



Productivity gains from teleworking in the post COVID-19 era: How can public policies make it happen?

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The ongoing health and economic crisis related to the COVID-19 pandemic and the required physical distancing measures force many firms to introduce telework (working from home) on a large scale. This may catalyse wider adoption of teleworking practices also after the crisis, with a wide range of impacts and uncertain net effects on productivity and other indicators. Public policies and co-operation among social partners are crucial to ensure that new, efficient and welfare-improving working methods emerging during the crisis are maintained and developed once physical distancing is over. To maximise the gains for productivity and welfare inherent in the use of more widespread telework, governments should promote investments in the physical and managerial capacity of firms and workers to telework and address potential concerns for worker well-being and longer-term innovation related in particular to the excessive downscaling of workspaces.



Key messages

- Widespread telework may remain a permanent feature of the future working environment, catalysed by the experiences made with teleworking during the COVID-19 crisis.
- The use of telework before the crisis varied substantially across countries, sectors, occupations and firms, which suggests a large scope for policies to contribute to the spread of teleworking.
- While more widespread telework in the longer-run has the potential to improve productivity and a range of other economic and social indicators (worker well-being, gender equality, regional inequalities, housing, emissions), its overall impact is ambiguous and carries risks especially for innovation and worker satisfaction.
- To minimise the risks of more widespread teleworking harming long-term innovation and decreasing worker well-being, policy makers should assure that teleworking remains a choice and is not ‘overdone’; co-operation among social partners may be key to address concerns e.g. of ‘hidden overtime’.
- To improve the gains from more widespread teleworking for productivity and innovation, policy makers can promote the diffusion of managerial best practices, self-management and ICT skills, investments in home offices, and fast and reliable broadband across the country.

Introduction¹

Teleworking – “work-from-home” or “home-office” – has been a necessary practice for many firms and workers during the lockdown period of the COVID-19 crisis. During this episode, societies have undergone a large scale “forced experiment” where sectors, firms and workers have continued to operate while being physically separated, provided they had the necessary technological, legal and digital security conditions. This has potentially large impacts on businesses of all kinds, whether they had embraced teleworking in the past or not (OECD, 2020^[1]). It should also be kept in mind that, while telework allowed some firms and workers to better ‘weather the storm’, especially those who used telework before, the ability to telework during the crisis was not open to all and differential access to telework may well have exacerbated existing inequalities. For instance, many workers – especially young, less educated workers at the bottom of the wage distribution – during the crisis worked in jobs requiring physical presence (Brussevich, Dabla-Norris and Khalid, 2020^[2]).²

Telework has been crucial to sustain production during the crisis, but its effects on productivity are unclear. In the short term, compared to the pre-crisis period, the exceptional conditions in which telework was implemented may well have lowered productivity for those who were able to work from home. In a recent interview, Nick Bloom from Stanford University, who previously identified important gains from telework under normal circumstances among Chinese call-centre workers (Bloom et al., 2015^[3]), emphasised that “We are home working alongside our kids, in unsuitable spaces, with no choice and no in-office days. This will create a productivity disaster for firms” (Gorlick, 2020^[4]). Indeed, a survey conducted by one of Japan’s research institutes during the lockdown period confirms decreased self-reported worker productivity (Morikawa, 2020^[5]). Conversely, a poll among US hiring managers found that managers were more likely

¹ This policy brief has been produced in the context of the [Global Forum on Productivity](#) and benefitted from support by its members.

² Consistent with this, occupations that are less prone to teleworking showed a much stronger increase in unemployment claims during the initial lockdown phase of the crisis (Kahn, Lange and Wiczer, 2020^[52]). However, they also saw a slightly larger drop in job vacancies, which possibly indicates that the demand fall for such activities is likely to be more significant.



to have experienced short-term productivity gains rather than losses due to remote work (Ozimek, 2020^[6]), suggesting that productivity losses during the crisis are by no means a foregone conclusion.

In the longer-term, productivity performance could improve to the extent that the crisis catalyses wider and smarter adoption of efficient telework practices, raising worker well-being and efficiency and lowering firms' costs. This could speed up the transition into a "new normal", which would have been more gradual in the absence of the crisis, given uncertainties and costs around the necessary organisational and management changes and other hurdles – cultural reluctance or legal constraints. Emerging evidence provides support for this notion: 61.9% of hiring managers interviewed in a recent US poll stated their intention to rely more on remote work in the future (Ozimek, 2020^[6]). However, against these positive longer-term productivity effects stand potentially adverse effects arising from increased spatial distance among employees, e.g. impaired communication resulting in lower innovation or the fusing of work and personal, family and social life leading to hidden overtime. Public policies and dialogue among social partners can play a key role in facilitating this transition and contributing to spreading of teleworking practices that enhance both productivity and worker well-being. They can enable firms to carry out the necessary adjustments, while counteracting potential risks and allowing more workers to benefit from welfare-improving telework opportunities.

Understanding the long-term impact of teleworking at the firm-level and aggregate productivity is important given the likely rising diffusion of this work practice globally. Future research conducted by the Global Forum on Productivity as part of its work on the Human Side of Productivity project³ aims to empirically investigate the link between telework and firm productivity using granular data. As a first step, this brief draws largely on existing evidence to discuss the potential role for policies to contribute to the more widespread use of efficient and welfare-improving telework in the medium- to longer-term, as the immediate health crisis recedes and firms and workers have more discretion whether or not to telework. The brief consists of two parts: First, it discusses the prevalence of telework in the pre-COVID-19 era, to gauge the scope for a wider use of telework after the crisis. Second, it discusses how policies can maximise the potential gains from more widespread telework for firms and workers. To that end, it briefly reviews the link between telework and productivity and discusses the challenges policies need to address. Based on this review, it then discusses some key policies contributing to higher gains from telework for productivity and worker well-being.⁴

The prevalence of teleworking pre-COVID-19

Differences across countries, industries, occupations and firms in the use of occasional telework before the crisis can be informative about the scope for more widespread use of telework during normal times, as well as about factors that need to be in place to use telework efficiently or that may prevent its use. By way of example, to the extent that factors such as lack of ICT skills, inefficient management practices or tasks requiring physical presence prevent the use of telework and are more common in some countries or types of firms than others, cross-country or cross-firm differences in the prevalence of telework give an indication of the scope for increasing telework via better management practices and public policies aimed at widening access to it.

Information on the use of telework before the crisis thereby complements insights gained from the use of telework during the crisis. The fast pace with which many firms adapted to the health crisis by conducting

³ See: <http://www.oecd.org/global-forum-productivity/Human-side-of-productivity-flyer.pdf>.

⁴ For further implications of the COVID-19 crisis on productivity, including disruptions to value chains and potential reshoring, structural changes and reallocations across sectors, firms and in the composition and human capital of the workforce, see Di Mauro and Syverson (2020^[53]). For the productivity impacts through financial factors, see OECD (2020^[54]).



a large number of jobs from home indicates that the use of telework pre-crisis remained well below what is feasible. In the US for instance, 94 percent of 1 500 hiring managers surveyed in April 2020 indicated that some of their workers teleworked during the crisis (Ozimek, 2020^[6]); in another survey that is representative for the US population, out of 25 000 respondents surveyed in April 2020, 34 percent of those employed four weeks earlier indicated having switched to telework during this period (Brynjolfsson et al., 2020^[7]). However, the use of telework during the crisis may only be partly transferable to telework during “normal times”: during confinement telework usually requires *all* tasks associated with a job to be done from home, whereas occasional or even regular teleworking before the crisis requires only *some* tasks to be done remotely. Moreover, workers were usually forced to telework during the crisis. While many may continue to telework in the longer term, as long as regulatory and other obstacles to telework persist many others may not want to.

How widespread was telework across countries?

Already in 2015 a substantial fraction of workers across many OECD countries teleworked – i.e. worked outside the office, from home or a public space – at least occasionally during the previous year (Figure 1). Yet, the extent of people teleworking varied widely across countries, from around 25 percent in Portugal and Italy to more than twice as many people in Sweden and Denmark.

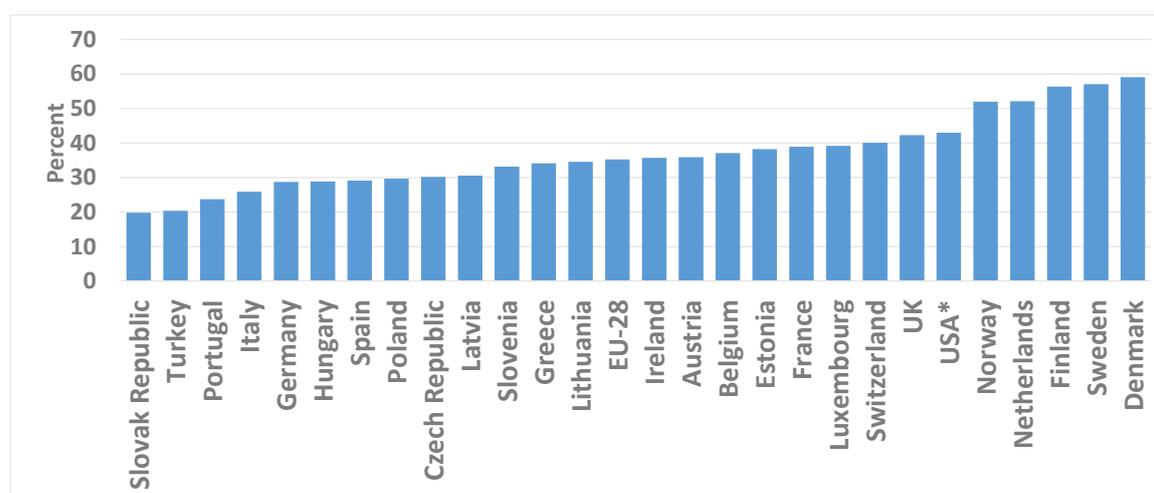
It is important to note that the share of people having teleworked shown in Figure 1 deviates from recent studies estimating the scope of jobs that can be performed by teleworking *during the crisis* (Dingel and Neiman, 2020^[8]; Boeri, Caiumi and Paccagnella, 2020^[9]); jobs that allow doing some tasks from home may not be suitable to be done entirely through teleworking. For instance, while in Sweden 57.2 percent of people reported having done some telework in 2015, only 30.7 percent of current jobs could be done during strict confinement (Boeri, Caiumi and Paccagnella, 2020^[9]). Interestingly, however, cross-country differences in the scope of jobs to be done entirely from home – based on occupational tasks, which may more closely reflect constraints to telework due to the nature of the jobs – are generally smaller than differences in actual telework reported in Figure 1. This suggests that, besides the industrial structure of countries -- i.e. differences in the composition of types of jobs leading to workers performing a different mix of tasks in each country -- other factors such as culture, use of managerial practices, the digital infrastructure, the skill endowment or the age structure of the workforce may drive these differences.⁵

⁵ Bloom and Van Reenen (2007^[55]) provide evidence on substantial differences in management practices across countries; (Bloom, Kretschmer and Reenen, 2009^[23]) provide evidence on cross-country differences in work-life balances. For evidence on the ability to telework during the crisis, Brussevic, Dabla-Norris and Khalid (2020^[2]) examine the role of socio-economic differences across countries.



Figure 1. Use of telework varies widely across countries

Share of people using telework in 2015/2016



Note: Figure shows use of telework for a selection of OECD countries and EU-average. For all countries except USA it shows the percentage of people (employed or self-employed) who reported having worked from home or a public space (such as cafés, libraries) during the reference year. Military occupations and subsistence farmers have been excluded from the sample. *For USA figure shows the percentage of employees who worked remotely during 2016.

Source European Foundation for the Improvement of Living and Working Conditions (2017^[10]); for the US Mann and Adkins (2017^[11]).

In addition, occasional teleworking shown in Figure 1 appears to be much more widespread than *regular* teleworking. For instance, in Germany only 12 percent of workers teleworked from home at least 1 day per week in 2014, and in Hungary only 1 percent did so during the past 4 weeks, while in both countries almost 30 percent of workers teleworked occasionally in 2015 (Eurofound and International Labour Office, 2017^[12]). Similarly for the US, while 43 percent of employees worked from home during 2016, only 15 percent of working hours between 2011 and 2018 were performed from home (Hensvik, Le Barbanchon and Rathelot, 2020^[13]). The large discrepancy between regular and occasional telework again suggests that – besides technical requirements – substantial non-technical obstacles to telework exist: most workers who could perform at least some tasks from home may choose not to do so, e.g. because of not having access to a suitable working environment at home or out of fear of being ‘stigmatised’. This potentially large role played by ‘cultural’ and other factors provides an indication for how much policies could help to increase telework, especially in countries with low use of telework pre-crisis such as Portugal.

How widespread was telework across sectors?

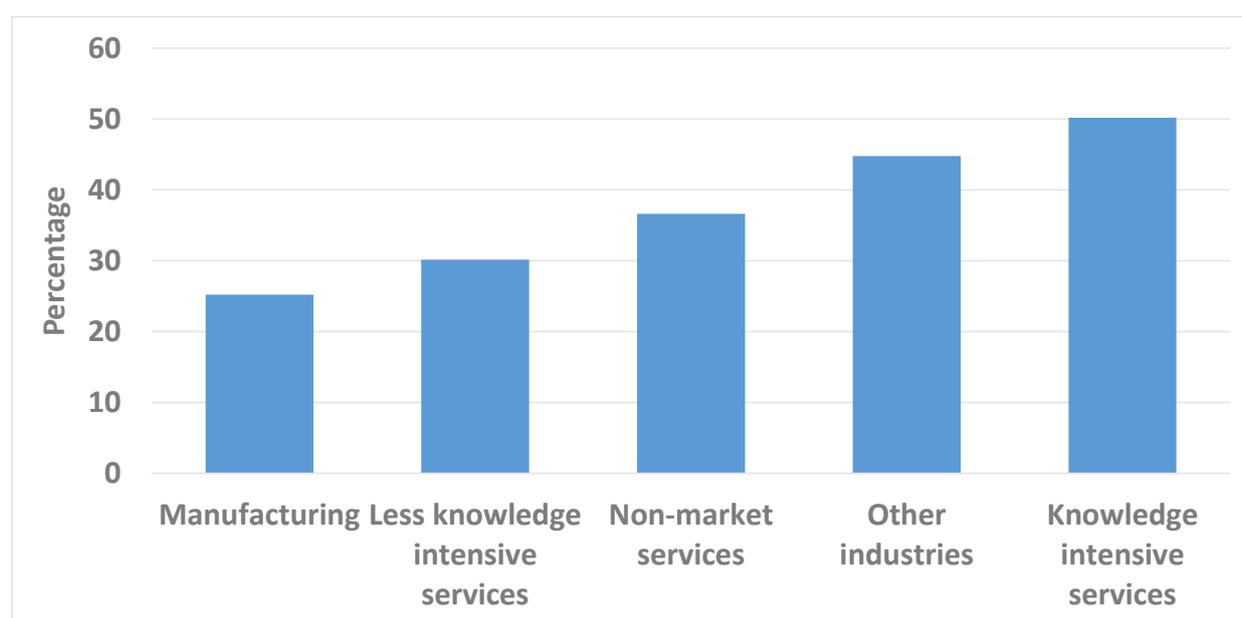
The extent of telework also varied widely across sectors. It was most common in knowledge-intensive services, e.g. professional and ICT services, and least common in manufacturing and less knowledge-intensive market services, e.g. including wholesale and retail and transportation (Figure 2 – for more detailed industries see Figure A1 in the Annex). These differences are likely to at least partly reflect task requirements, as many high skilled jobs in knowledge-intensive industries can be done remotely using laptops, whereas a physical presence is more likely to be required for many jobs in manufacturing or, say, accommodation. Similarly, many non-market services comprise jobs for which a physical presence is an important component, e.g. health and social work. Interestingly, a comparatively high fraction of people working in agriculture, construction, mining, electricity or water supply – denoted above as ‘other industries’ – used telework. While the current data do not allow a breakdown by industries and occupations, future work may shed light on which types of jobs teleworked intensively in these industries.



These broader patterns notwithstanding, there is substantial variation across industries within the aggregate sectors shown in Figure 2. For instance, education and activities of extraterritorial bodies in non-market services, including international organisations such as the OECD or the International Monetary Fund, are among the industries with the highest share of telework. Similarly, in less knowledge-intensive market services, real estate activities exhibit a large fraction of people doing telework. Although a substantial share of workers in public administration teleworked occasionally, this share still appears low in comparison to industries in knowledge-intensive market services that may perform many similar tasks. This comparatively low share may partly reflect a larger reluctance, or fewer incentives, to adopt novel working models. The crisis may act as a catalyst especially for the public sector to adopt these measures with potentially positive spill-over effects for productivity also in the market sector.

Figure 2. Use of telework varies across sectors

Cross-country average of percentage of people using telework in 2015 by sector



Note: The figure shows the percentage of people (employed and self-employed) who reported having worked at home or a public space (such as cafés, libraries) during the reference year by sector. Percentages are calculated as unweighted cross-country averages for each sector across Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus*, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and UK. Sectors are aggregated from NACE Rev. 2 1-digit industries. Military occupations and subsistence farmers are excluded from the sample. Other industries include: Agriculture, forestry and fishery; mining and quarrying; electricity, gas, steam and air conditioning; water supply and waste management activities; construction. Figure A1 in the annex shows the use of telework for more detailed industries included in each sector. Note that the underlying sample at the household level has not been stratified by industry; observations have been reweighted to account for each country's industrial structure. While the reported shares may not be statistically representative at the industry-level as a result, a comparison exercise with representative micro data from the UK has yielded a satisfactory accuracy.

*Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

*Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Source: European Foundation for the Improvement of Living and Working Conditions (2017^[10]).

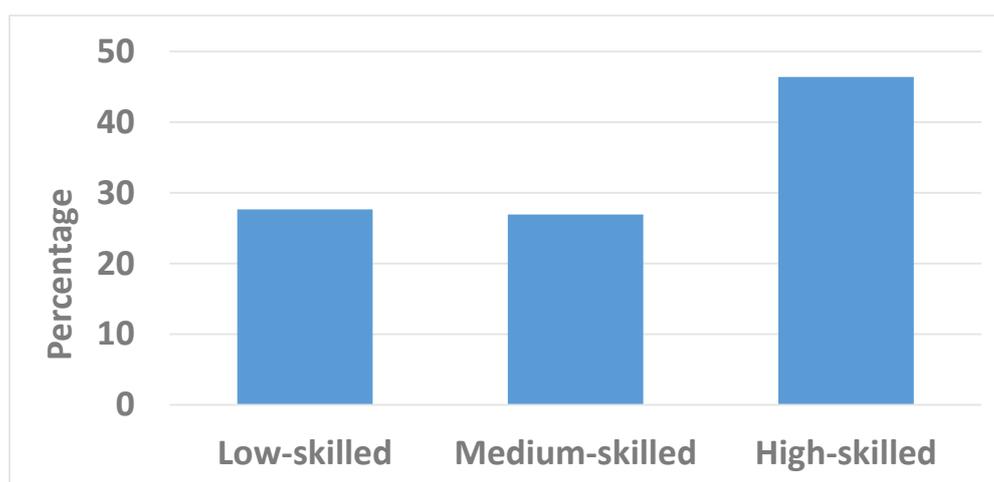


How widespread was telework across occupations?

As mentioned above, occupations vary in their potential to telework. Accordingly, Figure 3 confirms that the actual occupational use of telework before the crisis also varied substantially. Grouping occupations by skill content, teleworking was most common among high skilled occupations, e.g. managers and professionals, suggesting that many occupations prone to be done remotely for now require high skills. Indeed, cognitive and non-cognitive skills receive the highest returns in digital-intensive industries (Grundke et al., 2018^[14]). However, continuing digitisation may further increase the range of tasks to be done remotely (Autor, 2014^[15]). Telework was lowest among low- and medium-skilled workers, comprising occupations with many tasks requiring a physical presence, e.g. personal care workers, production workers or sales staff. Yet, among selected medium- and low-skilled occupations telework was in fact relatively frequent, notably market-oriented skilled agricultural workers or street vendors, which may reflect a high share of self-employed doing telework. Nonetheless, the overall high share of telework in high skilled relative to medium and low skilled occupations suggests that, in the absence of targeted measures to reduce gaps in the ability to telework, more widespread telework could exacerbate disparities in working conditions in the long-run.

Figure 3. Use of telework varies by occupational skill intensity

Cross-country average of percentage of people using telework in 2015 by occupational skill group



Note: The figure shows the percentage of people (employed and self-employed) who reported having worked at home or a public space (such as cafés, libraries) during the reference year by occupational skill group. The percentages are calculated as unweighted cross-country averages for each occupational skill group across Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus*, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and UK. Military occupations and subsistence farmers are excluded from the sample. Skill grouping of 2-digit ISCO 08 occupations are based on Goos, Manning and Salomons (2014^[16]) and Acemoglu and Autor (2011^[17]). Figure A2 in the annex provides shows the use of telework by 2-digit ISCO 08 occupations included in each skill group. Note that the underlying sample at the household level has not been stratified by occupations; observations have been reweighted to account for each country's occupational structure. The reported shares may not be statistically representative at the occupational-level as a result.

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Source: European Foundation for the Improvement of Living and Working Conditions (2017^[10]).



The general pattern of actual telework across occupations roughly fits the rankings by scope of occupations to telework during the crisis, such as those reported by Dingel and Neiman (2020^[8]) – consistent with evidence that some occupations are intensive in tasks that are particularly prone to telework. However, it is important to note that the suitability of an occupation to be performed through telework during the crisis is more stringent than the requirement to perform some of the tasks through telework; as occupations comprise a range of different tasks, some of which can be done remotely and some which may require or benefit from physical presence, many occupations that cannot entirely be done through telework are nevertheless fit for regular or occasional telework, e.g. sales staff or teachers may spend some days with face-to-face contact with customers and students while doing admin tasks at home, lab researchers who need to conduct experiments can write papers from home.

Which firms have been using telework?

In addition to differences in telework across countries, sectors and occupations, also differences across firms may indicate which factors are conducive to telework in ways that can affect productivity.⁶ Some evidence on the characteristics of firms using telework can be gained from the use of trust-based working time arrangements (TBW) in Germany. TBW can be seen as a prerequisite for telework. Similar to telework, TBW implies giving up control over working time and assessing worker performance solely based on their outputs (Viete and Erdsiek, 2018^[18]). Firms using TBW may therefore be more likely to use telework. In fact, for 2018 – when information on telework and TBW are available for Germany – there is a positive and significant correlation between using TBW and teleworking from home (correlation coefficient 0.3).

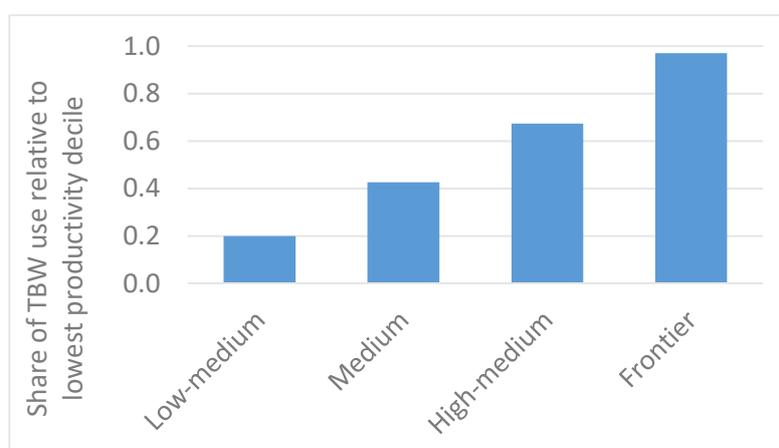
Figure 4 shows that the use of TBW is more widespread among the most productive firms, which are almost twice as likely to use TBW as the least productive firms. Importantly, however, these results do not indicate that firms are more productive *because* they use TBW; productive firms may share characteristics, such as using advanced management practices, which raise productivity and make it more likely to use TBW. Results do show however that the use of TBW is compatible with high performance.

⁶ Important differences in telework can also arise due to a range of other factors, e.g. differences in worker characteristics or regional factors. For the role of skills for the ability to telework see Espinoza and Reznikova (2020^[57]); for the ability to telework during the crisis by regions, see OECD (2020^[56]).



Figure 4. Use of trust-based working time arrangements (TBW) increases with productivity

TBW use in Germany across the productivity distribution



Note: The figure shows the difference in the share of firms using trust-based working time arrangements (TBW) between each productivity group and the bottom decile of the productivity distribution as percentage of the share in the bottom decile. Productivity groups refer to low-medium (2-4th decile), medium (5-6th decile), high-medium (7-9th decile), and frontier (10th decile). Deciles are based on annual productivity distribution within STAN A38 industries, excluding agriculture, forestry and fishery, financial and insurance activities, and public sector. Productivity is measured as 3-year backward moving average based on gross-output per worker. Results show unweighted average of shares across years and industries.

Source: OECD calculations based on German LIAB for 2000-2016.

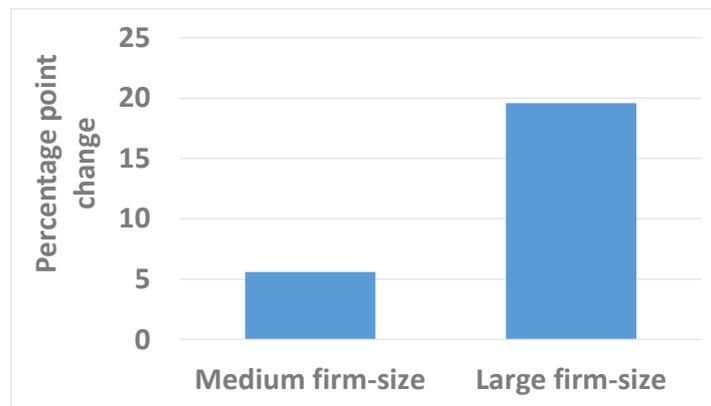
TBW is also more common among larger firms. Figure 5 shows how much more likely medium and large firms are to use TBW compared to small firms with otherwise similar characteristics, i.e. productivity, workforce composition, industry and firm age. For instance, large firms are almost 20 percentage points more likely than small firms to use TBW. This large effect may reflect a number of features associated with firm size and not included in the model, e.g. the use of advanced management practices, which warrant further analysis.

In addition to productivity and size, the firm's workforce composition is also linked with the use of TBW. Figure 6 shows that firms with younger and more skilled workers and managers are more likely to use TBW. For instance, replacing 10 percent of workers who have medium skills with high-skilled workers increases the probability to use TBW by about 2 percentage points; similarly, replacing 10 percent of managers who are middle-aged with older ones decreases the probability by 0.7 percentage points. The link between skills and TBW is in line with the fact that telework is more common among higher skilled professions (e.g. Eurofound and International Labour Office (2017^[12])). This may reflect that higher skilled workers on average may be better able to work independently, or that they may better engage in creative tasks in a flexible working environment. Similarly, highly skilled managers may be more prone to allow TBW as they are better able to implement it successfully, e.g. through establishing trust-based relationships with workers. The fact that TBW is less common among firms with a higher share of older workers may reflect their reluctance to deviate from traditional working models, or that older workers are less likely to possess the ICT skills necessary for telework. It may, however, also reflect differences in preferences, as competing tasks – and demands for better work-life balance – may be particularly pressing among young and middle-aged workers, e.g. when both parents are working with small children at home.



Figure 5. Use of trust-based working time arrangements (TBW) in Germany increases with firm-size

Marginal effect on TBW use of increasing firm size from small to medium and large



Note: The figure shows the expected marginal changes of probability of using trust-based working time arrangements when firm-size increases relative to small firms. Firm size groups comprise small (10-49 employees), medium (50-249) and large (250 or more). Results are based on a linear probability model of TBW use at the firm-level, controlling for log productivity, skill, age and gender composition of managers and workers respectively, share of part-time male and female employees, manager share, manager remuneration, firm-size and -age, and industry-year fixed effects. All variables except TBW use and firm-age are based on 3-year backward moving averages. Productivity is measured as gross-output per worker. Industries correspond to STAN A38, excluding agriculture, forestry and fishery, financial and insurance activities, and public sector. Standard errors are clustered at the firm-level. Results are statistically significant at the 5% level.
 Source: OECD calculations based on German LIAB for 2000-2016.

Figure 6. Use of trust-based working time arrangements (TBW) in Germany increases with a younger and more highly skilled workforce

Panel A: Marginal effect on TBW use of an increase in the share of high skill managers and workers



Panel B: Marginal effect on TBW use of an increase in the share of older managers and workers



Note: The figure shows the expected marginal changes in the probability of using trust-based working time arrangement for changes in the workforce composition. Results are based on a linear probability model of TBW use at the firm-level, controlling for log productivity, skill, age and gender composition of managers and workers respectively, share of part-time male and female employees, manager share, manager remuneration, firm-size and -age, and industry-year fixed effects. All variables except TBW use and firm-age are based on 3-year backward moving averages. Productivity is measured as gross-output per worker. Employees are classified as managers based on occupations. Industries correspond to STAN A38, excluding agriculture, forestry and fishery, financial and insurance activities, and public sector. Standard errors are clustered at the firm-level. Marginal effects are shown for a 10-percentage point increase in the share of older/high skilled managers/workers respectively with a corresponding decline in middle aged/medium skilled managers/workers. High skilled/medium skilled employees correspond to employees with university or technical college/occupational degree. Older/middle aged employees correspond to employees aged 50-85/30-50. Results are statistically significant at the 5% level.
 Source: OECD calculations based on German LIAB for 2000-2016.



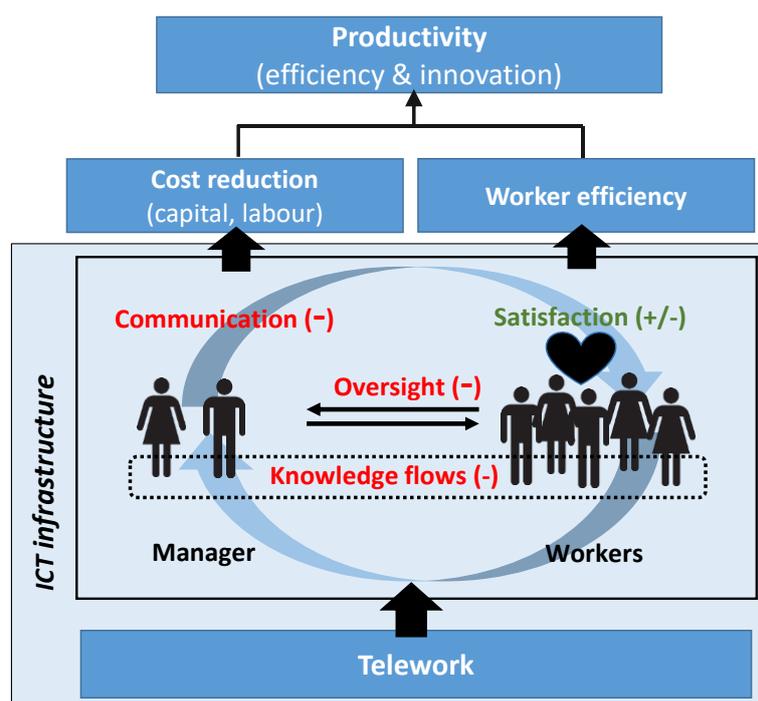
How can policies contribute to the spread of efficient telework?

A more widespread use of telework can have a wide range of impacts on firm performance and worker well-being. Policies are key to enable firms and workers alike to benefit from the many opportunities offered by the more common use of telework. This in turn can have positive effects on aggregate productivity and well-being, as well as additional policy relevant areas such as climate change or economic inequalities. This section lays out the factors that may shape the impact of teleworking on firms and workers, discusses the challenges policies need to address, and highlights which policies can act on these factors to improve productivity and worker well-being.

How does telework affect productivity?

Telework can improve or hamper firm performance, with its overall effect depending importantly on two main channels: A direct channel affects firm performance through changing the efficiency, motivation and knowledge creation of the workforce; an indirect channel is for telework to facilitate cost reductions that free up resources for productivity enhancing innovation and reorganisation. The functioning of either channel presupposes an appropriate ICT infrastructure, whose role is discussed in more detail further below (Figure 7).

Figure 7. Telework and productivity: what are the main channels?



Telework can improve firm performance by raising **worker satisfaction** and thus worker efficiency, e.g. through better work-life balance, less commuting or fewer distractions leading to more focused work or less absenteeism. It is, however, also possible that worker satisfaction decreases with telework, e.g. due to solitude, hidden overtime and a fusing of private and work life, or an inappropriate working environment at home. Existing evidence supports the notion that telework can raise worker efficiency: German establishments that allow for trust-based work practices or self-managed working time – including in the context of telework – show stronger product innovation intensities (Godart, Görg and Hanley, 2017^[19]), higher productivity (Beckmann, 2016^[20]) and more intensive worker effort (Beckmann, Cornelissen and Kräkel, 2017^[21]). For Portuguese firms Monteiro, Straume and Valente (2019^[22]) find that



effects on productivity differ greatly across firms but are generally positive for firms undertaking R&D. The positive association of telework with productivity may however be driven by third factors, e.g. better managed firms may be more likely to introduce such measures (Bloom, Kretschmer and Reenen, 2009^[23]). A positive *causal* impact of telework on worker efficiency has been tested and verified for call-centre workers in China (Bloom et al., 2015^[3]). The more widespread adoption of telework may also generate important spill-over effects for worker satisfaction by reducing traffic congestion, carbon and particulate matter emissions and lowering housing prices especially in high density urban areas.

Telework can also improve firm performance through facilitating **cost reductions**. Telework can directly lower capital costs by reducing office space and equipment required by the company (Bloom et al., 2015^[3]). Labour costs can be reduced as telework enlarges the pool of workers firms can choose from, increasing the skill supply and improving the match between jobs and hires, e.g. by employing high skilled workers who, for personal reasons, are tied to a specific location (Clancy, 2020^[24]). A complete shift to remote working in fact implies a substantial reduction in trade-costs for services faced by firms, broadening their ability to draw on the global talent base, e.g. from call-centre workers to specialist engineers and managers (Baldwin and Forslid, 2019^[25]). In addition, hiring costs may decrease if higher worker satisfaction reduces voluntary quits and turnover. Firms offering telework may also attract workers at lower wages than would otherwise be the case – in particular if combined with other measures that improve work-life-balance such as flexible hours – to the extent workers are willing to give up a higher salary in return for these amenities (compensating differentials).

Worker efficiency may also decrease with telework: telework reduces the number of in-person interactions, which impairs communication, knowledge flows and managerial oversight. A wide range of evidence supports the notion that personal meetings allow for more effective **communication** than more remote forms such as emails, chat, or phone calls. For instance, personal communication has been shown to be more convincing, to attract more attention, or to better allow observing ‘social clues’ (Bohns, 2017^[26]; Roghanizad and Bohns, 2017^[27]; Battiston, Blanes and Kirchmaier, 2017^[28]; Bonet and Salvadora, 2017^[29]). Disruptive forms of communication may surge to compensate for the lack of personal communication, e.g. increased email traffic or virtual meetings. Finally, besides its implications for the internal workings of the firm, less frequent personal communication can also have negative implications for its engagements with key stakeholders, e.g. clients and suppliers, with adverse effects for the overall performance of businesses (Hovhannisyan and Keller, 2019^[30]).

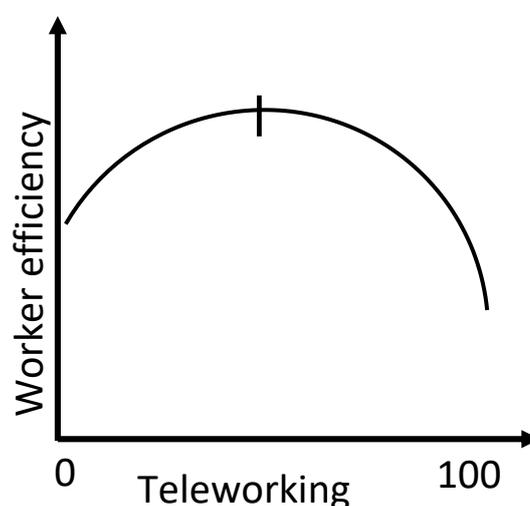
The lack of personal interactions can also decrease **knowledge flows** among employees. To the extent workers learn through interactions with colleagues they may acquire skills through learning-by-doing more slowly (Arrow, 1971^[31]; Bonet and Salvadora, 2017^[29]). Crucially, innovation and thus long-term productivity growth may suffer with telework. Innovation depends importantly on the *sharing* of knowledge: “What each individual knows is less important (...), what counts is collective knowledge” (Mokyr, 2002, p. 7^[32]). On the one hand, studies demonstrating a positive link between physical proximity and collaborative research output suggest that ‘chance encounters’, which occur when people share the same physical space, are indeed essential for knowledge sharing (Claudel et al., 2017^[33]). On the other hand, as information sharing between remote workers becomes more common, the more intensive use of telework may form part of wider and potentially efficiency enhancing firm reorganisations made possible by digitisation (Bloom et al., 2014^[34]; Antras, Garicano and Rossi-Hansberg, 2006^[35]).

Finally, to the extent that control over workers is exerted through face-to-face interactions and physical presence, telework can hinder **managerial oversight** and aggravate principal-agent problems, e.g. ‘shirking’ (Holmstrom and Milgrom, 1994^[36]; Shapiro and Stiglitz, 1984^[37]; Bonet and Salvadora, 2017^[29]). Telework requires a change from assessing performance in terms of inputs, i.e. time worked, to outputs, which implies giving up some control over workers and, in principle, provides workers with more opportunities to “slack”. However, digitalisation may also lead to more data on worker performance becoming available to managers, which may ultimately provide more information for efficient monitoring of workers than is generally available in a traditional office environment.



Overall, for firm-level productivity to increase with telework it is therefore crucial that worker satisfaction increases enough to offset the potentially negative effects on communication, knowledge flows and managerial oversight. The relative strength of these channels in turn is likely to depend on the intensity of telework⁷: the negative effect due to the lack of personal interactions likely becomes stronger with telework intensity, as opportunities for in-person communication diminish, while worker satisfaction improves with low levels of telework but may suffer from ‘excessive’ teleworking, e.g. due to solitude or a fusing of private and professional life. Worker efficiency therefore improves with low levels of telework but decreases with ‘excessive telework’, implying a ‘sweet spot’ where worker efficiency – and thus productivity – is maximised at intermediate levels of telework, although it should be noted that the exact form of this relationship likely varies with the relative importance of these factors by sector and occupation.⁸ Figure 8 summarises the likely overall effect of these factors through an inverted U-shaped relationship between the amount of telework (on the horizontal axis) and worker efficiency (on the vertical axis).

Figure 8. Telework and worker efficiency: an inverted U-shaped relationship



What are the policy challenges?

The ways in which telework may affect worker productivity and well-being carve a role for policies aimed at maximising its economic benefits. The crucial role of worker satisfaction in achieving productivity gains from teleworking implies that such gains and improvements in worker well-being go hand-in-hand, a sort of ‘divine coincidence’. Policies can exploit this ‘divine coincidence’ by facilitating the attainment of a level of telework closer to the optimal level (moving along the curve) and by improving worker satisfaction (or compensating the costs of diminished in-person interactions) at any given amount of telework (shifting the curve upwards). To this end, a number of policy challenges need to be addressed.

First, policies should ensure that teleworking remains a choice. This is to prevent that remote working arrangements are ‘overdone’. The importance of in-person communication especially for complex tasks and innovation implies that too much telework can decrease worker efficiency and long-term productivity growth. Indeed, the high importance given to clusters of entrepreneurship and the high geographical

⁷ Whether we think of the amount of telework as the fraction of workers or the share of work-time for an individual worker, the main patterns and trade-offs are very similar.

⁸ For instance, sectors and occupations performing more complex tasks may rely more on communication, thus experiencing lower efficiency gains from telework, which implies a lower optimal level of telework.



concentration of high-tech firms in the ICT sector (e.g. Silicon Valley) and the role of labs and departments in academia strongly suggest that sharing the same physical space is essential for innovation (Chatterji, Glaeser and Kerr, 2013^[38]). Workers also vary in their personal preferences or their ability to work independently, so that some workers may experience more or less satisfaction from teleworking (Financial Times, 2020^[39]). In that sense, their ability to telework may also depend on their skills (Grundke et al., 2018^[14]). Skill gaps among different worker groups, combined with the fact that jobs requiring high skills already appear to be most prone to telework, suggest that more widespread telework may exacerbate existing disparities in working conditions. Policies targeted at increasing the capacity for telework of disadvantaged worker groups, e.g. low skilled, older or rural workers, may help avoiding that they fall further behind and are excluded from the benefits telework offers. An additional risk is that telework may erode working time arrangements and lead to 'hidden overtime' becoming the norm, as with telework managers may primarily observe outputs but not time spent working. The ability to choose whether and how much to telework may therefore be crucial for achieving productivity gains. Indeed the call-centre study mentioned above (Bloom et al., 2015^[3]) concluded that those workers who chose telework achieved an improvement in output per worker nearly twice as compared to those who were simply being forced to do it. Yet, letting workers choose in itself does not guarantee an optimal level of telework, as they are unlikely to fully take into account the negative implications on innovation in the long-run when making their decision. It is therefore important to prevent that, e.g. in an attempt to save costs for office space, firms impose telework or reduce opportunities for personal encounters beyond what is optimal.

Second, policies should encourage arrangements that provide workers with an appropriate working environment. The adaptability of workers, and thus the efficiency gains stemming from improved worker satisfaction, depend crucially on working conditions while teleworking, e.g. in terms of ICT equipment, office space, or childcare. Worker satisfaction and thus efficiency may also decrease to the extent that some of the costs of teleworking are not provided for by firms but are shifted onto workers, e.g. if workers needed to compensate with more expensive housing or higher electricity bills. The supporting infrastructure may need to be adjusted to more widespread teleworking, e.g. childcare may need to be offered closer to the home. In fact, the double pressure of work and household and care duties while teleworking during the crisis may have fallen disproportionately on women or single parents, even though as a result of the crisis an increasing number of men took on caretaker tasks when their partners were engaged in 'essential' jobs (Donadio, 2020^[40]). Offering inappropriate or more limited childcare due to a higher incidence of employees working from home may thwart career advancement, especially for women, and jeopardise the potential improvement in equal opportunities inherent in the changing norms on caretaker duties during the crisis (Alon et al., 2020^[41]).

Third, policies should facilitate the diffusion of best practice managerial practices developed in response to the increased use of telework. Managers need to adapt to the opportunities and challenges posed by telework. Adherence to outdated managerial practices may prevent managers from adopting telework, thus foregoing the benefits inherent in the use of telework. The attendant reduction in direct oversight may require managers to shift from a culture of presenteeism to an output-oriented assessment of worker performance; lest they prevent workers from teleworking out of fear of being stigmatised (Eurofound and International Labour Office, 2017^[12]), or they overcompensate and disrupt workers by excessive 'checking in', e.g. with virtual meetings (Financial Times, 2020^[39]). The lack of workplace interactions resulting from increased telework may make worker representation more difficult and degrade intangible capital such as firm-specific innovations or a company culture fostering the workers' identification with the firm's goals. Better managed firms may be better able to establish a trusting relationship between managers and subordinates, making oversight less important in the first place. Management can also compensate for the lack of 'chance encounters' due to increased telework by deliberately creating opportunities for knowledge sharing, thereby counteracting the potential negative effect of telework on long-term productivity growth.

Finally, policies should support the provision of access to a fast, reliable and secure ICT infrastructure for firms and workers. The readiness of the ICT infrastructure, which often varies across regions and tends to



be less well-developed in more rural areas, is a key pre-requisite for enabling telework and its quality matters greatly for the efficiency of teleworking. Its first and foremost feature is to provide efficient means of communication, preferably by means of video conferencing, for which reliable and fast internet connections are necessary. This points to the quality of the broadband and wireless network between the firm and its workers' homes (OECD, 2020^[42]; Andrews, Nicoletti and Timiliotis, 2018^[43]; Bajgar et al., 2019^[44]). In addition, however, it also needs to accommodate security and privacy requirements, ranging from protection from cyber-attacks to setting transparency standards transparency on data collection from employees. For instance, working from home may require secure remote access to confidential data, e.g. in hospitals or banks; management support systems that provide information on task distribution and monitoring can facilitate managerial oversight (Viète and Erdsiek, 2018^[18]), but may also lead to fears of "surveillance" and the data collected in the process can raise demands for privacy protection. Finally, conducting more tasks remotely may require more public services being offered online, which in turn may entail changes to the legal framework, e.g. notaries accepting digital signatures.

Key policies to help maximise the productivity benefits

Policies addressing these challenges can help maximise the potential productivity gains from effective teleworking while protecting workers from negative side effects and assuring innovation in the long-run. Besides productivity improvements, such policies also promise additional benefits for a range of other policy areas, such as contributing to gender equality, improving job opportunities in rural areas and reducing congestion and housing costs in urban areas as well as better work-life balance in general. Relevant policies pertain to three main areas: supporting complementary investments; helping surmount cultural and legal hurdles; and mitigating potential side effects (Table 1). Specifically, the following policies appear particularly relevant:

Support complementary investments

- Stimulate investments into the communication infrastructure, e.g. to phase out slower xDSL by deploying fibre deeper into the broadband network of providers, to enhance the capability and resilience of the communication infrastructure (OECD, 2020^[42]), and contribute to bridge the geographical divide with high-speed broadband being less often available in rural areas (De Stefano, Kneller and Timmis, 2014^[45]).
- Accelerate the diffusion of the communication infrastructure required for telework through (conditional and targeted) financial support for ICT upgrades to encourage firms to implement teleworking (OECD, 2020^[11]).
- To promote overall telework and counter social and regional disparities, stimulate investments in relevant skills especially among workers currently less able to telework. As many workers already possessing skills necessary for telework, e.g. in knowledge-intensive services, are largely concentrated in urban areas, large gains in skill supply may be obtained by up-skilling workers in rural areas. Promoting online education is particularly suited to provide training opportunities beyond the reach of large cities (Clancy, 2020^[24]).
- Promote the sharing of best management practices through information campaigns and stimulating investments in management training.
- Provide funding for relevant research, e.g. Virtual Reality, to improve the quality of remote communication (Atkinson et al., 2020^[46]).

Surmount cultural and legal hurdles

- Counter resistance to introduce telework because of adherence to traditional working arrangements by promoting a 'right to telework' for at least some hours per week in suitable



occupations, or by directly subsidising telework, as done by the metropolitan government in Tokyo, Japan (The Japan Times, 2020^[47]). Framework arrangements for telework as part of collective agreements among social partners can play a crucial role to facilitate the use of telework.

- Offering bilateral tax agreements, e.g. as done between France and Belgium, facilitates working across borders and increases the effective skill supply to firms; similar adjustments may be required to accommodate the specific circumstances for cross-border workers on retirement benefits and health care provision.
- A cultural shift may be achieved through information campaigns on successful transitions and highlighting the broader societal benefits beyond productivity, such as reducing the environmental impact and improving work-life balance. Adapting the public sector to remote work could serve to showcase the benefits of telework and may ease bureaucratic burdens.
- Counter legal hurdles to telework by adapting the legal and regulatory system, e.g. accepting the use of digital signatures more broadly as introduced during the lockdown for French notaries (Atkinson et al., 2020^[46]).
- Importantly, the crisis is already catalysing a cultural shift regarding the distribution of care duties, as women, who are disproportionately engaged in these tasks, are more likely to be employed in essential professions and partners have to fill in. This shift could be reinforced by adapting the benefit and tax system, e.g. by reconsidering tax benefits for single-earner households (Alon et al., 2020^[41]).

Mitigate potential side effects

- The risk for innovation due to the lack of in-person interactions and knowledge sharing could be compensated for by deliberately creating opportunities for exchange. For instance, promoting co-working spaces across the country can foster innovation while saving commuting time and decrease regional inequalities (Clancy, 2020^[24]).
- Counter the risk that telework leads to 'hidden overtime' by promoting a 'right to disconnect', as e.g. instituted for the French post and telecom sector via collective agreements among social partners.
- Generally speaking, the risk of 'excessive' telework needs to be addressed so that firms do not impose costs for office space and IT equipment on workers, and workers remain free to choose whether or not to telework, e.g. by promoting restrictions on imposed telework and stimulating allowances provided by employers for home office equipment.
- Additional regulation may be necessary to prevent that teleworking across borders undermines national labour standards and wage agreements (Baldwin, 2019^[48]).
- As telework is associated with new technologies to monitor the performance and behaviour of workers, additional regulation on data protection may be necessary to ensure privacy rights.
- The provision of supportive infrastructure, for instance childcare, should be reassessed. Increased telework should not lead to company-provided childcare being reduced, but childcare may need to be offered closer to home. Increasing telework without complementary policies to improve supportive infrastructure could increase the burden especially on women from competing work and caretaker duties (Alon et al., 2020^[41]).



Table 1. The role of policies and institutions for making telework more productive

Disseminate best management practices	Facilitate an optimal level of teleworking	Provide an appropriate working environment from home	Provide fast, reliable and secure ICT infrastructure
Promote 'right to telework' and 'right to disconnect'			Consider additional data protection regulation to ensure privacy rights
Information campaigns and management training	Offer bilateral tax agreements	Stimulate company-provided allowances for home office	Fund relevant research, e.g. Virtual Reality
Stimulate investments in ICT infrastructure and ICT upgrades			
	Increase digital capacity of public sector, e.g. to showcase benefits of telework and facilitate remote work	Reassess supportive infrastructure, e.g. promote childcare being offered closer to home	
Promote co-working spaces across the country			
Promote investments in required skills, e.g. through online learning			

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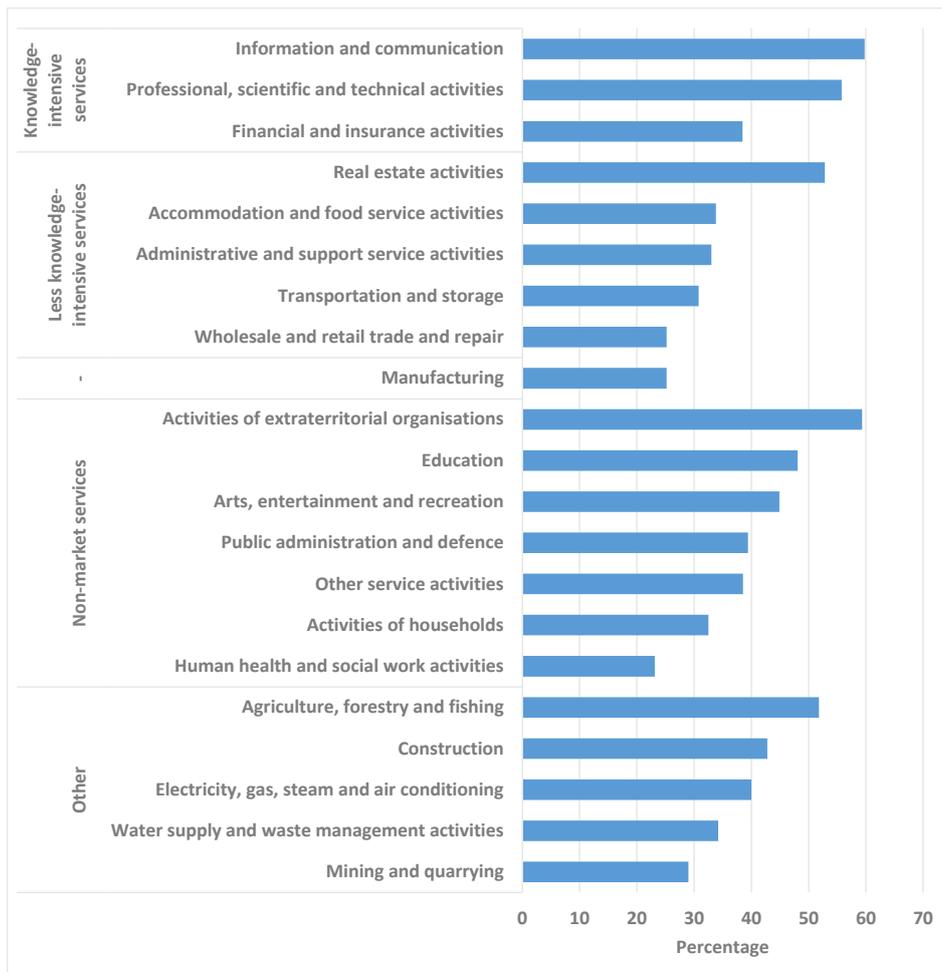
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Annex 1.A. Additional evidence on the use of telework by industries and occupations

Annex Figure 1.A.1. Use of telework varies widely across industries

Cross-country average by industry of share of people using telework in 2015



Note: Figure reports percentage of people (employed and self-employed) who reported having worked at home or a public space (such as cafés, libraries) during the reference year by sector. Percentage is calculated as unweighted cross-country average for each sector including Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus*, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and UK. Military occupations and subsistence farmers are excluded from the sample. Sectors are aggregated from NACE Rev. 2 1-digit industries. Note that the underlying sample at the household level has not been stratified by industry; observations have been reweighted to account for each country's industrial structure. While the reported shares are may not be statistically representative at the industry-level as a result, a comparison exercise with representative micro data from the UK has yielded a satisfactory accuracy.

*Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

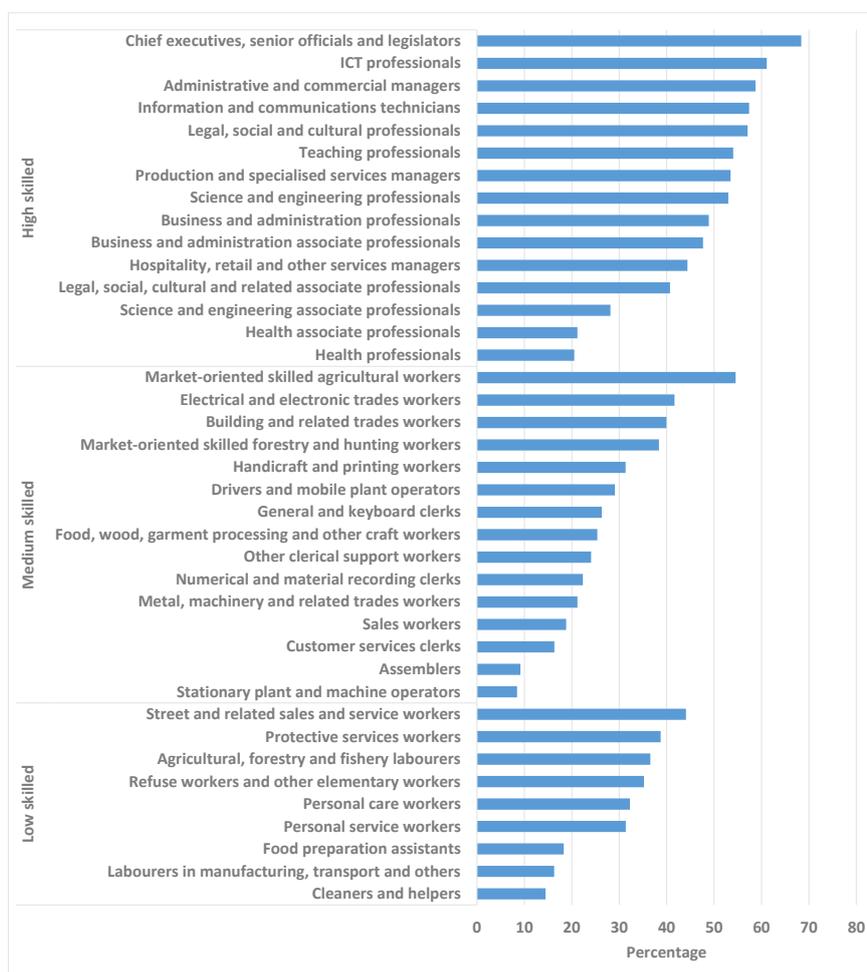
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Source: European Foundation for the Improvement of Living and Working Conditions (2017^[10]).



Annex Figure 1.A.2. Use of telework varies widely across occupations

Cross-country average by occupation of share of people using telework in 2015



Note: Figure reports percentage of people (employed and self-employed) who reported having worked at home or a public space (such as cafés, libraries) during the reference year by occupation. Percentage is calculated as unweighted cross-country average for each occupational skill group including Albania, Austria, Belgium, Bulgaria, Croatia, Cyprus*, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and UK. Military occupations and subsistence farmers are excluded from the sample. Skill grouping of 2-digit ISCO 08 occupations are based on Goos, Manning and Salomons (2014^[16]) and Acemoglu and Autor (2011^[17]). Note that the underlying sample at the household level has not been stratified by occupations; observations have been reweighted to account for each country's occupational structure. The reported shares are may not be statistically representative at the occupational-level as a result.

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Source: European Foundation for the Improvement of Living and Working Conditions (2017^[10]).



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