution of Δ WFH in 2019 to the industry–country (occupation–country) pair above the 75th percentile is associated with a 0.8 percentage points (1 percentage point) lower fall in employment. For comparison, employment has fallen by about 1.6 percentage points (2 percentage points) more in the first group of industry–country (occupation–country) pairs as compared to the second group during these years.

All this evidence suggests that working from home reduced the loss of employment during the pandemic years. The causal interpretation is not unique though. Another potential explanation could be that during the pandemic, the demand for employment increased in occupations/industries where working from home was higher than in occupations/industries where working from home was difficult. Restrictions harmed the Accommodation and Food industry, for instance, while the Information and Communication products saw increased demand. There are counterexamples, however, as the Health Activities industry demand increased even if its working from home was low and Real Estate Activities, which have high levels of working from home, saw a decreased demand.

5 Working from home frontier capacity

Policymakers can be especially interested in how much working from home there can be in exceptional times such as the COVID-19 pandemic. In this section, we propose a measure of the frontier capacity of working from home in the sample countries using the observed levels of working from home in the nationally representative EU Labour Force Survey during the pandemic. In particular, for each year, we take the 95th percentile of working from home in each 1-digit occupation, industry, and year across the sample countries and adjust it to the employment composition in industries and occupations in each country using the hours of employment in occupation–industry pairs.

$$\text{Capacity}_{ct} = \frac{\sum_{\text{o,i}} \text{Working from Home}_{\bar{\text{c}},\text{i},\text{o},t} \times \text{Hours of Work}_{\text{c,i,o},t}}{\sum_{\text{o,i}} \text{Hours of Work}_{\text{c,i,o},t}}, \tag{3}$$

where $\bar{\text{c}}$ is the country where working from home in an occupation–industry–year triple is at its 95th percentile across sample countries, t is the year, i and o index industries and occupations, and $\text{Hours of Work}_{\text{c,i,o},t}$ is the total number of hours of work in country c, industry i, and occupation o in year t. We use the 95th percentile instead of, for example, the maximum to alleviate concerns with outliers. We use 1-digit occupations to have sufficiently many observations in each occupation–industry–

country–year cell.[9] We compute this measure for the years mostly affected by the COVID-19 pandemic to maintain its relevance in such exceptional times. Our main measure of frontier capacity uses the share of employees who report that they at least sometimes work from home. This can be a relevant measure for evaluating country-level working from home capacity at a given point because partial working from home can contribute to maintaining economic activity and mitigate the spread of epidemics/pandemics (Alipour et al. 2021; Brotherhood and Jerbashian 2023).

The frontier capacity measure computes how much working from home there would be in a country if most facilitating working from home conditions available elsewhere were implemented. We assume that all sample countries can implement these conditions (e.g., Dingel and Neiman 2020 maintain a similar assumption). This includes equitable access to technology and the required expertise for its utilization, as well as the ability to implement comparable work conditions and regulations.[10] Similar to the measure of Dingel and Neiman (2020), the differences in our measure across countries are because of differences in their occupation–industry structure.

The first two columns of Panel A in Table 3 offer the frontier capacity measure for 2020 and 2021. The capacity of the labor force to work at least sometimes from home in 2020 is the lowest in Latvia (30%) and the highest in Sweden (53%). It has increased almost everywhere on average by 7 percentage points in 2021. In the third column of Panel A, we recompute Eq. (3) for 2021 using the 2020 values of the 95th percentile of working from home in each occupation and industry across countries. This counterfactual exercise allows us to check the drivers of the changes in the frontier capacity measure between 2020 and 2021. The values obtained with this exercise tend to be very close to the 2020 values of the frontier capacity measure.[11] This suggests that the observed changes in the frontier capacity between 2020 and 2021 are almost entirely driven by changes in the distribution of working from home, while changes in the occupation–industry employment structure play a small role.[12]

Bloom et al. (2021) document significant technological developments during the pandemic that increased the quality and efficacy of remote work. These technological developments could have alleviated the constraints on working from home and increased its capacity. In turn, changes in working from home and in the frontier capacity can also be attributed, for example, to non-medical intervention policies and changes in the behavior of individuals and firms and regulations of working conditions.

Panel B in Table 3 shows the average levels of working from home in 2020 and 2021. Working from home levels in countries such as Finland and the Netherlands are very close to their frontiers. This should not come as a surprise given that these countries have the highest levels of working from home in the sample. Moreover, the observed working from home level in the Netherlands in 2021 is above its capacity measure. This is because we have opted for a somewhat conservative measure while

[9] We exclude the industry–occupation cells with less than 30 household-level observations in the EU-LFS.

[10] Admittedly, these assumptions might be strong as they require, for example, employees to have similar human capital levels across countries with quite high levels of difference in GDP per capita.

[11] The only exception is Latvia where the resulting value is about 30 percent higher than the 2020 value.

[12] Complete lockdowns during pandemics can necessitate the performance of work almost entirely from home. Table XI in the Online Appendix—Further Results, reports the frontier capacity of working from home computed using the share of employed individuals who report that they usually work from home.

taking the 95th percentile of the observed working from home in occupation–industry pairs across countries in 2020 and 2021. In many of these pairs, the Netherlands has a higher value of working from home than the 95th percentile.[13] In turn, working from home levels at their peak in 2021 are significantly below the frontier capacity in the Southern European countries and former socialist block countries. This difference could be because of, for example, a lack of technological capacity and know-how to utilize/incorporate appropriate technologies at the worker, firm, and consumer level, as well as a lack of appropriate regulations of working conditions.

Several recent studies have attempted to gauge the feasibility of working from home across countries. They employ different methodologies, including assumptions about tasks that cannot be conducted remotely within occupations or survey data on remote work potential (e.g., Adams-Prassl et al. 2022; Alipour et al. 2023; Dingel and Neiman 2020; Gottlieb et al. 2021). In particular, Dingel and Neiman (2020) evaluate the importance of tasks incompatible with remote work at a granular 6-digit occupation level, leveraging survey responses on task performance from the O*NET database in the USA. They aggregate these findings to the broader 2-digit ISCO level using employment weights by occupation and further to the country level using employment weights by 2-digit occupations. Gottlieb et al. (2021) adopt a comparable approach, utilizing survey data on task performance from the World Bank's STEP database for developing countries. They show that the frequency of tasks that cannot be performed remotely in developing countries is higher than in developed countries. They also validate their findings by comparing their measure with measures of actual remote work levels in Brazil and Costa Rica in 2020. An advantage of our measure is that it does not rely on assumptions regarding tasks that can be performed remotely (e.g., Black and Spitz-Oener 2010 show that tasks can change with the adoption of technologies) but utilizes the observed actual levels of measures of working from home. Moreover, it offers the advantage of being applicable across the pandemic years. However, a limitation may arise from discrepancies in the access to technologies or the know-how for their adoption across countries, potentially leading to inaccuracies in estimating remote work capacity, especially in outlier cases.

Panel C of Table 3 offers the values of working from home capacity in sample countries in 2020 and 2021 according to the measures of Dingel and Neiman (2020) and Gottlieb et al. (2021), hereafter DN and GGPS, correspondingly. We compute the values of these measures using information on hourly employment in 2-digit occupations in sample countries from the EU-LFS. The values of the DN measure are on average close to the values of the frontier capacity. They tend to be slightly higher than the values of the frontier capacity in 2020 but are lower in 2021. The latter result could be partly because the DN measure utilizes assumptions on the importance of tasks in occupations from the February 2020 version of the O*NET database that employs pre-pandemic data. Similarly to the frontier capacity, the value of the DN measure is below the observed level of (at least sometimes) working from home in the Netherlands in 2021. It is also lower than the observed level of working from home in Norway in 2021.

[13] We take the maximum instead of the 95th percentile in Eq. (3) and offer the values of an alternative and less conservative capacity measure in Table XI in the Online Appendix—Further Results.

Table 3 Working from home capacity in countries

	A. WFH FC			B. WFH levels		C. Other measures			
						DN		GGPS	
Country	2020	2021	2021c	2020	2021	2020	2021	2020	2021
AT: Austria	0.36	0.43	0.36	0.25	0.26	0.38	0.38	0.14	0.14
BE: Belgium	0.39	0.46	0.39	0.28	0.35	0.43	0.44	0.15	0.15
BG: Bulgaria	0.27	0.32	0.28	0.03	0.05	0.29	0.30	0.10	0.11
CH: Switzerland	0.41	0.51	0.43	0.36	0.41	0.44	0.46	0.16	0.17
CY: Cyprus	0.33	0.41	0.34	0.07	0.12	0.37	0.38	0.13	0.14
CZ: Czechia	0.30	0.38	0.32	0.08	0.11	0.33	0.34	0.12	0.12
DE: Germany	0.37	0.46	0.38	0.20	0.25	0.41	0.41	0.15	0.15
DK: Denmark	0.41	0.46	0.40	0.36	0.36	0.44	0.43	0.15	0.15
EE: Estonia	0.35	0.43	0.37	0.20	0.24	0.36	0.38	0.13	0.14
ES: Spain	0.32	0.38	0.33	0.12	0.13	0.32	0.33	0.11	0.12
FI: Finland	0.38	0.42	0.36	0.37	0.40	0.42	0.40	0.15	0.14
FR: France	0.41	0.47	0.41	0.29	0.33	0.42	0.43	0.15	0.16
GR: Greece	0.33	0.35	0.29	0.10	0.15	0.38	0.40	0.13	0.13
HR: Croatia	0.30	0.35	0.30	0.10	0.13	0.33	0.32	0.12	0.12
HU: Hungary	0.31	0.38	0.32	0.10	0.12	0.31	0.34	0.11	0.12
IE: Ireland	0.41	0.45	0.39	0.31	0.40	0.41	0.43	0.15	0.16
IT: Italy	0.31	0.37	0.30	0.12	0.14	0.34	0.34	0.12	0.12
LT: Lithuania	0.35	0.41	0.36	0.06	0.11	0.36	0.37	0.13	0.14
LU: Luxembourg	0.46	0.51	0.44	0.44	0.41	0.55	0.55	0.20	0.20
LV: Latvia	0.21	0.30	0.27	0.03	0.11	0.35	0.38	0.12	0.14
NL: The Netherlands	0.42	0.51	0.44	0.40	0.56	0.46	0.48	0.17	0.18
NO: Norway	0.41	0.47	0.41	0.09	0.45	0.42	0.43	0.15	0.15
PL: Poland	0.35	0.42	0.36	0.13	0.11	0.36	0.38	0.13	0.14
PT: Portugal	0.34	0.38	0.33	0.22	0.26	0.36	0.40	0.13	0.14
RO: Romania	0.27	0.31	0.27	0.04	0.07	0.27	0.27	0.10	0.10
SE: Sweden	0.45	0.53	0.46	0.31	0.45	0.46	0.46	0.16	0.16
SI: Slovenia	0.38	0.45	0.38	0.17	0.21	0.40	0.40	0.14	0.14
SK: Slovakia	0.31	0.38	0.32	0.09	0.13	0.31	0.32	0.11	0.12

Panel A of this table offers the values of the frontier capacity of working from home in the sample countries calculated using Eq. (3) in 2020 and 2021. These values are derived from our baseline metric for remote work, defined as the proportion of employees who at least sometimes work from home. In column 2021c, it offers the values of the frontier capacity measure when we use the 95th percentile of the working from home measure from 2020 instead of 2021 in Eq. (3). Panel B offers the actual levels of working from home in 2020 and 2021. Panel C offers measures of working from home capacities computed using information about remote (in)compatibility levels in occupations from the O*NET and World Bank's STEP databases (see Dingel and Neiman 2020; Gottlieb et al. 2021), along with information on hours worked in these occupations in the sample countries from the EU-LFS database. See Table 5 in the Data Appendix for complete descriptions and sources of variables

Table 4 Correlations between working from home capacity measures and the observed working from home levels

Working from home capacity	2020	2021
A. Correlation with the observed levels of working from home		
Working from home frontier capacity	0.83	0.85
DN	0.85	0.84
GGPS	0.85	0.83
B1. Correlation with working from home frontier capacity		
DN	0.88	0.84
GGPS	0.87	0.84
B2. Correlation with DN		
GGPS	0.99	0.99

Panel A of this table offers the pairwise correlations between the observed levels of working from home in sample countries and the measures of working from home capacity. Panels B1 and B2 offer the pairwise correlations between the measures of working from home capacity. See Table 5 in the Data Appendix for complete descriptions and sources of variables

In turn, the values of the GGPS measure are significantly below the values of the frontier capacity and the DN measure. They are also significantly below the observed levels of working from home in the sample European countries. This is likely because this measure is computed using data on the importance of tasks that can be performed from home in occupations in developing countries where these tasks might be less important than in developed countries. The values of the frontier capacity significantly increase in 2021 as compared to 2020 but the values of DN and GGPS measures remain almost constant. This is because working from home levels increased in 2021 as compared to 2020 but employment structure remained virtually unaffected. Bloom et al. (2021) document significant technological developments during the pandemic that increased the quality and efficacy of remote work. These technological developments could have alleviated the constraints on working from home and increased its capacity.

All the measures of working from home capacity are strongly correlated with the observed levels of working from home in sample countries according to Panel A of Table 4. The pairwise correlations between these measures are also high as reported in Panel B of Table 4. Moreover, the correlation between DN and GGPS measures is almost 1 implying that in European countries the main differences between these two measures are in their levels.

6 Conclusions

We use data from the EU Labour Force Survey for 28 European countries and document the levels of working from home in countries, industries, and occupations in the pre-pandemic years 2011–2019, the years that were significantly affected by the COVID-19 pandemic 2020–2021, and 2022 when many of the pandemics-related

restrictions and policies were lifted. The Scandinavian countries tend to have the highest levels of working from home during the sample years, whereas Southern European and former socialist block countries have the lowest levels. Industries with higher levels of utilization of information and communication technologies (ICT) have higher working from home levels than industries with lower levels of ICT utilization. In turn, Managerial and Professional occupations have higher working from home levels than the remaining occupations, and blue-collar occupations have very low levels of working from home. Working from home has increased in several sample countries and almost all industries and occupations in the 2011–2019 period, except blue-collar occupations. It has increased significantly more in 2020–2021 than in 2011–2019. The sharp increase in working from home during 2020–2021 is strongly correlated with the measures of stringency of non-medical intervention policies. Working from home has slightly declined in almost all countries in 2022, although its values remain above the pre-pandemic levels. The only exception is Poland, where working from home returned to the pre-pandemic level in 2022. This cross-sectional evidence delivers support to the hypothesis that "working from home is here to stay" (e.g., Barrero et al. 2021).

We find that working from home and changes in employment during the pandemic are strongly positively correlated. This implies that working from home was associated with a lower fall in employment in these exceptional times.

Finally, we compute the frontier capacity of working from home in the sample countries using the observed levels of working from home during the years most significantly affected by the COVID-19 pandemic. The frontier capacity of working from home is the highest in Sweden, Luxembourg, and the Netherlands. More than half the labor force could work from home in these countries in 2021 according to this measure. It is the lowest in Latvia, Romania, and Bulgaria, where only around 30% of their labor force could work from home in 2021. This measure is strongly correlated with the task-based measures of working from home capacity introduced by Dingel and Neiman (2020). In contrast to these measures, it significantly varies over the years 2020–2021 because of significant changes in working from home during these years. This variability suggests that our measure may effectively capture the potential of easing constraints on remote work in sample countries.

Our results are relevant for policy in several ways. We offer evidence that working from home can provide effective means for saving employment in times of a pandemic. We also report differences in the possibility of working from home across industries and occupations that might need to be taken into account should such events repeat in the future. Our results further suggest that non-medical intervention policies can also affect the level of working from home. Finally, we compute a measure of working from home capacity and show that there can be ample space to increase working from home in many of the sample countries.

A Data appendix

See Table 5.

Table 5 Definitions and sources of variables

Variable name	Definition and source
Working from home (WFH)	The share of employed individuals who report that they work at home least sometimes out of the total number of employed individuals in countries, industries, occupations, and years. We use the usual hours of work to weight the observations together with individual-level sample weights from the EU-LFS. We exclude family workers and individuals older than 65 when computing this measure. See Appendix B for further details regarding this measure. Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
Working from home frontier capacity (WFH FC)	A measure of the capacity to work from home of the labor force in a country. We compute it using the observed levels of our main measure of working from home (WFH) in sample countries and equation (3). Our main measure of working from home is the share of employed individuals who report that they work at home least sometimes out of the total number of employed individuals. Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
Working from home frontier capacity$_{2019}$	A measure of the capacity to work from home of the labor force in a country in 2019. We compute it using the observed levels of working from home in 2019 in sample countries and equation (3). Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
DN	A measure of the capacity to work from home of the labor force in a country developed by Dingel and Neiman (2020). This measure is based on the determination of tasks that are incompatible with remote work and their importance in occupations using information from the O*NET database in the USA. Source: Authors' calculations using data on the ability to perform tasks in an occupation from Table A3 in Gottlieb et al. (2021) and information on employment hours by occupation from the 2023 release of the EU Labour Force Survey database
GGPS	A measure of the capacity to work from home of the labor force in a country developed by Gottlieb et al. (2021). This measure is based on the determination of tasks that are incompatible with remote work and their importance in occupations using information from the World Bank's STEP database for developing countries. Source: Authors' calculations using data on the ability to perform tasks in an occupation from Table A3 in Gottlieb et al. (2021) and information on employment hours by occupation from the 2023 release of the EU Labour Force Survey database
Δ WFH	Annual changes in working from home (WFH). Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
Employment growth	Annual growth of total employment hours in an occupation or industry. Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
Hours of work	The total number of hours of work in an occupation–industry pair in a country in a particular year. Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database

Table 5 continued

Variable name	Definition and source
Stringency index	This index measures the strictness of "lockdown style" policies that primarily restrict peoples' behavior. It is calculated using containment and closure policy indicators, as well as indicator recording public information campaigns. It has a daily frequency. We take the average over 2020 in each sample country and normalize it to have a 0 mean and 1 standard deviation across sample countries. Source: Hale et al. (2021)
Stay home	This index takes value 0 if no measures are applied, 1 if it is recommended not to leave the house, 2 if it is required not to leave the house with exceptions for daily exercise, grocery shopping, and essential trips, 3 if it is required not to leave the house with minimal exceptions (e.g., allowed to leave once a week, only one person at a time). It has a daily frequency. We take the average over 2020 in each sample country and normalize it to have a 0 mean and 1 standard deviation across sample countries. Source: Hale et al. (2021)
Workplace closures	This index takes value 0 if no measures are applied, 1 if it is recommended to close (or work from home), 2 if it is required to close (or work from home) for some sectors or categories of workers, 3 if it is required to close (or work from home) in all (but essential) workplaces. It has a daily frequency. We take the average over 2020 in each sample country and normalize it to have a 0 mean and 1 standard deviation across sample countries. Source: Hale et al. (2021)
Usually WFH FC	A measure of the capacity to work from home of the labor force in a country. We compute it using the observed percentage of employees who report that they usually work from home in sample countries and equation (3). Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
Max WFH FC	A measure of the capacity to work from home of the labor force in a country. We compute it using the observed percentage of employees who report that they at least sometimes work from home in sample countries and equation (3) where instead of the 95th percentile we take the maximum. Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
Usually working from home (UWFH)	The share of employed individuals who report that they usually work at out of the total number of employed individuals in countries, industries, occupations, and years. We use the usual hours of work to weight the observations together with individual-level sample weights from the EU-LFS. We exclude family workers and individuals older than 65 when computing this measure. See Appendix B for further details regarding this measure. Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database
Sometimes working from home (SWFH)	The share of employed individuals who report that they work at home sometimes out of the total number of employed individuals in countries, industries, occupations, and years. We use the usual hours of work to weight the observations together with individual-level sample weights from the EU-LFS. We exclude family workers and individuals older than 65 when computing this measure. See Appendix B for further details regarding this measure. Source: Authors' calculations using data from the 2023 release of the EU Labour Force Survey database

B Working from home variable in the EU-LFS

In the EU-LFS, working from home means doing any productive work related to the person's current job(s) at home. The answer is codified as: "Usually" when working at home half of the days worked in a reference period; "Sometimes" when working at home less than half of the days worked, but at least one hour in a reference period; and "Never" when working at home on no occasion in the reference period. The reference period is usually four weeks preceding the end of the reference week. Farmers are not considered to work from home when they work on their own farms. However, it is counted as work from home if farmers, for example, perform administrative work at home. Similarly, it is not counted as working from home if the work is performed in a workplace adjacent to the house or the apartment and has its own entrance.

Until the year 2020, employees are considered to work from home when there is an agreement with the employer, and hours can be credited as working time in the EU-LFS. This excludes working from home for personal reasons, time constraints, and without compensation. Exceptions are Finland, Italy, and Germany. In Finland and Italy, it included work hours even if they were not formally compensated or recognized. In contrast, in Germany, there were home office provisions. For example, individuals should work on a computer provided by the employer if they use a computer for working at home.

The new framework legislation implemented in 2021[14] implied some changes in the EU-LFS. Since 2021 all employed people are asked if they work from home, and if they answer yes, they are further asked about frequency. People who work from home must answer yes, regardless of whether they have a home office agreement. The new definition of home office captures to a greater extent the real use of home office, in contrast to the old definition.

There are some variations in the question regarding working from home, the coding of the responses, and the reference period in sample countries. The question about working from home in Austria asks about the frequency of working from home in the last three weeks. In France, it asks about working from home without a period of reference until 2013 and with a reference to the last four weeks from 2013 onward. The reference period in Germany is the last three months until 2016 and changes to the last four weeks afterward. In the case of Norway, there is no reference period. Respondents are considered to work from home "usually" if they worked from home twice or more times per week in the last four weeks in Italy. They are considered to work from home "sometimes" if they work from home less than twice a week. On some occasions, the question does not explicitly define the meaning of often/regularly or sometimes. This happens in Switzerland, Hungary, Poland, and Slovenia (all years), Finland, Croatia, Norway, and Slovakia (before 2021), Lithuania (before 2015), and Portugal and Romania (from 2021 on). The EU-LFS does not provide information on whether the respondents "sometimes" work from home till 2015 for the Netherlands.

This is an example of the question asked. It corresponds to Austria in the 2015 to 2020 questionnaires.

[14] The new framework legislation is informally referred to as the Integrated European Social Statistics "IESS." Regulation (EU) 2019/1700 of the European Parliament and of the Council of 10 October 2019.

The following questions deal with the period from Monday, ... to Sunday, ... (date of the reference period) (reference period: reference week + 3 weeks before). How often did you work from home during this time?
Work at home is:

- Teacher preparation times
- Preparation time of people in field service occupations
- Other work at home by agreement with the employer
- Self-employed/farmers: professional activities only, pure Housework doesn't count!

Answers:

1. On at least half of the working days
2. Less often
3. Never

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Data availability This study is based on data from Eurostat, EU Labour Force Survey. Access to confidential microdata is restricted to protect the anonymity of individuals.

Declarations

Conflict of interest Both authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

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