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The new geography of remote jobs in Europe

Davide Luca[a,b], Cem Özgüzel[c,d,e] and Zhiwu Wei[a]

ABSTRACT

The paper maps the diffusion of working from home across 30 European countries during the COVID-19 pandemic. We summarise the determinants of remote working and show that its uptake was lower than in the United States, and substantially uneven across/within countries, with most remote jobs concentrated in cities and capital regions. We then apply a variance decomposition procedure to investigate whether the uneven distribution of remote jobs can be attributed to individual or territorial factors. Results underscore the importance of composition effects as, compared with intermediate-density and rural areas, cities hosted more workers in occupations/sectors more amenable to working remotely.

KEYWORDS

work from home; remote work; telework; COVID-19; Europe

JEL I18, J20, O52, P25

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1. INTRODUCTION

The COVID-19 pandemic has led to a dramatic acceleration in the expansion of remote work across many advanced economies. The International Labour Organisation (ILO) describes remote work as any 'situation where the work is fully or partly carried out on an alternative worksite other than the default place of work' (ILO, 2020, p. 5). Alternative worksites include co-working spaces, cafes, etc. but – most often – workers' own residences. Because of this, there has been a growing debate on the implications of working from home (WFH) (by which we mean both fully remote and hybrid work) for the geography, real estate markets and productivity of large cities. Similarly, there has been substantial debate on the extent to which remote work may lead to a structural relocation of workers and advanced economic activities from core urban centres towards less densely populated areas (Crescenzi et al., 2022; Fiorentino et al., 2022; Florida et al., 2023; Glaeser, 2022; Grabner & Tsvetkova, 2022; Nathan, 2023; Nathan & Overman, 2020), especially when work is done fully remotely. While there is a growing number of studies uncovering the geography of WFH in the United States (Althoff et al., 2022; Ramani & Bloom, 2021), the cross-country comparative empirical evidence from other Organisation for Economic Co-operation and Development (OECD) countries is, however, scarcer.

Exploring the geography of remote jobs across Europe is hence important and sets the stage for more in-depth analyses. Addressing this gap is also important from a policy perspective, as it will allow better understanding what factors are associated with WFH and may hinder achieving the maximum net potential benefits associated with remote work, especially in areas where its uptake is still limited (Eurofound, 2020; European Commission, 2021; OECD, 2020a, 2021c). There is still ongoing debate on the effects of remote work for productivity. Recent studies, for example, argue that reduced face-to-face interaction may have negative effects on the productivity of high-skill workers and may reduce innovation (Brucks & Levav, 2022). Some studies, by contrast, challenge such views (e.g., Huggins & Thompson, 2022). Overall, there is a growing consensus on how, in the future, the share of work done at least in part remotely will be higher than pre-COVID (Aksoy et al., 2022; Bick et al., 2023),

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and how new forms of work will likely influence the evolution of regional development trajectories (Stantcheva, 2022).

We contribute to the literature by: (1) offering the first comprehensive cross-country investigation of the new geography of WFH across all the European Union (EU) 27 member states plus Norway, Switzerland and Iceland; and (2) rigorously measuring the extent to which the geographically uneven uptake in WFH can be explained by composition or contextual factors.

The first part of the article provides systematic descriptive evidence on the new geography of remote jobs across the regions and cities of Europe. Special attention is devoted to exploring the geographical and sectoral heterogeneity in the extent to which remote work has increased during the pandemic. To do so, we leverage microdata from the annual waves of the EU Labour Force Survey (EU-LFS) carried out in 2019, 2020 and 2021. With over 1.5 million respondents in 2019, around 1.2 million in 2020 and around 1.1 million in 2021, the survey provides a large and geographically representative sample size.

Findings suggest that the average uptake across Europe was lower than in the United States (cf. Althoff et al., 2022), and was markedly uneven across and within European countries. Most places with higher levels of remote work before the pandemic also experienced a fastest uptake afterwards. Moreover, on average, workers living in capital regions and urban centres experienced the highest remote work uptake. Furthermore, the uptake was particularly strong in certain areas such as capital regions where it quadrupled, increasing from 6% to 22% during the same period. More generally, between 2019 and 2021, the share of remote workers more than tripled in cities, while it only doubled in towns and semi-dense areas and rural areas. These findings are consistent with recent theoretical contributions. Scholars have indeed argued that the 'work-from-home revolution' will not significantly alter the economic geography of the global city system (Florida et al., 2023) nor lead to a 'big city exodus' (Nathan & Overman, 2020) but, instead, will trigger a redistribution of economic activities and workers from city centres to large cities' hinterlands (Bond-Smith & McCann, 2022; Gokan et al., 2022; Mariotti, 2021). While our main empirical focus is on survey respondents who 'mostly' work from home, the patterns we uncover are similar when replicating the analysis for respondents who 'sometimes' work from home.

Second, the paper explores the drivers of WFH uptake. Drawing on the literature on shocks and regional resilience (cf. Crescenzi et al., 2016), we broadly identify three main sets of conditions potentially influencing the spread of WFH: compositional, contextual and societal factors. Compositional determinants relate to the demographic/sectorial structure of local and regional economies. Contextual factors refer to the place-specific territorial conditions in which local and regional agents are situated, and which may enable/inhibit workers to switch to remote work. Finally, societal factors are those broader (national) conditions within which local and regional agents are situated.

While the share of remote workers across all European regions rose on average from 5.4% in 2019 to 14% in 2021, the increase was uneven across European countries, reflecting pre-COVID cross-country differences and, as expectable, government lockdown policies during the pandemic.

Confirming international evidence, the results highlight how the workers who have adopted to remote work tend to be older, self-employed and with higher levels of formal education. They also tend to work in information and communication, financial and insurance, education, professional, scientific, and technical sectors and in occupations such as managers, professionals, technical and associate professionals. These sectors and occupations are in line with those identified by the literature with relatively high 'teleworkability' index (e.g., Barbieri et al., 2022; Sostero et al., 2020). Unexpectedly, the results do not point to significant gender differences in remote work uptake during the pandemic. At the territorial level, findings also show that regional higher internet speed and higher excess mortality rates were significant predictors of the likelihood of working remotely in the first year of the pandemic, but their explanatory power and significance comparatively decrease in 2021.

The article subsequently employs the variance decomposition procedure proposed by Gelbach (2016) to identify the relative role of individual versus territorial factors in explaining the remote work uptake gap we identify between cities and other areas. Controlling for country-specific heterogeneity, both individual and territorial regressors are relevant predictors of remote work uptake. At the same time, the variance decomposition analysis suggests that workers and industrial composition play a larger role than territorial factors. Controlling for country-specific time trends, the individual characteristics of the respondents can explain about 87.6% of the overall gap in remote work between cities and other areas in 2020, while contextual territorial factors can explain only about 12.4% of such variation.

Overall, the paper contributes to the growing literature on remote work. There is substantial related research on the territorial spread of COVID-19 across Europe (inter alia, see Ascani et al., 2020; Corradini et al., 2022; and Diaz-Ramirez et al., 2022). There is also a growing amount of research focused on the micro-scale, exploring how COVID-19 and remote work uptake have been affecting the structure of cities in specific countries (inter alia, see Brail & Kleinman, 2022; De Fraia et al., 2021; Delventhal et al., 2022; Kyriakopoulou & Picard, 2023; and Legeby et al., 2023). Yet, we still lack systematic, cross-country empirical evidence on the territorial diffusion of WFH across the whole of Europe. This is only partly related to the effects of the pandemic, and better understanding the new geography of remote jobs across Europe can set the stage for other contributions in this special issue.

The remainder of the paper is structured as follows. The next section reviews the existing literature on the nature and determinants of remote work uptake. The third section discusses the data sources and describes our measures of remote work and their validity. The fourth section documents the changes in the geography of remote work throughout the pandemic across Europe. The fifth section empirically tests, for European workers, the extent to which potential enabling/inhibiting factors explain the likelihood of working remotely during the pandemic. The last section concludes.

2. COVID-19 AND THE UNEVEN EXPANSION OF REMOTE WORK

The outbreak of the COVID-19 pandemic has led to a dramatic acceleration in the expansion of work from home, which can be fully remote, or hybrid. In the United States – one of the countries where the new emerging patterns of work have been studied the most – around one-third of all workers took up remote working during the first months of 2020 (Yang et al., 2022). In the UK, by April 2020, the share of individuals working remotely increased by around 20 percentage points compared with pre-pandemic levels (OECD, 2021b). Similarly, between February and December 2020, Australia witnessed a 15 percentage point increase (OECD, 2021b). Noteworthy rises in remote work uptake have also been recorded across emerging and middle-income countries (cf. Gottlieb et al., 2021).

Various factors have been linked to the territorial diffusion of remote work. Drawing on the literature on shocks and regional resilience (cf. Crescenzi et al., 2016), we broadly identify three main sets of conditions potentially influencing the spread of WFH: compositional, contextual and societal factors. Compositional determinants relate to the demographic/sectorial structure of local and regional economies. Contextual factors refer to the place-specific territorial conditions in which local and regional agents are situated, and which may enable/inhibit workers to switch to remote work. Finally, societal factors are those broader (national) conditions within which local and regional agents are situated. The following subsections discuss each hypothesis in detail.

2.1. Societal conditions: the role of lockdown policies and general employment regulation

First and foremost, the acceleration in the expansion of remote work was linked to the outbreak of COVID-19, and to the different lockdown policies implemented by governments. These measures diverged significantly across countries, and around the world have been shown to be positively associated with WFH levels (Aksoy et al., 2022). Beyond lockdown measures, country-specific employment regulations and general social acceptance of working remotely instead of working in the office are also critical determinants in the spread of WFH.

2.2. Remote work and sectoral and workforce composition

Remote work uptake may differ across cities and regions as these places do not host the same type of sectors and/or workers. For example, professional and management jobs are generally more amenable to remote work than other occupations (OECD, 2021a). Consequently, while the places with a higher concentration of low-skilled jobs are less likely to switch to remote work, others where skilled tradeable services or industries (e.g., information, finance and insurance, professional services, and management) are located will find it easier to adapt (Adams-Prassl et al., 2022; Althoff et al., 2022). The sectors and occupations with relatively high 'teleworkability' index have been identified by the literature, including information and communication, finance and insurance, real estate, professional services, teachers, managers, and keyboard operators (e.g., Barbieri et al., 2022; Sostero et al., 2020). Since such industries and jobs tend to concentrate in cities, these places may be more suitable for switching to remote work.

Remote work may also correlate with individual characteristics such as education, gender or age of workers. For example, individuals with higher levels of formal education are more likely to work in occupations that are more amenable to remote work (Adams-Prassl et al., 2022; OECD, 2021a). Studies also found that self-employees are more willing to work remotely (Eurofound, 2020).

The evidence on the relationship between gender and remote work potential is mixed. Drawing on survey data from the US and UK, Adams-Prassl et al. (2022) suggest that women are less likely to work in occupations and sectors that are amenable to remote work. For example, women are more likely to be overrepresented in non-tradeable service sectors such as hospitality and health, while being underrepresented in managerial roles. However, in a cross-country study, Sanchez et al. (2021) do not find such a clear pattern. They suggest that women are less likely to be employed in jobs amenable to remote work in Turkey, while the opposite is true for Brazil, Mexico and the EU, while there are no clear patterns in India. Similarly, Sostero et al. (2020) also claim the absence of any difference across genders in terms of remote work across the EU. However, women have historically been more likely to stay home for child and family care needs, especially in countries with more traditional and patriarchal social norms. During the pandemic, women may have used remote work more than men to 'cushion' the sharp reduction in childcare support associated with lockdown measures (Alon et al., 2020). Overall, the association between remote work and gender remains unclear.

The evidence on the importance of age also remains inconclusive. While older workers may on average, possess weaker information and communication technology (ICT) skills, older workers are more likely to hold senior managerial positions, which are by nature more amenable to remote work (Dingel & Neiman, 2020; OECD, 2021a; Sanchez et al., 2021).

2.3. Contextual factors and remote work uptake

Remote work requires a suitable context, that is, local conditions. First and foremost, many occupations that are in theory teleworkable require a fast and reliable internet connection. Internet has allowed many jobs to be conducted remotely, even in sectors where up to recently physical presence was deemed essential, for example, in education, health or tradeable services (Braesemann et al., 2022). Similarly, research shows that broadband connectivity allows small towns near larger metropolitan centres to 'borrow size' and reap the advantages of larger agglomerations (De Vos et al., 2020).

Yet, there are significant differences in the digital infrastructure both within and across many countries (OECD, 2022; Vilhelmson & Thulin, 2001). For example, in 2020, the internet speed in cities was on average 23% faster than national averages, while speed in towns/semi-dense areas and rural areas was respectively 7% and 30% slower than average.

Second, the suitability of home conditions for remote work can also matter. Cuerdo-Vilches et al. (2021) suggest that having a more spacious home with a dedicated workspace, or good environmental quality are associated with higher uptake of remote work. In most OECD countries, these factors are usually more easily available in less dense regions and outside of large cities, where real estate prices are higher. There is, however, also a strong argument to assume that large cities may host more remote workers, especially when this is hybrid and involves at least a few days in the office. Bond-Smith and McCann (2022) focus on the costs and frequency of commuting as the key element to understanding how WFH will impact on cities. They suggest that the reduction in the frequency of commuting reduces its opportunity costs, and hence makes large urban agglomerations and their hinterlands more appealing, that is, it increases the job matching opportunity for hybrid workers in large cities and enlarge their hinterlands, potentially encroaching on the local hinterlands of smaller cities and towns. As the two authors suggest, compared with North America this may be particularly true in Europe, where cities tend to be much more closely located.

Third, the decision to take up remote work may be closely related to the local impact of the pandemic and its heterogeneous geographies (inter alia, see Ascani et al., 2020; Corradini et al., 2022; and Diaz-Ramirez et al., 2022), as workers living in areas hit more severely by the pandemic might have been more willing – or forced – to stay at home to avoid the virus (Diaz-Ramirez et al., 2022). The severity of the pandemic, captured through the excess mortality, was strikingly uneven across the subnational regions of OECD member states (Diaz-Ramirez et al., 2022). Because of higher population density and higher risks of contagion, urban areas have historically tended to be more negatively affected by pandemics. One could hence also assume that higher WFH rates in cities during the COVID-19 pandemic may be driven by higher fear of contagion among urban dwellers (cf. Eurofound, 2020).[1]

In summary, differences in uptake may be driven by different sets of factors. The remainder of the analysis will test these alternative hypotheses empirically.

3. DATA AND THE MEASUREMENT OF REMOTE WORK ACROSS EUROPE

3.1. Overview of the EU Labour Force Survey (EU-LFS) and the empirical sample

The empirical analysis draws on data from three waves of the annual EU-LFS carried out in 2019, 2020 and 2021. The EU-LFS is conducted by the national statistical institutes of EU member states (plus a few non-EU countries). Each national survey is a cross-sectional household survey meant to be representative of the entire workforce at the 'Territorial Level 2' (TL2) level,[2] and follows common Eurostat classifications as well as the ILO guidelines.

This paper restricts the focus to all employees and self-employed individuals aged 17 and over living across all the 27 EU member states, plus Norway, Switzerland and Iceland.[3] The paper excludes workers employed in agriculture, forestry and fishing, and the armed forces. It does so because in these sectors the concept of remote work has limited relevance, and it is difficult to distinguish between working remotely and working in the 'usual' workplace.

Overall, the available sample covers more than 1.5 million workers for the 2019 wave, around 1.2 million workers in 2020 and around 1.1 million respondents in 2021. The dataset also provides survey weights, and these are used throughout the analysis.

3.2. The measurement of remote work

Remote work can include WFH, as well as working from other sites such as co-working spaces, cafes, etc. (see Mariotti et al., 2023; and Mariotti et al., 2023, for detailed descriptions of co-working and other new working spaces). The current research focuses on WFH, that is, work that takes place fully or partly within the worker's own residence.[4] This is done on two grounds. First and foremost, the analysis is constrained by data availability, as the information available in the EU-LFS focuses specifically on WFH. Second, despite the growing relative importance of co-working spaces, we believe that their absolute share as workplaces is still modest overall.

Work can be carried out fully remotely, or in a hybrid way. The survey records whether respondents: (1) 'mainly work at home'; (2) 'sometimes work at home'; and (3) 'never work at home'.[5] While it is difficult to clearly ascertain if respondents who 'mainly' work from home do so entirely, as opposed to 'sometimes', the current analysis assumes that the formers are 'full-time remote workers', while the latter are more likely involved in 'hybrid work'.[6] Figure 1 plots the shares of workers who 'mainly' or 'sometimes' worked remotely during

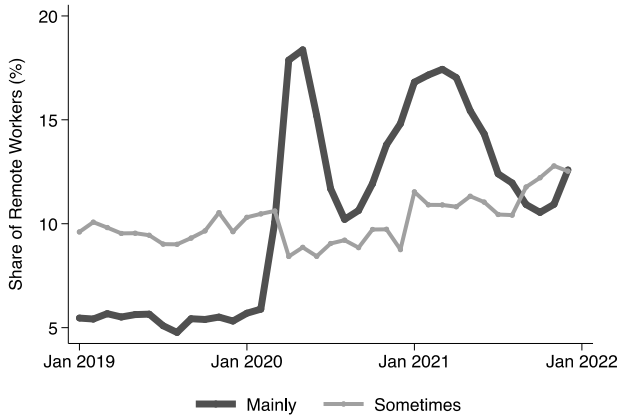

Figure 1. Evolution of hybrid and remote work across Europe for 30 European countries, 2019–21.
Note: In most countries, the share of workers who 'mainly' worked remotely increased significantly, whereas the share of workers who 'sometimes' worked remotely has remained relatively stable. This plot, as well as all other pieces of analysis, uses as customary survey weights.
Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS).

the period spanning from January 2019 to December 2021 (the most recent point for which data are currently available).

As shown, the share of respondents who 'sometimes' work remotely has only moderately increased. By contrast, the share of those 'mainly' working remotely has almost tripled after the onset of the pandemic, rising from 5.5% in 2019 to 14% over 2021, while peaking at 18.5% in May 2020. Although it is difficult to offer an exact international comparison because of differences in how surveys identify remote work, the share of home workers from the EU-LFS seems overall lower than in the US where, according to the US Current Population Survey (a sample of around 60,000 individuals across all the US states) WFH peaked in May 2020 at around 40% (cf. Althoff et al., 2022). Even at the peak of the pandemic during the spring of 2020, across Europe the share of those 'mainly' WFH was below 20%.

Appendix A in the supplemental data online offers a set of additional figures breaking down the overall estimates of Figure 1. For example, Appendix A breaks down the aggregate values of Figure 1 into macro-groups of countries distinguishing between Central and Eastern Europe, Western Europe, Southern Europe, and Northern Europe.[7] The results highlight substantial differences across each macro-region, with remote work being more prevalent in Western and Northern European countries. However, the trends are similar across the continent, and confirm how the increase primarily involved respondents 'mainly' WFH (cf. Figures A.1 and A.2 in Appendix A). To study how the pandemic influenced the work mode change, we therefore focus on those 'mainly working from home'. (Robustness checks will show that results are robust when also considering respondents 'sometimes' working remotely.)

Figure A.6 in Appendix A online shows the occupations and sectors with the highest remote work uptake, comparing the share of actual remote workers in each year across 720 industry–occupation pairs. The adoption of remote work has been highest in industries such as 'information and communication', 'finance and insurance', 'professional, scientific and technical services' and 'education', and among occupations such as managers, professionals and associate professionals. As one would expect, the combination of industry and occupations is also relevant. For example, while before the pandemic differences were modest, we find that ICT professionals had higher propensity to work from home than teaching professionals during the pandemic.

To ascertain the extent to which our measure of *actual regional remote work* correlates to measures of regional remote work *potential*, we calculate a measure of potential following the approach of Dingel and Neiman (2020) for the United States and applied in the European context by the OECD (2020b) (see Appendix B in the supplemental data online for details on how we calculate it). The two measurements are closely linked, and the correlation between the two increases during the pandemic (see Appendix C in the supplemental data online for the correlation results).

3.3. Other individual-level variables

For each respondent, the EU-LFS provides a comprehensive set of individual details such as age, educational attainment, engagement in economic activities (or industries), occupation, employment status, gender, personal relationship status, and being a parent of children under 15 years old. Economic activities are classified according to the Nomenclature of Economic Activities (NACE), while occupations are classified following the International Standard Classification of Occupations (ISCO-08). For reason of space, the paper reports only the results for the industries and occupations which, according to the analysis reported in Figure A.6 in Appendix A in the supplemental data online, were mostly associated with remote work uptake. These industries are 'information and communication', 'finance and insurance', 'professional, scientific and technical services' and 'education', while the occupations include managers, professionals and associate professionals.[8] Finally, the EU-LFS also reports the degree of urbanisation of where each respondent lives.[9]

Table D.1 in Appendix D in the supplemental data online provides a detailed breakdown of the average shares for each of the variables included in the analysis, distinguishing between the 2019, 2020 and 2021 EU-LFS waves, while highlighting the survey response rate for each variable.

3.4. Territorial-level variables

Importantly, the EU-LFS matches each respondent to their TL2 region of residence.[10] It is therefore possible to measure the remote work uptake at the regional level and match the EU-LFS data to other territorial information. It is worth stressing that measuring the location of workers at the place of residence – rather than the

place of work – helps to minimise any potential measurement error otherwise linked to workers who, during the pandemic, might have moved out of cities while continuing to work for an employer based in urban centres.

Following the conceptual framework, the analysis includes regional-level variables on internet speed deviation (relative to national averages) from the OECD Regional Database, and data on excess mortality from Diaz-Ramirez et al. (2022). Internet speed deviation data are collected quarterly for each region and, within each subnational region, are disaggregated by degree of urbanisation.[11] Excess mortality data measure monthly excess deaths at the regional level in 2020 and 2021 relative to the averages over the period 2016–19, and is a proxy for capturing the severity of the pandemic in each region.[12] The analysis matches the two regional level variables with the EU-LFS data by region, degree of urbanisation and time (where applicable).[13] Table D.2 in Appendix D in the supplemental data online reports key descriptive statistics for the regional-level variables. In 2020, the average monthly excess mortality was 4%, compared with 12.5% in 2021. Across all years, the average internet speed was faster in cities than towns and semi-dense areas, and rural areas. In 2020, internet speed disparities between cities and other areas increased, with cities becoming on average 23% faster than national averages, while towns/semi-dense areas and rural areas were respectively 7% and 30% slower. In 2021, the gap in internet speed increased between cities and towns and semi-dense areas but reduced between cities and rural areas.

4. THE UNEVEN GEOGRAPHICAL EXPANSION OF REMOTE WORK

This section maps the geographical distribution of remote work uptake in Europe between 2019 and 2021. It first provides a country-level overview, followed by an analysis at the TL2 level, while also distinguishing between areas at different degrees of urbanisation. The evidence shows an overall level of path dependency in the spread of remote work. The areas with a higher share of remote workers in 2019 have tended to experience a faster uptake during the pandemic. Besides, while almost all areas experienced an increase in the number of remote workers, the uptake has been particularly fast in capital regions and in cities.

4.1 Results by countries

Since the outbreak of the pandemic, almost all countries experienced increases in the spread of remote work. However, this increase has been markedly uneven within and across countries. Figure 2 plots the shares of remote workers for each of the 30 countries covered by the data. Countries are ordered vertically by their 2019 shares.

As expectable, across most countries remote work uptake is closely linked to governmental lockdown policies. Figure A.3 in Appendix A in the supplemental data online plots the monthly shares of remote workers and the monthly average stringency index across each of the 30 European countries included in the analysis, using the index developed by Hale et al. (2021) to measure the stringency of government lockdown policies during the pandemic.[14] The plots confirm how a majority of countries – such as Austria, Denmark, France and Germany – experienced a peak in their shares of remote workers in April–May 2020, when their respective governments imposed the most stringent restrictions.[15]

While the increase in the remote work during the pandemic was uneven across countries, the uptake has generally tended to be stronger in countries with higher pre-pandemic levels. (Two exceptions are Sweden and Ireland which, by 2021, had become two of the countries with the highest incidence of remote work despite lower pre-pandemic levels.) In 2019, the Netherlands had the highest share of remote workers (around 15% of the workforce) while Bulgaria had the lowest incidence (only 1%). In 2021, the highest incidence of remote work was recorded in Luxembourg, Belgium, Sweden and Ireland, all with

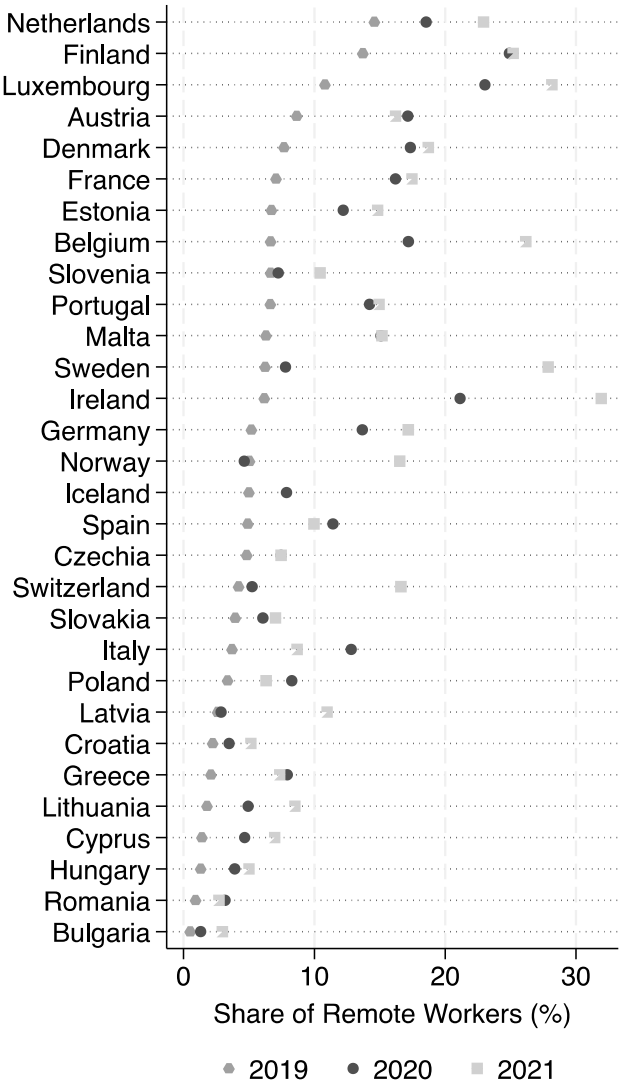

Figure 2. Shares of remote workers by country, 2019–21. Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS).

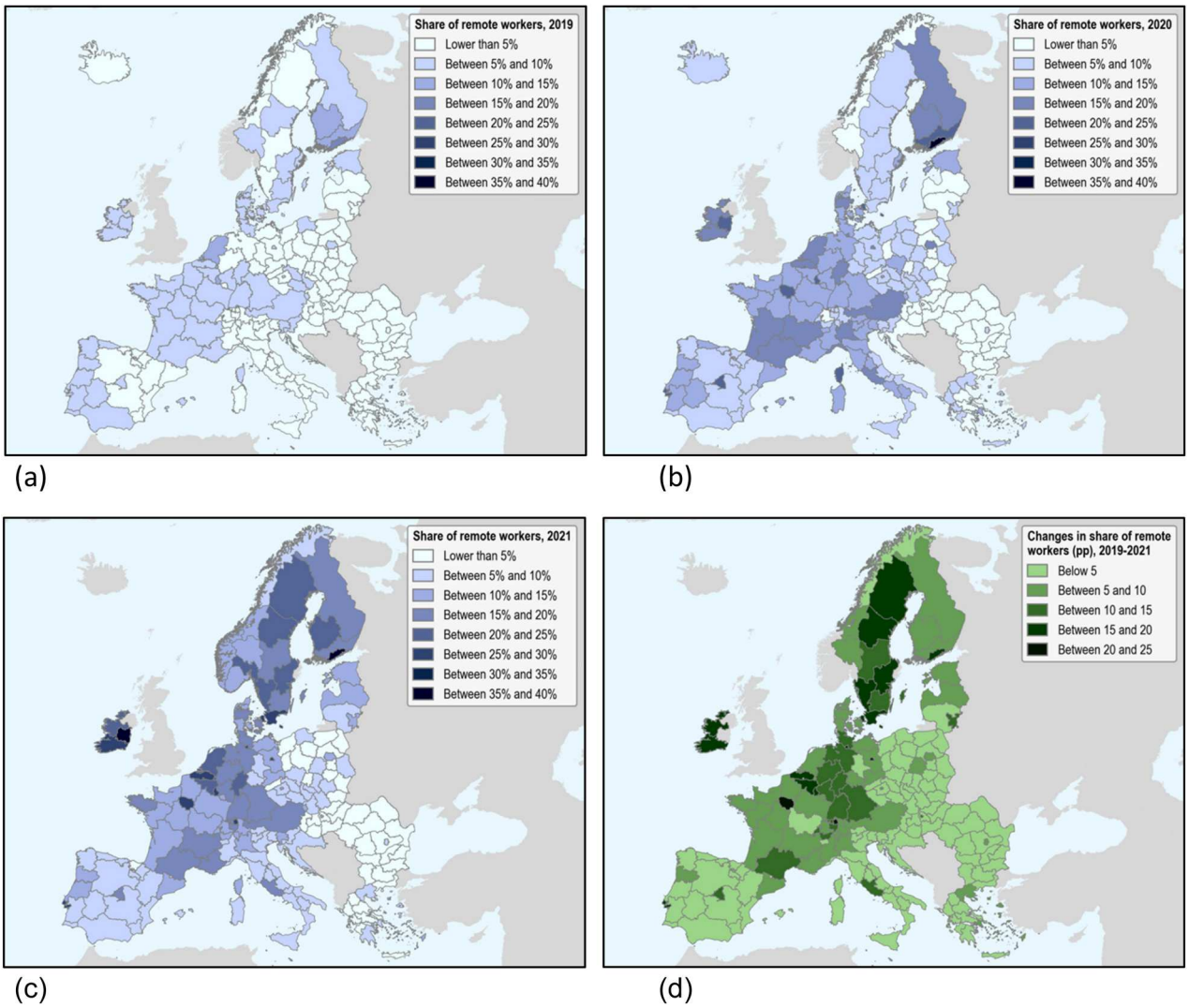

Figure 3. Regional share of remote workers by TL2 regions in 2019 (a), 2020 (b), 2021 (c) and changes in absolute percentage points (d).
Note: Data for Norway and Iceland are only available for one year and hence it is not possible to calculate changes in (d).
Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS).

over 25% of respondents working remotely. (While it is beyond the scope of our current analysis, future comparative work should explore in more depth the national-level policies which may have contributed to this cross-country divergence.)

4.2. Results by TL2 regions

During the pandemic regions diverged in their shift to remote work. Figure 3 maps the high spatial heterogeneity in the rates of remote work uptake. It shows the shares of remote workers across European TL2 regions (except for Austria, the Netherlands, Iceland and Croatia, where subnational information is unavailable) in 2019 (Figure 3a), 2020 (Figure 3b) and 2021 (Figure 3c), as well as the changes in absolute percentage points over the three years (Figure 3d). Before the pandemic, the differences between TL2 regions were modest across the continent. By contrast, by 2021 distinctive patterns had developed. With a few exceptions – e.g., southern France, northern Sweden and parts of western Germany – most regions with the highest incidence of remote work at the end of the pandemic were clustered around capital cities, or in regions hosting large urban centres. While the average share of remote workers across the continent increased from around 5% in 2019 to around 14% in 2021, in capital regions it almost quadrupled, growing from 6% in 2019 to around 22% in 2021.[16]

4.3. Results by the degree of urbanisation

This final section maps the geographical heterogeneity in remote work uptake distinguishing respondents by their degree of urbanisation. This is possible since the EU-LFS records not only the TL2 region where respondents live, but also whether they live in cities, in towns and semi-dense areas or rural areas.[17]

Figure 4 shows that while all areas recorded similar levels of remote work prior to the pandemic, since 2020

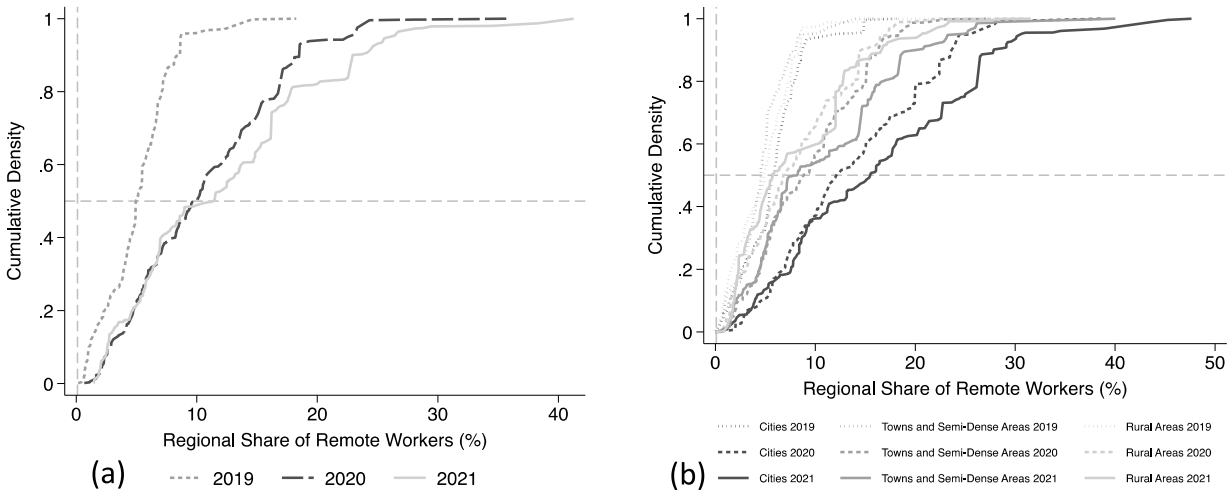

Figure 4. Cumulative distribution functions of regional share of remote workers, 2019–21: (a) total shares; and (b) by degrees of urbanisation.
Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS).

cities have experienced a markedly higher uptake compared with other areas. Figure 4a presents the dispersion in the cumulative distribution function of the regional shares of remote workers. The more vertical are the lines, the more homogeneous are all regions. It shows how, over time, all lines shift to the right, suggesting that across all TL2 regions, the shares of 2021 consistently exceeded those of 2019. Similarly, the plot shows how prior to the pandemic the share of remote workers did not exceed 15% in the most extreme cases, with shares below 10% across most regions. By contrast, by 2021 the regional-level shares have become significantly more dispersed, ranging from 2% to over 40%. Figure 4b then breaks down the regional cumulative distribution functions by the degree of urbanisation. It shows that, in 2019, remote work was only marginally higher in cities (6%) than in towns and semi-dense areas (5%), or in rural areas (5%). By 2021, however, while remote work spread everywhere, cities experienced the fastest surge.

To conclude, most places with higher levels of remote work before the pandemic also experienced a fastest uptake afterwards. Moreover, on average, workers living in capital regions and urban centres experienced the highest remote work uptake.

5. INDIVIDUAL VERSUS TERRITORIAL FACTORS AND THE GEOGRAPHY OF REMOTE WORK

The previous section highlighted the uneven geography of remote work uptake. This section tests what factors explain such heterogeneity. It does so by analysing the extent to which, holding country-specific heterogeneity constant, the individual and contextual factors identified in section 3 predict the likelihood of respondents to work remotely during the pandemic. Understanding the relative importance of individual versus territorial factors is essential for designing future policies around WFH. The results suggest that individual remote work uptake is explained by both individual and contextual characteristics. Territorial features such as regional excess mortality from COVID-19 and internet speed partly predict why cities hosted more remote workers than semi-dense and rural areas. However, the worker composition in terms of jobs and sector of employment seems to play a bigger role in explaining remote work uptake.

5.1. Empirical model and variables

The analysis adopts the following empirical model:

$$RemoteWork_{ir} = \beta_1 PerChar'_{ir} + \gamma_1 City_{ir} + \gamma_2 RegChar'_{rm} + \delta_r + \alpha_{cm} + \epsilon_{ir}, \quad (1)$$

where $RemoteWork_{ir}$ is a dummy indicating if individual i in region r works remotely. As the EU-LFS is a repeated cross-sectional survey (i.e., it does not interview the same individuals over time), the regressions are run separately for each of 2019, 2020 and 2021.[18]

Although remote work is a binary outcome, the paper applies an ordinary least squares (OLS) estimator (i.e., a linear probability model). This is done as OLS results are easier to interpret. Logit outputs are reported in Section F in Appendix F in the supplemental data online and show that the results remain qualitatively unchanged.

The matrix of personal characteristics $PerChar'_{ir}$ is included to test the importance of compositional factors. These characteristics are age groups, educational attainments, one-digit NACE[19] industries, two-digit ISCO-08[20] occupations, full-time employment status, gender, relationship status and being a parent of children under 15. Each of these personal characteristics is expressed as a dummy variable. Thus, the coefficient on each dummy of $PerChar'_{ir}$ can be interpreted as the difference in remote work uptake relative to the respective reference group.[21]

To test the contextual effect hypothesis, the empirical model first controls for the level of urbanisation of respondents' place of residence. $City_{ir}$ is a dummy indicating if

the respondent lives in a city, as opposed to a town and semi-dense or rural area. The coefficient of the $City_{ir}$ dummy can be interpreted as the difference in remote work uptake between workers living in cities and all other areas (towns and semi-dense and rural areas).[22]

The analysis then supplements the EU-LFS survey data with regional indicators. In addition to the time-invariant region fixed effects (FEs) δ_r, which can account for a variety of region-specific idiosyncratic factors (e.g., differences in climate and natural amenities, infrastructure endowment, local government quality, etc.), the matrix $RegChar'_{rm}$ includes two key regional factors: internet speed deviation and excess mortality rates during the pandemic. Internet speed deviation is measured, within each TL2 region, by the degree of urbanisation. It is therefore mapped to the EU-LFS by regions by degrees of urbanisation each year. The excess mortality rate captures the local severity of the pandemic and is measured as the regional cumulative increase in mortality every month m compared with the regional average number of deaths in the same month over the period 2016–19. As such, it is matched to the EU-LFS by TL2 regions and by months. Workers in areas with higher excess mortality rates are expected to be more likely to work remotely.

The regressions include TL2 regional FEs, which allow comparing individuals living within the same region. Therefore, the coefficients β_1, γ_1 and γ_2 capture the contribution of each factor on the remote work uptake relative to other individuals working *within* the same TL2 region. While the estimation of equation (1) may still suffer from endogeneity (e.g., because of individual sorting based on unobservable characteristics), the inclusion of regional FEs helps minimise the risk of omitted variable bias which may otherwise seriously undermine the results.[23]

Lastly, the regressions control for country-by-month FEs α_{cm} to account for country-specific societal characteristics and for trends in the evolution of the lockdown measures during the pandemic. ϵ_{ir} is the error term. For all regressions, robust standard errors are clustered at the TL2 regional level. While we primarily focus on respondents who 'mainly' work from home, we also run additional tests where the dependent variable indicates those 'sometimes' working remotely. The outputs are reported Table F.3 in Appendix F in the supplemental data online. We find that the results are qualitatively consistent with our baseline estimates but, quantitatively, the coefficients of most variables are smaller in magnitude. We would expect this, since those 'sometimes' WFH may be more like those 'never' WFH, who are the reference category.

The pandemic may have caused workers able to work remotely to relocate from cities to less densely populated areas (cf. Ramani & Bloom, 2021; and Althoff et al., 2022, for an analysis of the US context; and Burgalassi & Jansen, 2024, for an evaluation across OECD countries). One concern when estimating model 1 is that being able to work remotely may influence the decision of respondents to move out of cities, therefore leading to reverse causality when estimating the coefficients γ_1.[24] Although examining the real-time in-/outflow of workers within/across TL2 regions is out of the scope of this paper, the EU-LFS data allows to preliminarily identify whether there is a structural change in the composition of the workforce in/out of cities. A statistically significant decrease of one category of respondents (e.g., professionals) in cities, mirrored by an equal increase in less dense/more rural settings would hint at a systematic relocation of such type of respondents. To this aim, the analysis compares the regional demographic structure across cities, towns and semi-dense areas, and rural locations since the onset of the pandemic.

For each of the individual variables included in the vector $PerChar'$, Table E.1 in Appendix E in the supplemental data online reports the differences in means between 2021 and 2019 across the different degrees of urbanisation. Appendix E also tests if any potential difference in means is statistically significant. While future work will need to explore this important point in more details, the preliminary results suggest that most shares did not significantly change during the pandemic. In other words, even if recent research has explored incipient changes in locational trends in and out of cities (Burgalassi & Jansen, forthcoming), our data show that these changes have not yet occurred in big enough numbers to make reverse causality a main source of concern in our analysis.

5.2. Regression results

Figure 5 reports the regression coefficients and their 95% confidence intervals from a parsimonious specification of equation (1), where the degree of urbanisation and the two regional indicators are not included, that is, exclusively controlling for the composition hypothesis. Figure 5 presents separate estimates for 2019, 2020 and 2021 (it is important to remember that the data are a repeated cross-section, and it is hence not possible to build a panel).

For reasons of space, the detailed regression coefficient estimates are reported in Table F.1 in Appendix F in the supplemental data online. Since the dependent variable is binary, Appendix F also reports a set of results estimating equation (1) with a logit model instead of a linear one. The non-linear results are broadly in line with the OLS outputs, which we prefer for easier readability.

The findings can be summarised as follows. First, respondents belonging to older age groups are significantly more likely to work remotely.[25] The highest WFH incidence is among workers aged 65 and over, whose coefficient is more than double of those for respondents aged 35–49 or 50–64, even after accounting for differences in education attainment, sectors and occupations.[26] The age group coefficients are similar across years, suggesting that the higher likelihood of older respondents to work remotely is not linked to the higher health risks associated to COVID-19. The association between older age and remote work may be explained by respondents still in work but already beyond retirement age, who may be more likely to opt for more flexible forms of work.

Second, as expected, the sectors of employment matters. Accounting for differences in other individual

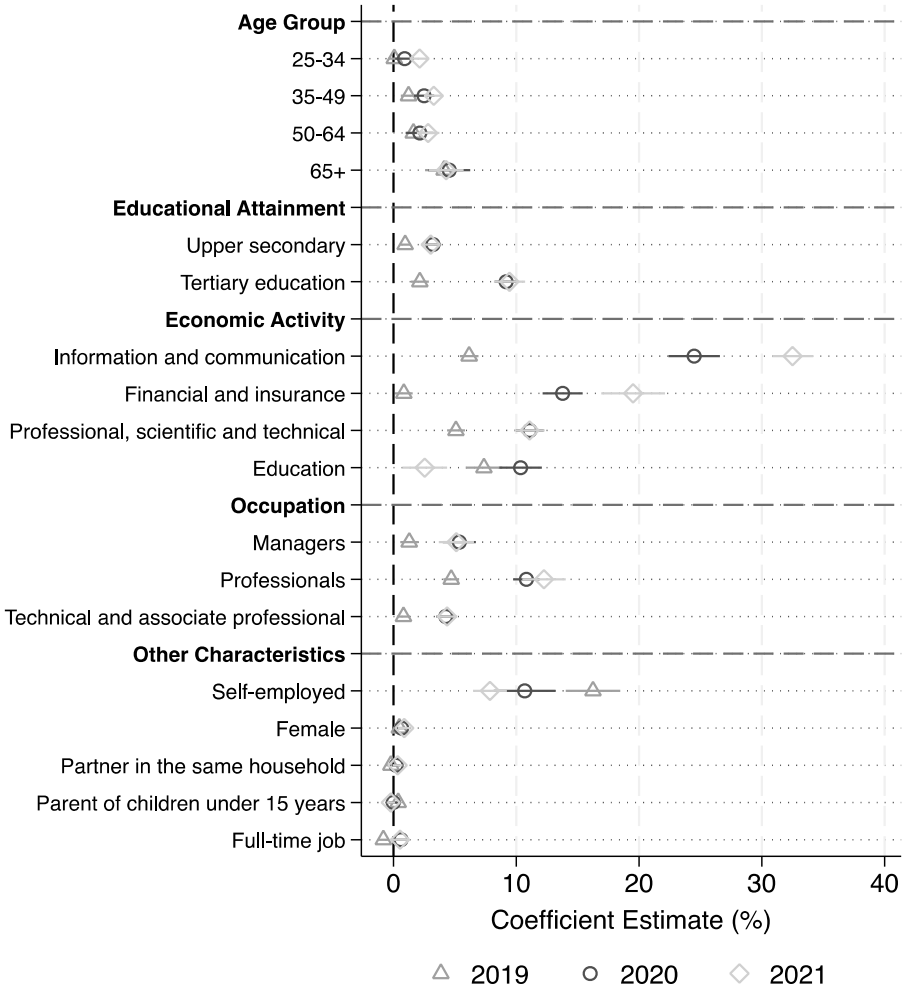

Figure 5. Who was more likely to work remotely during the pandemic?
Note: The figure plots the regression coefficients and 95% confidence intervals estimated from a parsimonious specification of equation (1). All regressions control for country-by-month and region-fixed effects. Robust standard errors are clustered at the TL2 level. The detailed coefficient estimates and robust standard errors underlying the figure are reported in columns (1) and (5) of Table F.1 in Appendix F in the supplemental data online.
Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS).

characteristics, remote work was higher among respondents involved in information and communication, finance and insurance, professional, scientific, technical, and education sectors. Similarly, all things equal, managers, professionals, technical and associate professionals were more likely to work remotely. We also observe significant urban–rural gaps in remote work within these occupations during the pandemic (see Table F.4 in Appendix F in the supplemental data online). Holding the same occupations constant, city workers had higher chance to work remotely than rural workers. While it is beyond the scope of our paper to identify why, two possible explanations are: (1) cities may offer contextual factors which may be more favourable to remote workers; and (2) similar occupations may involve different tasks in urban and rural areas. For instance, urban managers may be more likely to be involved in sectors more amenable to remote work than rural managers. The heatmaps presented in Figure A.6 in Appendix A in the supplemental data online indeed provide strong evidence of differences in remote work potential within similar occupations.[27] Relatedly, even holding age, sectors and occupations constant, tertiary education remains a strong and significant predictor of remote work (confirming the findings of Adams-Prassl et al., 2022; OECD, 2021a, 2021c).

Third, self-employed respondents were more likely to work remotely than employees before and during the pandemic, but the difference shrunk since 2019. One plausible explanation is that self-employed may had already switched towards flexible and more efficient forms of work while, by contrast, before the COVID-19 shock, employers were less favourable to allow employees to work outside of the office. The pandemic hence may have altered employers to alter pre-existing inertia, leading to a more dramatic shift in working patterns. By contrast, full- versus part-time status is weakly correlated to remote work patterns, both before and during the pandemic.

Finally, and unexpectedly, specific individual characteristics such as gender, relationship status and being a parent of children under 15 are virtually uncorrelated

with the likelihood of working remotely. The results (not presented but which are available upon request) suggest that in 2020 and 2021 the coefficient for identifying as a female was positive and significant when all other regressors are excluded. Its magnitude remains, however, modest, and comparatively smaller than factors such as tertiary education, age, employment status or economic activity/occupation. This finding is in line with the pre-COVID-19 results by Sostero et al. (2020), who have shown how the incidence of remote work by gender was similar across the EU, and by Sanchez et al. (2021) who argue that gender has overall a limited power in explaining teleworkability around the world.[28]

Figure 6 reports the results from estimating a full specification of equation (1), that is, controlling for the city dummy and the two regional regressors. The coefficients for all the other individual regressors remain nearly unchanged compared with Figure 5, either before or during the pandemic. Controlling for the full set of covariates, the coefficient for $City_{ir}$ is small. This suggests that the urban–rural gap in remote work uptake highlighted in the exploratory analysis is mostly explained by the other regressors. The final part of the section will assess in more depth such a hypothesis.

The coefficient for regional excess mortality, a proxy for the severity of the pandemic, is large, positive and significant in 2020 (even after controlling for individual characteristics). It, however, reduces in magnitude and significance in 2021, suggesting that, after the initial shock, the decision of respondents to work remotely has been linked to other factors.

Similarly, the coefficient for the internet speed deviation is close to zero in 2019. It then becomes positive and significant in 2020, to reduce again in magnitude and significance in 2021.[29] This may suggest that – pre-pandemic – the choice to work remotely was primarily linked to other factors. Internet speed deviation becomes a significant predictor during the first phase of the pandemic and is comparable with the magnitude obtained for respondents aged 65+, or around half of that for tertiary education. Taken together, these findings may suggest that while internet speed is a precondition, its presence per se is not a main driver of remote work.

One may be concerned that the limited explanatory power of the territorial variables may be caused by the inclusion of regional FEs, which absorb part of the between-regional variation. As a robustness, we rerun a battery of specifications excluding the regional FEs, as well as dropping the country-by-month FEs. Results (see Table F.7 in Appendix F in the supplemental data online) suggest that this is not the case, as coefficients are overall very similar to when including all the FEs.

5.3. What explains the gap between cities and other areas?

The descriptive analysis presented in the fourth section showed that cities experienced a higher increase in the share of respondents working remotely. And yet, in the regression results just presented the coefficient for the city dummy was small and almost insignificant. The current section examines why this might be the case. To this aim, it changes the order in which regressors are added in equation (1) with the goal of identifying which specific set of factors mediates the correlation between working remotely and the city dummy.

We test five model specifications. Each regresses $RemoteWork_{ir}$ on $City_{ir}$, while sequentially including the other regressors. The analysis examines what set of variables 'absorbs', that is, helps explain, the gap in remote work uptake between cities and other areas. The five specifications are defined as follows: (1) no controls (model 1); (2) controlling for country-by-month FEs (model 2); (3) controlling for both country-by-month and region FEs (model 3); (4) controlling for country-by-month and region FEs, as well as for individual regressors (model 4); and (5) controlling for country-by-month and region FEs, individual and regional factors (model 5).

Figure 7 presents the results. The largest increase in the models' explanatory power occurs when including the individual regressors. The country-by-month FEs have virtually no effect. Including the regional FEs influences the magnitude of the city dummy, but not substantially. By contrast, the size of the city dummy shrinks substantially after controlling for individual factors in model 4. Table G.1 in Appendix G in the supplemental data online reports the adjusted R^2s of the regressions underlying the results presented in Figure 7.

An important caveat of the previous exercise is that adding regressors sequentially may be misleading if these explanatory variables are correlated among each other. To ensure that the above conclusions do not suffer from such a bias, the analysis follows the decomposition procedure proposed by Gelbach (2016), a method which is insensitive to the order in which regressors are included. The method implies estimating a baseline model with only the main regressor of interest (here the $City_{ir}$ dummy, more generally denoted X_1) and, subsequently, estimating a full model where all other covariates (generally denoted X_2) are included. The conditional decomposition relies on the least-square identity that links the estimates of the base and full specification coefficients on the main regressor of interest (X_1) via the following omitted variable bias formula:

$$\hat{\beta}_1^{base} = \hat{\beta}_1^{full} + (X_1' X_1)^{-1} X_1' X_2 \hat{\beta}_2^1. \quad (2)$$

As the decomposition is based on the parameter estimates computed from the full specification, it is order-invariant (Gelbach, 2016).[30] The results suggest that the gap in remote work uptake between cities and other areas is primarily explained by composition effects, that is, by the concentration in cities of workers with individual characteristics more likely associated with remote work. Table 1 presents the results of the decomposition procedure. The method implies estimating a baseline model with only the main regressor of interest (the $City_{ir}$ dummy) and, subsequently, estimating a full model where all other covariates are included. The estimates for the city

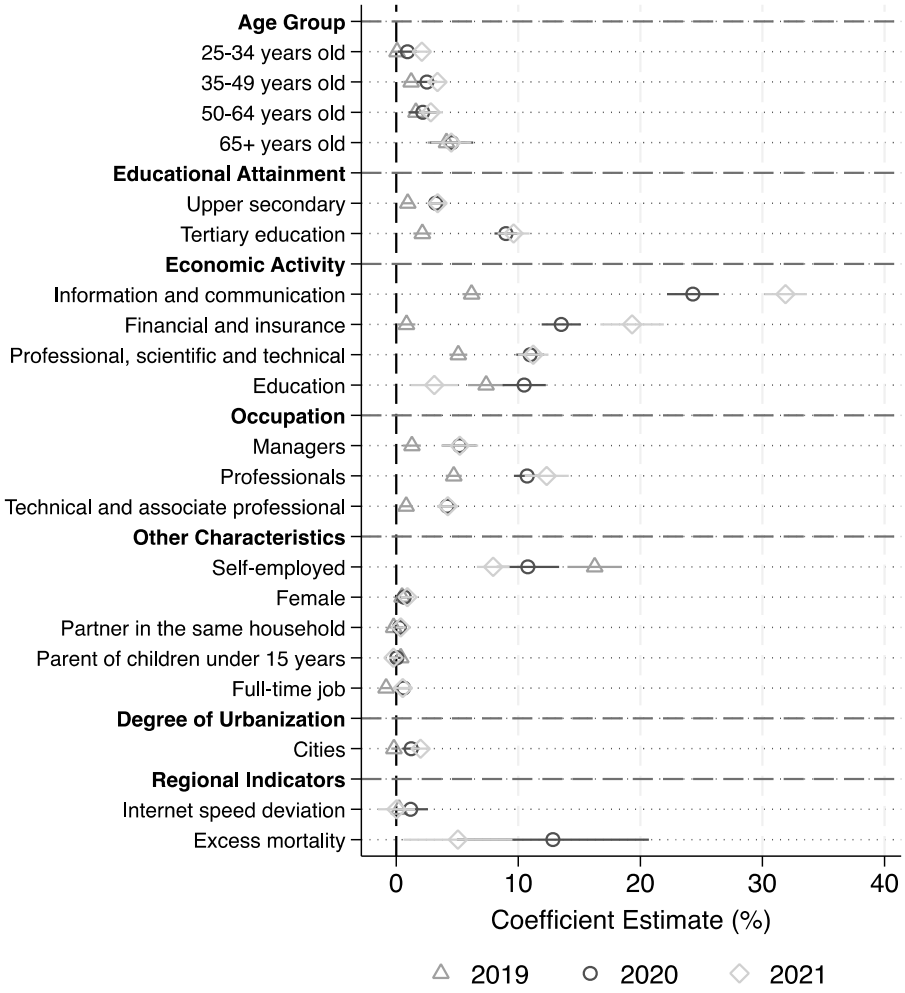

Figure 6. Who was more likely to work remotely and where?
Note: This figure plots coefficient estimates and 95% confidence intervals on various individual and regional factors underlying remote work uptake. All regressions control for country-by-month and region fixed effects. Robust standard errors are clustered at the TL2 level. Coefficient estimates and robust standard errors are also reported in columns (2) and (6) of Table F.1 in Appendix F in the supplemental data online.
Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS), OECD.

dummy are reported in columns (1) and (2). Column (3) shows the difference between the first two columns. Finally, column (4) calculates the extent to which the individual-level set of regressors, as opposed to the regional ones, help explaining the difference of column (3). Table 1 suggests that in 2019 the share of remote workers in cities was 0.84 percentage points higher than in other areas, or –0.19 percentage points lower when controlling for individual and regional factors. In 2020, then, the share of workers working remotely in cities was 4.75 percentage points higher than in other areas. This gap shrinks to 1.23 percentage points when controlling for all the covariates. In 2021, the urban–rural gap in remote work uptake is 5.54 percentage points, or 1.99 percentage points when controlling for all the covariates. (These coefficients correspond to those reported in the third and fifth columns of Figure 7.)

Importantly, in 2019, individual factors explained around 91.4% of the difference reported in column 3. By contrast, regional-level regressors account for only 8.6% of the difference reported in column 3. In the wake of the pandemic, while the influence of regional factors marginally increased, individual factors still accounted for 87.6% of the gap between urban and other areas. In 2021, the contribution of individual factors even reaches 99.7%. Together, we conclude that the urban–rural gap in remote work uptake is primarily driven by composition effects.

6. CONCLUSIONS AND IMPLICATIONS

The COVID-19 pandemic prompted a seismic shift in how work is conducted. Consequently, we have seen an increase in the number of remote workers. Despite this growing phenomenon, is WFH, by which we mean both fully remote and hybrid jobs, going to significantly alter the economic geography of the global-city system and lead to a 'big city exodus' (Nathan, 2023)?

Understanding these shifts in the work landscape matters because it has a direct bearing on future trends around

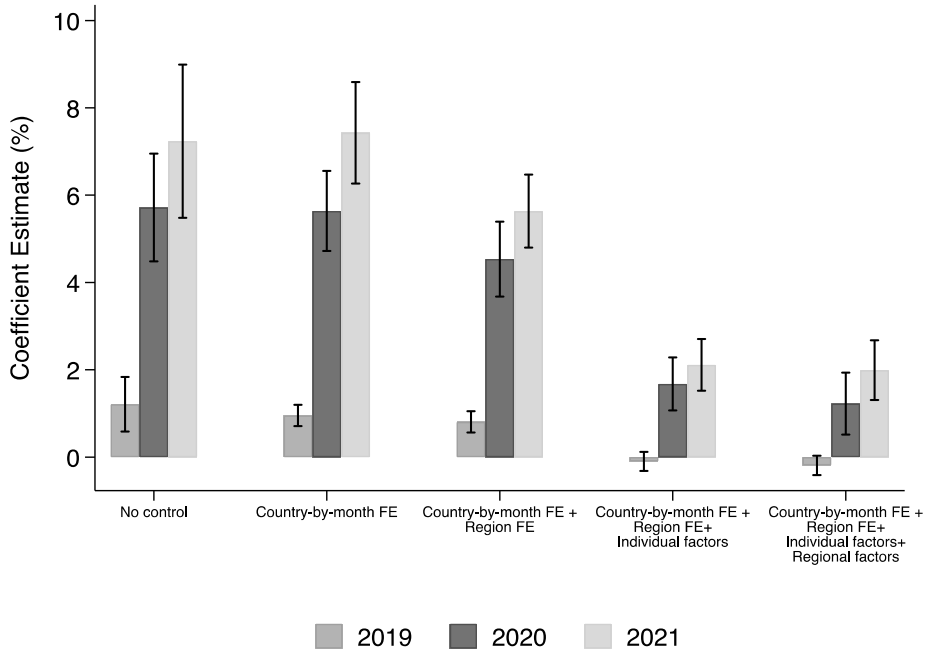

Figure 7. Remote work uptake gaps between cities and other areas (semi-dense and rural).
Note: This figure plots the gap in remote work uptake between cities and other areas (towns and semi-dense areas, and rural areas are combined). The plots show coefficients for 2019, 2020 and 2021 separately, while also reporting 95% confidence intervals. The gaps are estimated by regressing the individual remote work status dummy on a dummy indicating if the respondent lives in an urban area. The figure presents results for five model specifications. Each of the five specifications, corresponding to the sets of vertical columns, respectively includes different sets of covariates as follows: (1) no control; (2) only control for country-by-month fixed effects; (3) control for both country-by-month and region fixed effects; (4) control for country-by-month and region fixed effects, and individual factors; and (5) control for country-by-month and region fixed effects, individual and regional factors. For all regressions, robust standard errors are clustered at the TL2 level.
Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS), Organisation for Economic Co-operation and Development (OECD).

regional inequalities and development. In recent decades, many rural regions across OECD countries have, for example, faced higher rates of population decline and ageing than cities,[31] as well as lower growth in living standards. The possibility to work remotely has been touted as a new opportunity for areas outside of large urban agglomerations to mitigate/reverse these structural trends (OECD, 2021a, 2021c). Research from the US suggests that this has not, in fact, been the case (Ramani & Bloom, 2021). But what are the trends in Europe?

Contributing the growing body of literature on remote working and its potential spatial effects (inter alia, see Ahrend et al., 2023; Althoff et al., 2022; Crescenzi et al., 2022; Fiorentino et al., 2022; Florida et al., 2023; Glaeser, 2022; Nathan, 2023; Nathan & Overman, 2020; and Ramani & Bloom, 2021), the paper provides the first systematic exploration of the new geography of remote work that has emerged across 30 European countries, documenting the uneven expansion of work from home across the continent. It then summarises the factors which, according to the literature, are associated with remote work uptake, distinguishing between three groups of drivers, namely compositional (e.g., age, gender and family structure, educational attainments, sector/occupation of work, etc.), contextual (such as internet speed and local severity of the pandemic), and societal (e.g., national lockdown policies). We also exploit a decomposition procedure to assess the relative power of each group in explaining the urban–rural gap in remote work uptake that we observe in the data.

The analysis shows that the spread of remote work has been markedly uneven. Before the pandemic, most areas had similar shares of remote workers. Since 2020, while all European countries have experienced a rise in remote working, its uptake was highly uneven across and within countries. While international differences are closely linked to the stringency of government lockdown policy, countries with strongest pre-pandemic levels also experienced a higher uptake. At the subnational level, remote work uptake was strongest in cities and capital regions.

The results also show that the subnational uneven expansion of WFH across space is primarily explained by composition effects and the uneven distribution of workers and industries more amenable to working remotely. Within each region, age, self-employment status and higher educational attainments are strong predictors of the individual likelihood of working remotely. Moreover, remote work is closely related to specific service industries such as information and communication, finance and insurance, and education. Similarly, respondents occupied as managers, professionals, technical and associate professionals have a higher chance of switching to remote

Table 1. Role of individual and regional factors as driver of remote work gap between cities and other areas.

	Specification		Difference between the two specifications	% Share of column 3 explained by each set of factors
	Base (1)	Full (2)	(3)	(4)
(a) *2019*				
City dummy (i.e., gap between cities and other areas, % points)	0.844***	−0.189*	1.033***	
	(0.130)	(0.113)	(0.114)	
Covariates:				
Individual factors	No	Yes		91.4%
Regional factors	No	Yes		8.6%
(b) *2020*				
City dummy (i.e., gap between cities and other areas, % points)	4.751***	1.226***	3.525***	
	(0.462)	(0.359)	(0.436)	
Covariates:				
Individual factors	No	Yes		87.6%
Regional factors	No	Yes		12.4%
(c) *2021*				
City dummy (i.e., gap between cities and other areas, % points)	5.535***	1.994***	3.542***	
	(0.438)	(0.346)	(0.311)	
Covariates:				
Individual factors	No	Yes		99.7%
Regional factors	No	Yes		0.3%

Note: This table reports the gap in remote work uptake between cities and other areas and measures the extent to which this gap that can be explained by individual as opposed to regional sets of regressors. Standard errors are shown in parentheses. *Significant at 10%; **5%; ***1%.
Source: Authors' own elaboration of data from the European Union Labour Force Survey (EU-LFS), Organisation for Economic Co-operation and Development (OECD).

work. Surprisingly, gender, relationship status and being a parent of children under 15 are not significantly associated with actual remote work uptake.

Regional factors such as internet speed and regional excess mortality are positively associated with the growth of remote working in 2020, but their explanatory power and significance decrease in 2021. Besides, their overall role in explaining the likelihood of working remotely is smaller than the influence of workers' individual attributes. Similarly, the remote work gap between cities and other areas is also primarily driven by composition effects.

While the paper offers novel systematic evidence on the geography of remote work in Europe since the onset of the pandemic, future research may address some of the limitations of the current analysis. Because of data availability the current research is only able to focus on the years of the pandemic. While commentators suggest that remote work is here to stay (Bick et al., 2023), future research should explore whether the spatial patterns observed during the pandemic are indeed long-term or, instead, workers and employers will revert in the medium-term to pre-COVID working habits. Relatedly, the EU-LFS does not offer detailed measures of how much time is spent at home as opposed to the workplace. In this paper, we were unable to measure in a more precise way what 'mainly' as opposed to 'sometimes' WFH implies. Future work may hence try to address this shortcoming by drawing on alternative data sources. Similarly, future comparative work should explore in more depth how, beyond national lockdown measures, country-specific and regional policies are influencing the spread of new forms of work.

The findings of our study shed light on how the pandemic has influenced the spread of remote work in Europe and how it has impacted cities and regions unevenly. Our research underscores that besides essential factors such as reliable internet access, individual characteristics, sectoral and industry composition play a significant role in the rise of remote work during the pandemic. Understanding this new remote work landscape is crucial for policymakers.

From the standpoint of future trends of regional inequalities and development (cf. Iammarino et al., 2019), then, while remote work may in theory benefit mid-sized towns and peripheral areas, many workers will continue to stay in their regions, especially just

outside city centres. Working from home may even favour further agglomeration of economic activities around larger urban areas, especially when workers are asked to go to the office at least a few days per week. As argued by Bond-Smith and McCann (2022), the fall in commuting frequency associated with WFH may counterintuitively favour larger urban areas where commuting distances are longer.[32]

Considering these trends, some rural areas and towns may succeed in attracting remote workers, especially when they can offer attractive amenities and are relatively close to large cities. This is, for example, a goal part of Ireland's current Rural Development Policy.[33] More generally, however, local governments should focus on developing suburban areas to accommodate the influx of remote workers and provision of quality public services and amenities. Investment in infrastructure, housing, coworking spaces and community facilities in suburbs can attract professionals and enhance residents' quality of life. However, it is vital to strike a balance, preserving the essence of urban centres. Smart urban planning initiatives like mixed-use zoning and green spaces can make urban living attractive for remote and non-remote workers alike.

Finally, these results revealed challenges related to the ability of some workers to adopt remote working schedules. Recognising the changing nature of work, and the preference of most workers for more workplace flexibility (Aksoy et al., 2022; Barrero et al., 2021), policymakers should invest in upskilling and reskilling programmes tailored to remote-friendly industries. By recognising the role of composition factors and addressing barriers to remote work adoption, policymakers can create more inclusive and remote-friendly work environments, ensuring that the potential benefits associated with remote work are accessible to all, regardless of where they live.

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DATA AVAILABILITY STATEMENT

The codes used for this research are available from the authors upon request. The dataset, by contrast, cannot be shared since the EU-LFS has restricted access. Interested researchers need to apply to Eurostat for microdata access (https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; accessed in February 2023).

DISCLOSURE STATEMENT

The authors declare no conflict of interest. The opinions and arguments expressed herein do not necessarily reflect the official views of the OECD or its member countries. Views expressed herein are those of the authors and do not necessarily reflect the views of their institutions.

NOTES

1. We thank one anonymous referee for highlighting this point.
2. The EU-LFS is representative at the Eurostat NUTS2 level. For most European countries, NUTS2 regions correspond to the OECD TL2 classification. In Belgium, France, and Germany, however, NUTS2 do not exactly correspond to TL2 regions, but are a tier between TL2 and TL3. In these cases, the current analysis retains the NUTS2 structure. Furthermore, in the cases of Austria, the Netherlands, Iceland and Croatia, the survey data are only available at the country (TL1) level.
3. The EU member states included in the study are Austria, Bulgaria, Belgium, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.
4. It is important to note again that WFH is not completely equivalent to remote work because home, for some jobs such as those carried out by home-based workers, can be the default place of work. Due to data limitations, we exclusively use WFH to measure remote work. Moreover, we also distinguish WFH from telework, which refers to situations where workers 'use information and communications technology (ICT) or landline telephones to carry out the work remotely', while there is an overlap between telework and WFH, that is, telework from home (ILO, 2020). WFH can be adopted in a full or hybrid mode (hybrid working refers to the situations where workers spend some of their time in the default place and some at home), depending on the frequency with which workers carry out WFH, as described below.
5. This variable refers to the main job of the respondent. Within a reference period of four (to 12) working weeks preceding the end of the reference week, 'mainly' denotes working at home at least half of the time; 'sometimes' denotes working at home less than half of the time; and 'never' denotes working at home on no occasion.
6. It is important to stress that the survey does not offer more detailed measures of how much time is spent at home as opposed to the workplace. It is hence impossible to measure in a more precise way what 'mainly/sometimes'

WFH imply. Similarly, it is not possible to identify workers who work remotely but not at home.

7. Countries in Central and Eastern Europe include Poland, Hungary, Romania, Czechia and Slovakia. Countries in Western Europe include Germany, the Netherlands, Belgium, Luxembourg, Austria, Switzerland and France. Countries in Southern Europe include Portugal, Spain, Italy, Greece, Slovenia, Croatia, Cyprus and Malta. Countries in Northern Europe include Iceland, Norway, Sweden, Finland, Ireland, Estonia, Latvia, Lithuania and Denmark.

8. Results for any other industries and occupations not explicitly reported in the paper are available on request.

9. The surveys report the degree of urbanisation of the place of residence rather than of the place of work (cf. https://ghsl.jrc.ec.europa.eu/degurba.php, accessed on 14 February 2023). This is a limitation since respondents may live outside of cities but commute to them to work. Section 4 provides a discussion of how such a limitation may affect the results of the analysis.

10. While for brevity the remainder of the analysis will refer to TL2 regions, it must be remembered that the EU-LFS is available at the Eurostat NUTS2 level, which in the cases of Belgium, France and Germany do not exactly correspond to TL2 regions. And it is available at the TL1 level for Austria, the Netherlands, Iceland and Croatia. It is important to stress that our focus on TL2 (and TL1) is primarily driven by data availability. In an ideal world one could, for example, explore functional labour market areas, although: (1) finding such data for a comparative cross-country analysis covering 30 countries and including remote work variables is to our best knowledge virtually impossible; and (2) functional labour market units may be endogenous to remote work patterns. Similarly, individual observations are not geo-tagged in the EU-LFS, and hence we cannot work around smaller spatial units. Overall, while our strategy is primarily explained by data availability, we do our best by interacting TL2 (or TL1) regions with degrees of urbanisation. This is the smallest units that we can observe.

11. In contrast to the EU-LFS, data on internet speed deviation and excess mortality are available at TL1 and TL2 levels. We match four TL1 regions for both variables, and 186 TL2 regions for excess mortality. The numbers of TL2 regions matched for internet speed deviation data are 192 (2019), 196 (2020) and 193 (2021). Cyprus and Ireland do not have excess mortality information.

12. We are unfortunately unaware of any cross-country consistent dataset measuring the stringency of government lockdown policies at the subnational level. In absence of such a variable, we include excess mortality as a second-best proxy. It is also worth noting that in all our regressions we include country-by-month fixed effects and, thus, we do capture any stringency measure which is constant across regions of each country. Figure A.7 in Appendix A in the supplemental data online plots national monthly excess mortality against the national stringency index on government lockdown policies. While there is no perfect correlation between the two variables, in most countries there is an overall link between the stringent level of governments' responses to the pandemic and excess mortality.

13. Since internet speed deviation has little variation across quarter, we calculate the annual averages of internet speed deviation and match it with the EU-LFS by region by degree of urbanisation and by year. To capture the pandemic severity across month, we match excess mortality with the EU-LFS by region by month (excess mortality information is not available at the degree of urbanisation level).

14. They compute a systematic daily stringency index to record cross-national government responses to the pandemic, accounting for various lockdown measures such as school closings, travel restrictions, financial support, investments in health systems, vaccine policies, etc. Higher values of the stringency index imply that national governments have taken more restrictive measures to contain the spread of the COVID-19 virus.

15. Figures A.4 and A.5 in Appendix A in the supplemental data online replicate the exercise respectively replacing the overall stringency index with two of its subcomponents.

16. There are some exceptions. Countries such as Germany and Italy, traditionally characterised by the presence of multiple economic core cities, show high levels of remote work uptake also outside of their capital city-region.

17. The survey unfortunately reports the degree of urbanisation of the place of residence rather than of the place of work. This is a limitation since respondents may live outside of cities but commute to them to work. Such a limitation leads to measurement error. At the same time, measuring the degree of urbanisation at residence level may lead to a downward bias in the urban–rural gap uncovered by the analysis. If, for example, respondents who work in cities but live in rural areas transition to remote work, measuring the degree of urbanisation at place of residence would mean that these respondents would increase the share of workers from rural areas, hence reducing the urban–rural gap highlighted in Figure 7. Overall, an optimal strategy to mitigate these measurement errors would be to have data at the functional urban area (FUA) level. Such data are, however, not available.

18. Due to the nature of the survey as a repeated cross-section, utilising the panel dimension to run an individual-level model measuring outcomes in changes rather than levels is not feasible. Nonetheless, for robustness checks, we pool together data from all three survey waves and run regressions incorporating country-by-year fixed effects and region fixed effects. These results align closely with our baseline estimates for the samples interviewed during the pandemic, as detailed in Table F.2 in Appendix F in the supplemental data online.

19. The Nomenclature of Economic Activities (NACE) represents the European statistical classification of economic activities (cf. https://nacev2.com/en, accessed on 14 February 2023).

20. This is the International Labour Organisation's (ILO) International Standard Classification of

Occupations (cf. https://www.ilo.org/public/english/bureau/stat/isco/isco08/, accessed on 14 February 2023).
21. Reference groups for each variable are as follows: 17–24 years old, lower secondary education level, 'other' industry, 'other' occupation, employee, being employed part-time, male, without a partner in the same household, and not having children under 15.
22. The analysis combines towns and semi-dense areas with rural areas because the marginal difference in remote work between the two categories is more modest (cf. Figure 4).
23. It is important to stress that the risk is minimised but not ruled out, for example, if the role of potentially omitted regional/local factors changed over time.
24. At a larger scale, one may be equally concerned about the movement of workers *between* regions, also leading to endogeneity in the estimates of the regional coefficients γ_2.
25. Urban respondents in the groups of 25–34 and 35–49 years old are more likely to work remotely than their rural counterparts during the pandemic, while the groups of 50–64 and 65+ years old do not tend to experience such an urban–rural divide (see Table F.2 in Appendix F in the supplemental data online).
26. According to own elaboration of data from the EU-LFS, the shares of people over 65 years old employed are 17.3% (2019), 17.5% (2020) and 18.0% (2021).
27. While exploring other kinds of heterogeneity is out of the scope of this paper, we acknowledge that it would be an interesting avenue for future research. We thank one anonymous referee for raising this point.
28. Table F.5 in Appendix F in the supplemental data online suggests that female workers in the age group of 35–49 years old were more likely to work remotely than their male counterparts. However, we find that while female workers who hold parent status for children under 15 years old were more likely to work remotely prior to the pandemic, no such difference was observed during the pandemic (see Table F.6 online).
29. Internet speed in 2021 remains insignificant when excluding all other regressors, or when adopting alternative measures such as average speed rather than regional deviation from the national average.
30. The method builds on the Kitagawa–Oaxaca–Blinder decomposition (see Gelbach, 2016, for more details).
31. Cf. https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20230117-2 (accessed April 2024).
32. As the two authors argue, rather than allowing work from anywhere, the remote work revolution generates greater forces to live within a commutable distance of ever-larger cities. This is because remote (and flexible) work reduces the cost of commuting while, at the same time, cities continue to offer a series of agglomeration economies and amenities often not available outside of urban areas.
33. See https://www.gov.ie/en/publication/4c236-our-rural-future-vision-and-policy-context/#rural-development-policy-2021-2025-our-rural-future (accessed April 2024).

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