

The Role of Telework for Productivity During and Post COVID-19

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Abstract – Motivated by the sudden adoption of telework in the wake of the COVID-19 pandemic, the OECD Global Forum on Productivity (GFP) undertook an online survey among managers and workers in 25 countries about their experience and expectations on telework, with a particular focus on productivity and well-being aspects. Respondents had an overall positive assessment from teleworking both for firm performance and for well-being, and wish to increase the share of teleworkers from pre-crisis levels. On average, the ideal amount of telework is envisaged around 2-3 days per week, in line with the idea that the benefits (e.g. less commuting, fewer distractions) and costs (e.g. impaired communication and knowledge flows) are balanced at an intermediate level of telework intensity. Further adaptive changes from management are also needed, such as the coordination of schedules and further investments in ICT tools and skills.

JEL: D24, M1, O3

Keywords: productivity, telework, working from home, well-being, survey

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The COVID-19 pandemic has caused a profound breakdown of global economic activity, with potentially far-reaching longer-term implications for the way businesses are organised. Faced with the need to reduce the spread of the virus, governments worldwide introduced strict lockdown measures and required social distancing. For many companies, the introduction of teleworking (working from home, remote work, or telecommuting) arrangements¹ – despite being new and hitherto never implemented (ILO, 2020) – were the only way to maintain the business open and avoid furloughing or laying-off staff.²

However, the future of telework and the longer-term overall effects of this working arrangement are still a matter of discussion, especially as concerns firm productivity and innovation. On the one hand, the adoption of telework could increase firm-level productivity due to more satisfied and more focused employees, among other reasons. On the other hand, knowledge flows within the firm – necessary to sustain creative collaboration, innovation and productivity growth in the long run – might be hampered due to less frequent serendipitous and *ad-hoc* personal interactions, especially across different teams (Hertel *et al.*, 2005; OECD, 2020a).

To gain systematic and timely evidence on these issues, the OECD Global Forum on Productivity (GFP)³ developed and implemented an online survey and reached respondents from 25 countries and from a wide range of sectors. It asks managers and workers about their subjective experience and expectations of telework to provide lessons about the implications for productivity and the measures to be put in place to maximise benefits. Even though this survey comes with a moderate overall sample size and with larger companies better represented, our key findings are consistent with other recent studies (Barrero *et al.*, 2021; Ozimek, 2020) using data from country-specific surveys with more extensive samples.

The survey builds on previous OECD analysis, which laid out the most important channels and trade-offs inherent in telework and highlighted findings from the pre-pandemic literature (OECD, 2020a). It was organised around three main thematic blocks covering three time periods. In the first part, it investigated the adoption rate of telework before the outbreak of COVID-19 and during the first two waves of the crisis (approximately the Spring and the Autumn 2020 in Western European countries).

In the second part, it asked respondents about the impact the adoption of telework had on the performance of the company and the well-being of workers, and which supportive measures the companies decided to implement amidst the pandemic to blunt this shock. In the third part, it inquired about expectations for the future (see the full list of questions in Criscuolo *et al.*, 2021b).

We show that a large majority of managers and workers had a positive experience with teleworking, even during the initial stages of the pandemic, and consequently, they expect to continue doing so in the future.⁴ In particular, the share of the workforce who will telework post-COVID on a regular basis (i.e. at least once per week) is expected to be in between the level observed before and during the pandemic – and much closer to the higher levels observed during the pandemic. Importantly, both managers and workers expect this to occur in a hybrid way, with 2-3 days per week as the most desired intensity, in contrast to the more extreme degree (often 5 days per week) during the initial stages of the pandemic. Around half of the respondents – workers more than managers – emphasise the need for further managerial changes to fully benefit from telework arrangements, such as the coordination of schedules across workers, management training, additional investments in ICT infrastructure and digital skills. These measures are more likely to be implemented by initially more productive firms, which can lead to a further widening of productivity gaps between more and less productive firms.

The paper is organised as follows. Section 1 reviews the growing evidence about telework and the main channels for productivity. Section 2 provides background on the survey and presents the findings: first, it describes the use of telework pre-COVID and during the initial stages of the crisis. It continues with a focus on the more subjective views about overall experience and the

1. In the questionnaire on which this study is based, teleworking is defined as “carrying out work while remaining physically at home – or at a secondary residence, co-working space, café, etc. – and not being present at the company’s or a client’s premises during normal working hours, irrespective whether it is occasional or regular”. Strictly speaking, this definition is broader than the simple “working-from-home” since it encompasses even other working premises (e.g. co-working space or café) and captures broadly “remote working” practices. Nonetheless, in this paper, we will use all these terms interchangeably (see Allen *et al.*, 2015 for a discussion).

2. Adams-Prassl *et al.* (2020a) report that workers in industries that could perform only a small share of their tasks from home (typically less educated people in labour intensive sectors) were more likely to lose their job during the pandemic, similarly to findings in other studies (Bick *et al.*, 2021; Papanikolaou & Schmidt, 2020).

3. The GFP aims to foster international co-operation between public bodies with responsibility for promoting productivity-enhancing policies. See oe.cd/gfp.

4. Of course, not all jobs are equally “teleworkable”; see discussion in Section 2.2.

adaptive measures taken during the crisis, as well as future expectations on the use, the expected costs and benefits and the required long-term adaptive measures. The conclusion discusses some of the broader economic implications.

1. Telework and Productivity: Existing Evidence and the Main Mechanisms

The impact of teleworking arrangements on firm-level productivity is *a priori* ambiguous. From pre-pandemic times, a randomized control trial (RCT) among call centre workers in a Chinese company shows that working from home is associated with a 13% performance increase due to better concentration and higher work satisfaction (Bloom *et al.*, 2015). Other studies endorse this result in similar settings (Angelici & Profeta, 2020). Confirming that remote work increases the productivity of call-centre workers (by about 7.5%), Emanuel & Harrington (2021) seek to explain why this working arrangement was nonetheless poorly implemented before the pandemic. They argue that employees who decide to work from home suffer a promotion penalty (12% less likely to be promoted in the surveyed company in their study) relative to their office peers – a disadvantage that Bloom *et al.* (2015) have also identified.⁵ Consistent with this, Barrero *et al.* (2021) suggest that “*the pandemic created the conditions for coordinated experiments with WFH (work-from-home) in networks comprised of firms, customers and suppliers [...] The pandemic swept aside inertial forces related to experimentation costs, biased expectations, and coordination within networks that had previously inhibited remote work.*”

Other studies found opposite results on productivity effects of telework pre-COVID-19. Battiston *et al.* (2017) stress the importance of face-to-face communication with teammates and how the lack of this interaction may have detrimental effects on productivity. The impact of telework on productivity largely depends on the nature of the tasks (Lewis *et al.*, 2021). Companies in need of tight, frequent coordination, communication and bonding among colleagues may suffer relatively more from the widespread adoption of telework.

COVID-19 has provided a mass, large scale “social experiment” with teleworking.⁶ Early survey evidence collected during the pandemic points to a positive impact on self-assessed productivity according to managers. An online survey by Ozimek (2020) finds that 56% of managers perceive telework “better than expected”. Another survey by Barrero *et al.*

(2021) confirms this finding and claim that work from home will stick in the future due to several reasons, related to better than expected experience during the pandemic and to the fact that the investments carried out to enable telework remain in place. Surveys focusing on the employee’s perspective are also positive: Bloom *et al.* (2021) find a roughly 2% more efficient workforce on a self-reported basis.

Using cross country data from 27 countries, Aksoy *et al.* (2022) document that employers plan for an average of 0.7 remote working days per week, with workers wishing for one day more, on average. In addition, they find that most employees were positively surprised by their productivity while working from home, and this productivity surprise can act as one of the main drivers for the diffusion of this practice even more after the pandemic.

Yet again, even during pandemic times, there are also opposite findings: using a sample of more than 10,000 professionals working in an Asian IT services company, Gibbs *et al.* (2021) report an approximate 20% productivity decline due to telework during the COVID-19 crisis because of more costly communication and coordination with colleagues. Morikawa (2021) presents an even more negative figure for Japan: productivity fell by more than 30% for employees working from home during the initial stages of the pandemic. The wide range of findings clearly indicates the role of various factors affecting the relationship between telework and productivity, ranging from sectoral specialization, ICT infrastructure but also managerial style and cultural norms.

Building on our previous OECD policy brief (OECD, 2020a), we discuss and synthesise these conflicting factors below. First, the presence of adequate ICT and broadband infrastructures is a prerequisite for the adoption of teleworking arrangements; their quality is likely to be also key for teleworking experience and performance (Bai *et al.*, 2021; ILO, 2020).

Second, telework could directly improve firm performance by raising worker satisfaction through better work-life balance, less commuting (Clark *et al.*, 2019) and fewer distractions at

5. Therefore, workers less concerned with career progression – who may also tend to be less productive – are more likely to select into working from home programmes, which could have contributed to the stigma associated with telework during pre-COVID times.

6. Of course, the global environment was peculiar, unprecedented, and in many aspects detrimental to a good experience: in most cases, childcare was unavailable, and telework was required in an extreme intensity (often at 100%) – rather than chosen voluntarily.

home.⁷ Telework also empowers workers with greater autonomy, which can contribute to lower stress levels (Gajendran & Harrison, 2007). On the other hand, worker satisfaction could also decrease with a high intensity of telework, as workers might feel more isolated, fear lower possibilities for career development, have to work from inappropriate working environments and might not be able to separate anymore work and private life. The balance of these pros and cons thus depends on personal circumstances and preferences as well as on the voluntary nature and the intensity of telework, which explains why it is hard to pin down whether telework, in general, is more positive or negative for mental and physical well-being (Oakman *et al.*, 2020).

Third, telework improves firm performance by reducing capital use (less office space and equipment) – thus raising multi-factor productivity – especially if the savings are directed towards productivity-enhancing investments and reorganisation.

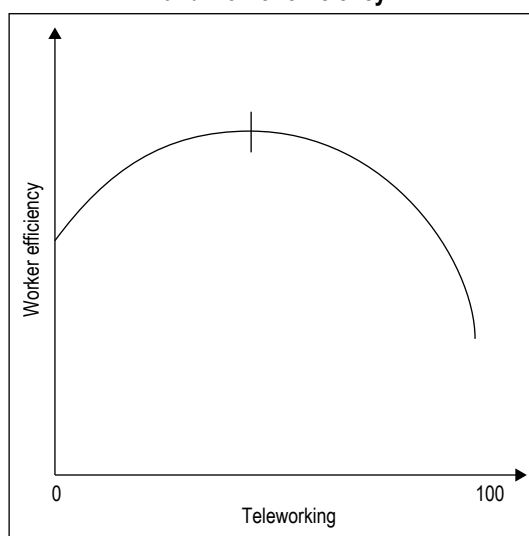
Fourth, by enlarging the pool of workers from which they can draw, firms may achieve a better match between job requirements and worker skills, and can also reduce labour costs. Finally, hiring costs may also decrease if higher worker satisfaction reduces the rate of voluntary quits.

However, telework may decrease the efficiency of workers by reducing in-person interactions with colleagues. The lack of physical proximity hampers communication, knowledge flows within and across firms, and managerial oversight. All these factors have been shown to affect the rate of innovation and knowledge creation (Grossman & Helpman, 1991; Jaffe *et al.*, 1993; Arrow, 1974), especially for creative jobs where information is imperfect, swiftly evolving and not codified (Storper & Venables, 2004). Finally, working from home can have also negative implications for a firm’s engagement with important stakeholders such as clients and suppliers, thereby weakening the overall performance of the company (Hovhannisyanyan & Keller, 2019).

The channel through worker satisfaction and well-being is likely to be key for productivity gains, promising a “double-dividend” for workers and firms alike. The discussion above suggests that telework should ideally be adopted at such intensity that its positive effects on worker efficiency offset the losses. Efficiency gains – and indeed worker satisfaction – may be higher when workers do not telework throughout the whole working week and are free to choose remote work voluntarily.

All in all, this implies an inversely U-shaped relationship between the intensity of telework and efficiency at the worker level – as shown in Figure I – with a “sweet spot” at intermediate levels of telework (Bloom *et al.*, 2021; Kazekami, 2020).⁸ Of course, worker satisfaction – and hence likely performance as well – should rise at all levels of uptake if telework is voluntary, thereby shifting the entire curve upwards (Angelici & Profeta, 2020). An appropriate and reliable ICT infrastructure similarly raises the entire curve at all levels of uptake but can also increase the optimal intensity of telework (move the maximum of the curve rightwards). In any case, the optimal intensity of telework at intermediate levels implies a hybrid working mode (spending some days at the office, some days at home) which poses new challenges for managers related to coordination and communication.

Figure I – Schematic relationship between telework intensity (0-100% of working time) and worker efficiency



Source: See OECD (2020a).

2. The OECD-GFP Telework Survey: Background and Results

2.1. Background: Key Features and Limitations of the Survey

The telework survey of the GFP was launched online in October 2020, consisting of 20 questions with multiple-choice responses (see more details, including the full list of questions,

7. This is most likely to be the case during “normal times”, while the COVID-19 pandemic represents an exceptional situation from many points of view. Studies have confirmed the negative impact of the pandemic per se on mental health and personal satisfaction (e.g. Mata *et al.*, 2021).

8. Developing a general equilibrium model, Behrens *et al.* (2021) confirm the hump-shaped relation between telecommuting and productivity, concluding that production is likely to be maximised when telework takes place at an intermediate level.

in Criscuolo *et al.*, 2021b). One of its key features is its focus on the subjective perceptions and expectations, of both managers and workers. Accordingly, it consists of two separate, complementary questionnaires. The first one was addressed to managers, focusing on the managers' view of the performance of the company and the impact of telework on productivity. The second one asked about the experience of workers and the impact of telework on their well-being.

An important goal when assembling the survey was to achieve broad cross-country coverage. To that end, the questionnaires were distributed online among members of business associations (for managers) and trade unions (for workers), simultaneously in several countries.⁹ Our sample spans 23 OECD countries along with Brazil and Malaysia, based on responses from 1,306 private sector managers and 3,404 workers. Table A1-1 and Table A1-2 in Appendix detail the sectors and the countries sampled in our survey and provide further summary statistics.¹⁰

Among the limitations, we mention the moderate sample size by country. This implies that our results are no substitutes for existing large-scale representative surveys run by statistical agencies (Criscuolo, 2021; Ker *et al.*, 2021; OECD, 2021). Reassuringly, when cross-checking the ranking of countries in more objective measures such as actual telework use we find close results with those more complete sources. Another caveat is the differing sample sizes across countries and the over-representation of larger companies in our sample. This is demonstrated by the generally high median employment (see Appendix, Tables A1-1 and A1-2). To mitigate this issue, we include firm size category fixed effects in regressions to control for size-related differences across firms. We also added country and sector fixed effects to capture potentially sample-driven variations along these dimensions as well. We also carried out robustness checks for our results when excluding the two countries that have the largest representation in the sample (Italy and France, see Online Appendix S1 – link at the end of article), which confirm our main findings.

2.2. Telework Adoption Before and During the COVID-19 Pandemic

First, on average across all countries in our sample, our survey reveals a dramatic increase in the share of regular teleworkers – which are defined as workers working from home at least once per week – from almost 31% before the

pandemic to almost 58% during the first wave (*extensive margin*).¹¹ Telework intensity can be further characterised at the *intensive margin*, that is the intensity of telework at the individual worker level, expressed in the number of days per week. On average, while before the pandemic only 10% of the total workforce worked from home for the entire working week and 13% just one or two days per week, the former increased to 43% during the first wave whilst the latter shrank to only 4%, thus confirming the claim that the surge in telework was almost entirely driven by the “Work-from-Home-Only” workers (Bick *et al.*, 2021).

Around 40% of the total workforce in the knowledge-intensive services sector – which includes highly *teleworkable* activities like IT, finance and other professional and intellectual services – could telework regularly even before the pandemic, compared to only around 15% in the construction and the manufacturing sector (Figure II). This is consistent with important variations across activities in the feasibility of telework (or *teleworkability*, see Dingel & Neiman (2020) and Sostero *et al.* (2020)). The share of teleworkers skyrocketed during the pandemic, and it reached high levels (around 70%) in the sectors more prone to remote work, such as knowledge-intensive services and the public sector.

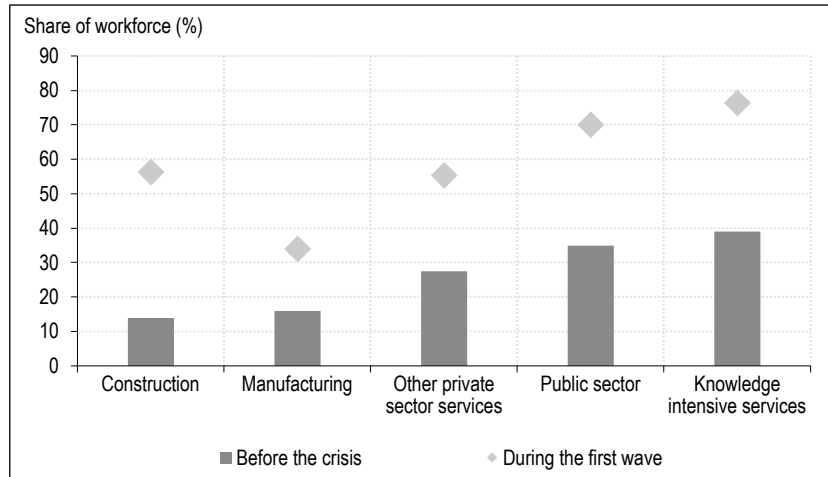
Teleworking arrangements were more common in large companies compared to small ones and that the pandemic maintained this ranking unaltered (Figure III), in line with other recent evidence (Mongey & Weinberg, 2020). More than 30% of workers in large companies could regularly work from home while only less than 20% in a typical small company. During the crisis, these proportions more than doubled. Relying on the European Labour Force Survey, Criscuolo (2021) shows that telework uptake during the crisis was more pronounced amongst large businesses.

9. This was carried out by the Business at OECD (<https://www.businessat-oecd.org/>) and the Trade Union Advisory Committee (<https://tuac.org/>), two international bodies representing the main national business associations and trade unions, respectively.

10. The sample size can vary depending on the question as not all respondents filled up the whole questionnaire.

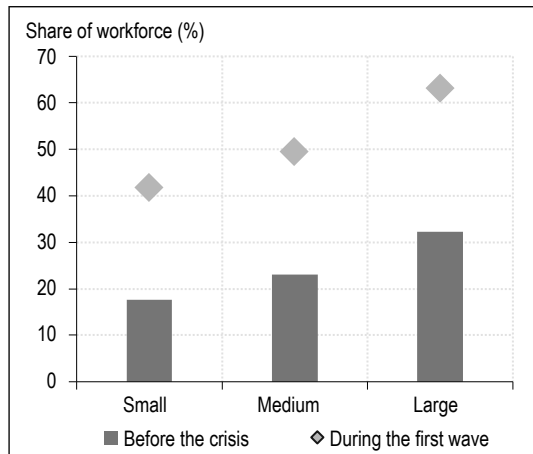
11. Criscuolo (2021) shows that in April 2020 almost 40% of workers in the Euro area teleworked, a figure growing to around 45% by summer 2020. The 2021 OECD Employment Outlook (OECD, 2021) reports overall lower adoption rates during the crisis, but they also find a substantial increase across OECD countries from around 16% of the workforce before the crisis to around 37% during the first wave (April 2020). In the United States, the share of the workforce working from home rose from around 15% before the pandemic to around 50% (Brynjolfsson *et al.*, 2020). Eurofound (2020) documents that during the COVID-19 pandemic approximately 34% of the workforce in the European Union worked exclusively from home.

Figure II – The adoption of teleworking arrangements across sectors



Source and sample: Telework Survey, OECD GFP. Manager and worker sample combined, with 1,440 firm-level observations from workers (averaged by firms if several workers respond from the same company) and 823 managers ("Before the crisis") and 1,449 firm-level observations from workers, 813 from managers ("During the first wave").

Figure III – The adoption of teleworking arrangements across firm size



Source and sample: Telework Survey, OECD GFP. Manager and worker sample combined, with 1,403 firm-level observations from workers and 860 managers ("Before the crisis"); 1,412 observations from workers and 851 from managers ("During the first wave").

To shed light on the role of productivity in allowing firms to adopt telework before and during the crisis, we ran firm-level regressions linking initial productivity levels (measured by

the log of the ratio of sales over the number of employees throughout the paper) to telework adoption at the extensive margin, controlling for size and country-sector fixed effects (Table 1).¹² The relationship was found to be robustly positive and significant, both before and during the crisis, meaning that more productive companies tended to grant regular teleworking arrangements to a larger share of their workforce. Of course, this positive correlation may partly be driven by omitted, unobserved common drivers, notably the adoption of advanced managerial practices. Indeed, the link between advanced management practices and productivity has long been established (see Scur *et al.*, 2021 for a recent and comprehensive review), and the link with telework also seems plausible.¹³ In any

12. To account for some country-wide factors potentially escaping fixed effects, all regressions in Tables 2 to 5 were also ran including controls for country size and level of development (log GDP and log GDP per capita, respectively). The results (which are available upon request) remained unchanged as concerns the key explanatory variables.

13. See Bloom *et al.* (2009), who found that better-managed companies have also better work-life balance practices – which also include home-working entitlements, among other benefits.

Table 1 – More productive firms relied more on telework before and during the crisis

Variable	Adoption rate before the crisis		Adoption rate during the crisis	
	(1)	(2)	(3)	(4)
Log Labour Productivity (Sales/Employment) before the crisis	0.045** (0.015)	0.042** (0.016)	0.057** (0.019)	0.051** (0.018)
Adoption rate before the crisis			0.432*** (0.057)	0.407*** (0.056)
Size FE	No	Yes	No	Yes
Country x Sector FE	Yes	Yes	Yes	Yes
Observations	557	557	554	554
Adjusted R ²	0.257	0.259	0.451	0.469

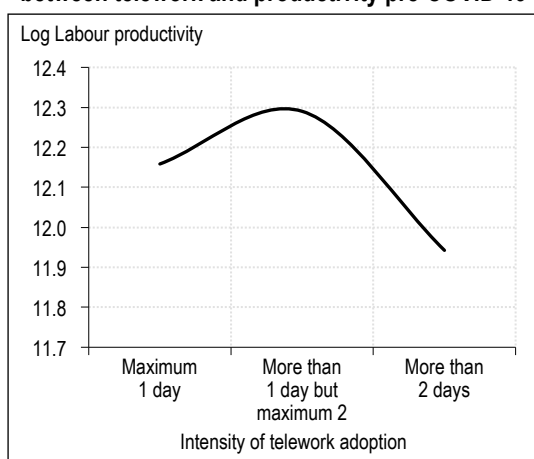
Note: To avoid extreme values in our productivity estimate due to errors or the presence of outliers, we restrict our sample to the core 90% of observations (discarding the top and the bottom 5% of observations). Robust standard errors in parentheses. * p < 0.0/05, ** p < 0.01, *** p < 0.001. Results are robust to excluding country fixed effects and instead controlling for the size and the level of development of countries.

Source: Telework Survey, OECD GFP. Results based on the manager sample.

case, the conclusion from our findings is that high telework adoption and high productivity are clearly not incompatible. Given that more extensive telework, if implemented appropriately, has the potential to raise productivity further, the initial advantage of high productivity firms with telework practices can contribute to a widening of the already large productivity gaps across companies (Syverson, 2011; Andrews *et al.*, 2019; Criscuolo *et al.*, 2021a).¹⁴

Regarding the intensive margin, our survey tends to empirically support an inverted U-shaped relationship between the intensity of telework and productivity during the pre-pandemic era, as argued in Section 1, with the maximum of labour productivity corresponding to companies granting, on average, 1-2 days per week of telework for the typical worker (Figure IV).

Figure IV – A hump-shaped relationship between telework and productivity pre-COVID-19



Note: The figure reports the average labour productivity across companies by number of days teleworked. Source and sample: Telework Survey, OECD GFP. Sample is 557 managers.

2.3. The Experience of Managers and Workers with Telework During the Crisis

During the COVID-19 crisis, about 63% of managers and 74% of workers had an overall positive assessment of their teleworking experience from the point of view of company’s performance and worker’s subjective well-being, respectively (Figure V). On the contrary, just around 12% of workers and 15% of managers report a negative experience during the crisis. Our survey shows that workers provided a remarkably similar average assessment across sectors,¹⁵ while managers in the knowledge-intensive service activities reported a more positive assessment than in other less teleworkable activities, such as construction or manufacturing (see Figure A1-IV in Appendix). Interestingly, firm size seems to matter for both managers and workers, with a more positive experience in large companies (see Figure A1-V in Appendix).

Following Barrero *et al.* (2021), we test whether this positive experience during the pandemic will give rise to more widespread adoption of telework in the future (a “breaking the stigma” type mechanism). We find that a positive assessment provided by managers during the pandemic period is indeed positively correlated with the

14. We also find evidence that the adoption rate of telework before the pandemic is a good predictor of the adoption rate during the first two waves of the pandemic (Table A1-3 in Appendix 1 tests directly this statement, which is also confirmed indirectly in Table 2). This is likely driven by a strong initial fixed cost component of setting up telework arrangements such as investments in ICT, server, clouding, cyber-security software and managerial and soft skills. In firms that have paid those fixed costs, telework more likely remains a common practice.

15. This probably means that responses from less teleworkable sectors came from workers employed in administrative and clerical positions, which could more easily adapt to the new teleworking environment, in line with our previous finding of a relatively high reported telework intensity during the crisis even in these sectors (cf. Figure II).

Figure V – The experience from using telework during the COVID-19 crisis



Source and sample: Telework Survey, OECD GFP. Sample is 901 managers and 2,767 observations for workers.

widespread adoption of telework in the future, even when controlling for adoption rates during and before the pandemic (Table 2).

To confirm this view, we calculate the average desired (by employees) and planned (by employers) level of telework in the future for each different subjective assessment level, from very negative to very positive (Figure VI, Panel A). While managers who had a very negative experience during the pandemic plan to offer regular telework to less than 10% of their workforce, managers with a very positive assessment of the period are keen on granting regular telework to more than 60% of the workforce in their company. Interestingly, the link between

assessment and telework level in the future is less pronounced for workers. Even those who had a very negative assessment and had a very bad experience with telework from the point of view of their satisfaction and well-being think that, in the future, more than 50% of workers will work from home regularly.

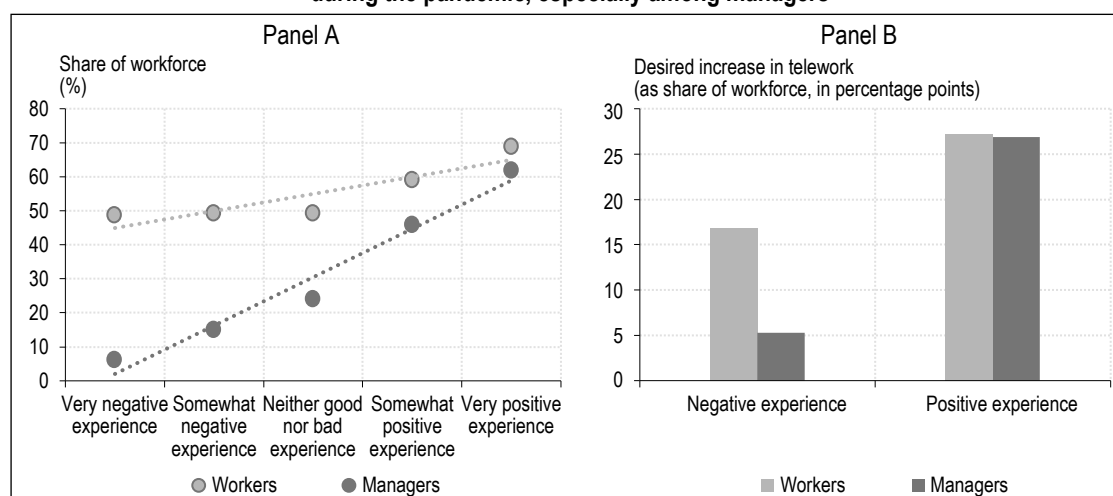
Panel B of Figure VI plots the change in the adoption rate of telework relative to the pre-COVID-19 period that managers (workers) would like to implement (expect to be implemented) as a function of their experience during the crisis. On average, managers and workers who had a very positive or somewhat positive experience during the crisis would like to see an increase in the share

Table 2 – Will the experience during COVID-19 represent a turning point for the future adoption rate of telework?

Variable	Adoption rate in the future					
	(1)	(2)	(3)	(4)	(5)	(6)
Experience during COVID-19*	0.122*** (0.006)			0.057*** (0.007)	0.058*** (0.007)	0.055*** (0.008)
Adoption rate during		0.659*** (0.032)		0.462*** (0.041)	0.388*** (0.042)	0.391*** (0.046)
Adoption rate before			0.633*** (0.035)	0.246*** (0.042)	0.232*** (0.042)	0.238*** (0.044)
Constant	-0.031 (0.022)	0.100*** (0.014)	0.254*** (0.014)	-0.053** (0.020)		
Country FE	No	No	No	No	Yes	No
Sector FE	No	No	No	No	Yes	No
Size FE	No	No	No	No	Yes	Yes
Country x Sector FE	No	No	No	No	No	Yes
Observations	877	877	877	877	877	877
Adjusted R ²	0.210	0.398	0.241	0.470	0.718	0.501

*Indicates the experience of managers with telework during COVID-19 for the performance of the company. Note: Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001. Results are robust to excluding country fixed effects and instead controlling for the size and the level of development of countries. Source: Telework Survey, OECD GFP.

Figure VI – Future telework intensity depends on the experience during the pandemic, especially among managers



Note: Both panels refer to the experience with telework that managers and workers had during the crisis. Source and sample: Telework Survey, OECD GFP. Results based on 843 observations for managers and 2,294 for workers.

of teleworkers by more than 25 percentage points. This figure drops to only 5 percentage points for managers who had a negative experience. As for workers who had a negative experience, they still expect an increase in the adoption rate of telework in the future of about 15 percentage points. Overall, these results are in line with Barrero *et al.* (2021) and with Aksoy *et al.* (2022), who show that expectations for telework intensity after the pandemic are positively related to the productivity “surprise” of telework during the pandemic (defined as the actual experience during the crisis minus *ex-ante* expectation).

Given the importance of the experience managers had during the pandemic for the future of telework adoption, it is crucial to better investigate the causes that contributed to a positive or negative assessment of the period. The experience of managers can indeed be driven by two contrasting sets of factors: (i) those that facilitate and enable the use of teleworking practices and (ii) those that create a barrier and impede a smooth adoption of them. Our survey covers both aspects, as discussed below.

2.3.1. Enabling Factors and Barriers to Telework

The most common adaptive measure introduced by companies was by far the organisation of regular online meetings with colleagues and supervisors, implemented by almost 70% of firms. Moreover, around one-third of firms in our sample have supported workers’ purchases of IT and other office equipment during the pandemic – investments in tangible capital. In addition, 20% of them have provided training to equip managers and workers with the skills to work

remotely – investments in intangible capital. These findings are in line with De Filippis *et al.* (2020) with regards to more online meetings and with Riom & Valero (2020) concerning rising investments in digital technologies during the pandemic.

Among these enabling factors, regular virtual meetings, company support for office equipment, worker and managerial training were found to be significantly linked to the telework experience at the firm level (Table 3). The adoption rate of telework before the pandemic at the firm level, which can be interpreted in this context as a proxy for managerial ability to deal with remote teams, has also played a positive role regarding the experience during the crisis (see also Bai *et al.*, 2020). Among the impeding factors, telework experience is negatively affected by poor ICT infrastructure quality, the simple unfeasibility of carrying out from home the tasks performed in the company and, to a lesser extent, concerns about firm performance (Table 4).

2.3.2. Advantages of Telework: Contrasting the Views of Managers and Workers

To explore further what lies behind the positive experience by managers and workers, Figure VII highlights the most important perceived benefits from telework for managers (panel A) and workers (panel B).

More than 60% of managers in our sample believe that, despite the challenging and certainly not ideal environment, the productivity of their workers increased because of telework (because workers are more concentrated and commit fewer errors at home). This result echoes other

Table 3 – Adaptive measures are positively linked to telework during the crisis

Variable	Managers’s assessment of the impact of telework on the performance of the company during the pandemic			
	(1)	(2)	(3)	(4)
Organising regular online meetings	1.24***(0.11)	1.08***(0.11)	0.95***(0.11)	0.86***(0.12)
Supporting purchase of IT and office equipment	0.55***(0.09)	0.53***(0.09)	0.49***(0.09)	0.48***(0.09)
Refurbishing office spaces	0.11 (0.09)	0.16 (0.09)	0.04 (0.09)	-0.01 (0.09)
Provide training	0.39***(0.10)	0.29** (0.09)	0.24** (0.09)	0.25** (0.09)
Adoption rate of telework pre-pandemic		0.95***(0.13)	0.84***(0.13)	0.84***(0.13)
Constant	2.05***(0.10)	2.00***(0.10)		
Country FE	No	No	Yes	No
Sector FE	No	No	Yes	No
Size FE	No	No	Yes	Yes
Country x Sector FE	No	No	No	Yes
Observations	877	877	877	877
Adjusted R ²	0.24	0.27	0.86	0.88

Note: Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001. Results are robust to excluding country fixed effects and instead controlling for the size and the level of development of countries.

Source: Telework Survey, OECD GFP.

Table 4 – The importance of impeding factors for teleworking experience during the crisis

Variable	Managers's assesment of the impact of telework on the performance of the company during the pandemic			
	(1)	(2)	(3)	(4)
Legal barriers		0.06 (0.04)	0.03 (0.04)	0.02 (0.04)
Lack of health and safety regulation		0.09 (0.05)	0.10* (0.05)	0.08 (0.05)
Physical presence is required		-0.23*** (0.04)	-0.20*** (0.04)	-0.19*** (0.05)
Management is not familiar		0.05 (0.05)	0.02 (0.05)	0.03 (0.05)
Monitoring workers is difficult		-0.07 (0.04)	-0.08 (0.05)	-0.08 (0.05)
Lacking ICT infrastructure		-0.22*** (0.06)	-0.21*** (0.06)	-0.20** (0.06)
No appropriate home-working environment		0.03 (0.05)	0.06 (0.05)	0.02 (0.06)
Concerns about firm performance		-0.12* (0.05)	-0.13** (0.05)	-0.10 (0.05)
Adoption rate of telework before the crisis	1.56*** (0.12)	0.90*** (0.14)	0.82*** (0.15)	0.81*** (0.14)
Constant	3.01*** (0.06)	4.73*** (0.23)		
Country FE	No	No	Yes	No
Sector FE	No	No	Yes	No
Size FE	No	No	Yes	Yes
Country x Sector FE	No	No	No	Yes
Observations	877	546	546	546
Adjusted R ²	0.10	0.24	0.89	0.91

Note: Robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001. Results are robust to excluding country fixed effects and instead controlling for the size and the level of development of countries.
Source: Telework Survey, OECD GFP.

surveys that focus mainly on the US scenario (Barrero *et al.*, 2021; Bartik *et al.*, 2020; Ozimek, 2020) as well as in cross-country settings (Aksoy *et al.*, 2022). Moreover, 57.5% of the managers in our sample believe that workers work more because of the time saved on the commute.¹⁶ Productivity can also be enhanced if companies save on unnecessary expenses and divert these savings on investments and innovation, enlarge the pool of workers from which they can choose and upskill the workforce by hiring new talents: more than half of managers in our sample believe all these factors are potential advantages of teleworking. Our survey reveals that the more managers perceived the top four advantages brought about by telework to be present in their company, the more likely they are to introduce telework in their company at the extensive margin (Figure VIII).

Turning to the point of view of workers, the saving on commuting costs and time is perceived as the crucial advantage of telework by almost 90% of workers in our sample (Figure VII, Panel B). Commuting is deemed very expensive (between 2.4% and 4.8% of the United States GDP according to Redding & Turner (2015)) and very unpleasant (Kahneman *et al.*, 2004). Also, telework allows to better work on tasks that require concentration according to around 85% of respondents. More than 80% of workers in our sample believe that a higher flexibility in working hours is another advantage, while 75% consider that the flexibility in choosing

where to live is also one. Finally, more than 80% of workers in our sample believe that another important advantage provided by telework is the possibility to accommodate other competing household duties.

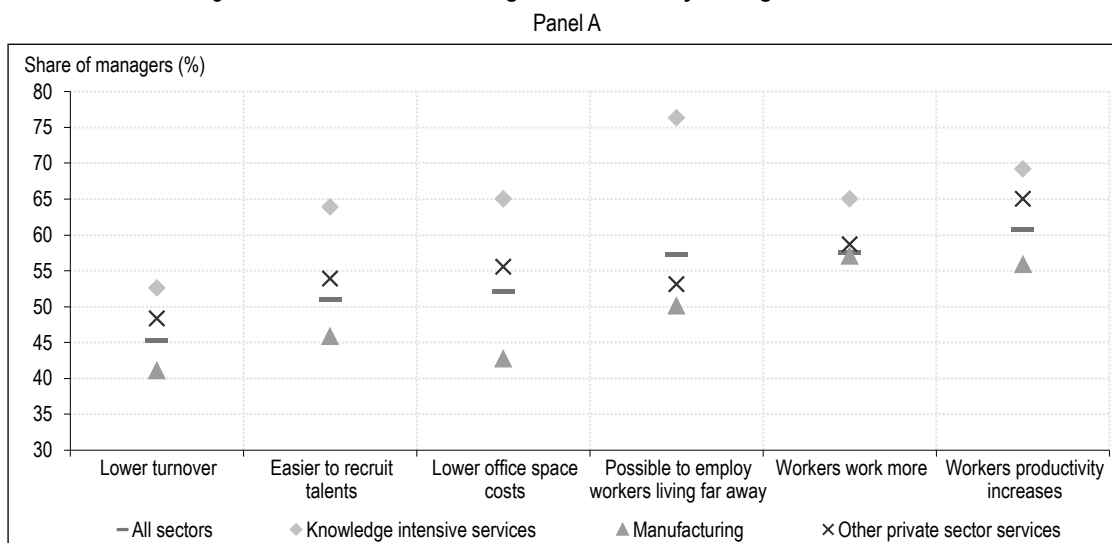
2.3.3. Disadvantages of Telework: Contrasting the Views of Managers and Workers¹⁷

As for the downsides, more than 75% of managers in our sample fear that an excessive level of working from home could decrease the collaboration between team members, thereby hampering firm-level productivity growth in the long run. Also, 73% of managers believe that corporate culture and the identification of workers with the company's beliefs may be jeopardized if workers do not come to the office or company's premises. Moreover, around 70% of managers believe that training staff in a teleworking environment is more difficult and that employees learn less on the job. More than 60% of managers in our sample think that the teleworking environment is less innovative and creative. As many new innovative ideas and collaborations often come out from informal discussions with colleagues in the same firm or

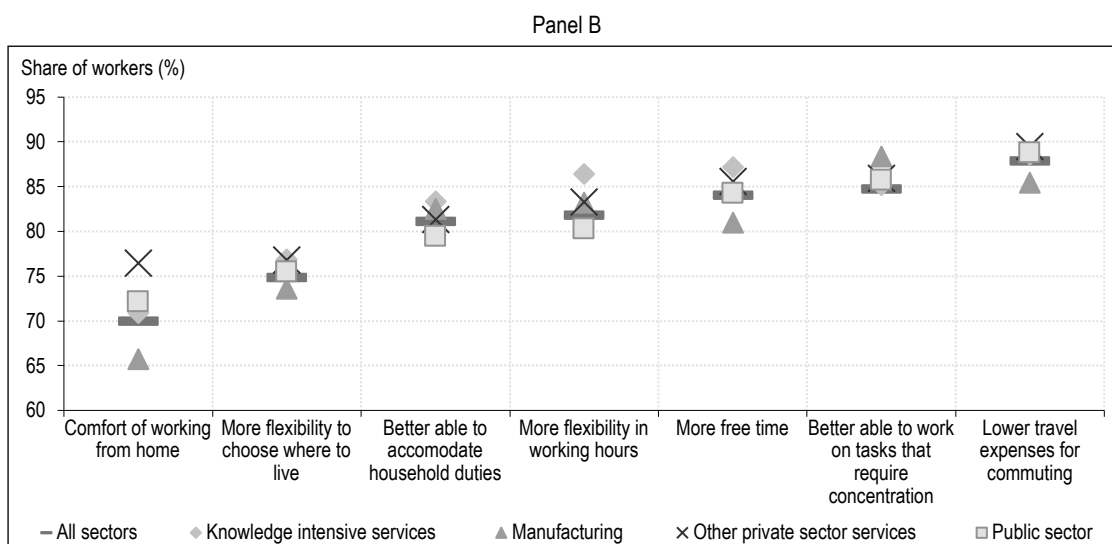
16. In practice, to the extent that hours worked are unrecorded during telework, managers may of course find it hard to disentangle what fraction of productivity increases come from increased hourly productivity or from more hours worked.

17. Differences across sectors were found to be rather small, hence the text focuses on the results for all sectors.

Figure VII – Perceived advantages of telework by managers and workers



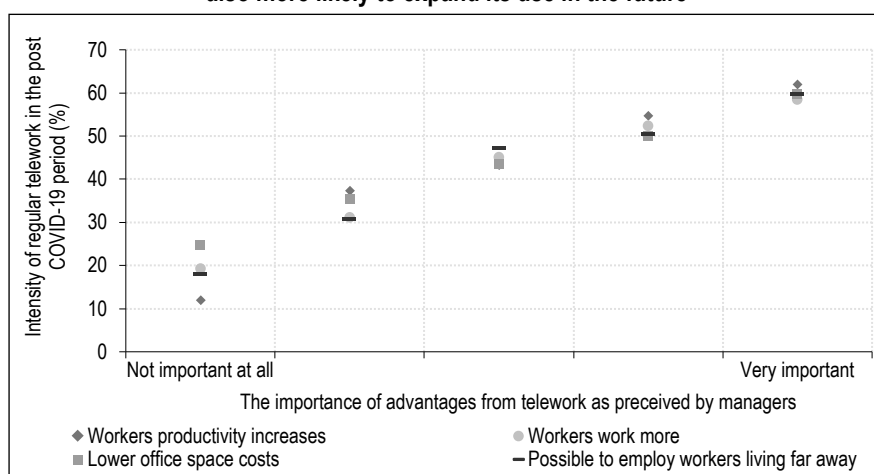
Note: Share of managers mentioning these upsides as very important, important or somewhat important.



Note: Share of workers mentioning these upsides as very important important or somewhat important.

Source and sample: Telework survey, OECD GFP. Sample is 795 managers (Panel A) and 2,486 workers (Panel B).

Figure VIII – Managers who perceive telework benefits as more important are also more likely to expand its use in the future



Note: The X-axis represents the managers' evaluation of the benefits of telework on a scale from 1 (not important at all) to 5 (very important) – See Online Appendix S2.

Source and sample: Telework survey, OECD GFP. Sample is 767 managers.

with peers working in other similar companies, the lack of these opportunities may harm innovation and productivity growth in the long run (Crisciolo, 2021; OECD, 2020a). The risk of cyber-attacks was considered a serious disadvantage of telework by around 60% of managers in our sample. Finally, the fear that employees might work fewer hours received the lowest response, below 50%.

Looking at the downsides from the perspective of workers' wellbeing, more than 80% of workers in our sample fear the lack of social interactions and the fusing of work and private life as the main downsides of telework. This resonates well with insights from management literature (Mazmanian *et al.*, 2013; Barley *et al.*, 2011). Working from uncomfortable spaces and for longer hours, which are perceived as important disadvantages by around 70% of workers in our sample, may also contribute to stress and reduced wellbeing. Additionally, around 60% of workers highlight the risk of difficult worker representation and advice from team members. We find that around 60% of them feel to be distracted by other competing household duties. Finally, very few workers in our sample foresee the risk of lower visibility and lower chances of career advancement (at least in the short run), despite previous evidence from the literature documenting negative effects in the long run (Emanuel & Harrington, 2021).¹⁸

2.4. Expectations About Telework Post-COVID-19: How Much and in What Ways?

Focusing on the expected change at the extensive margin reveals that around 40% of managers

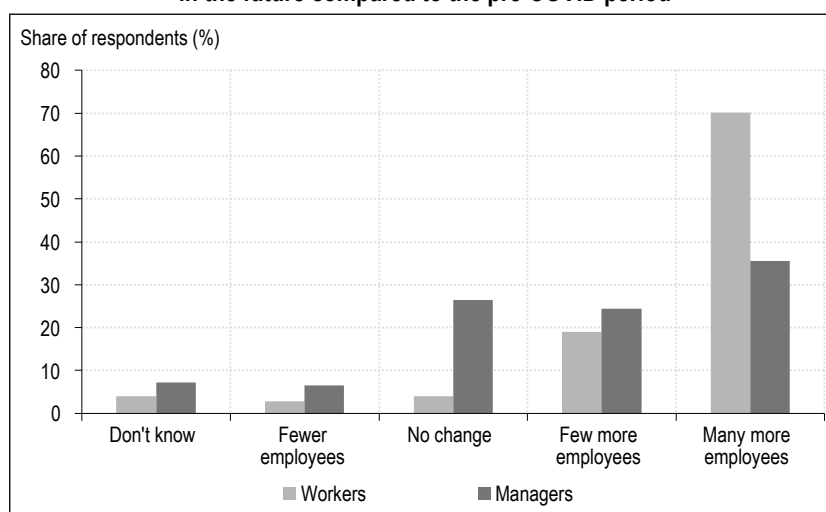
and 70% of workers foresee many more workers teleworking from home in the future compared to the pre-pandemic period (Figure IX). Only 6% of managers and 4% of workers forecast a lower adoption rate of telework in the future than previously. Company leaders also think that the ideal level of telework is somewhere between the pre and during pandemic levels, though closer to the latter: while only slightly more than 20% of workers in the manufacturing and the construction sectors (likely those in clerical and administrative positions) will work from home in the future, about 70% of workers in the knowledge-intensive services sector will have this possibility (Figure X).¹⁹

Turning to the intensive margin, the preferred teleworking mode from the point of view of the company's performance – as indicated by managers – is hybrid, with 2-3 days teleworking (Figure XI-A and Figure XI-B). Only around 13% of the workforce in the knowledge-intensive service sector could completely work from home (i.e. five days per week) in the future. This figure drops to less than 5% in all the other sectors. Large companies will likely allow regular telework to almost 50% of their total workforce, about 20 percentage points more than small or medium-sized companies. Given that managers were asked to provide the ideal distribution of workers doing telework from the point of view of the overall performance of the company, these findings confirm the hypothesis that the combination that is

18. Responses on the downsides were found to be relatively similar across sectors, both for managers and workers.

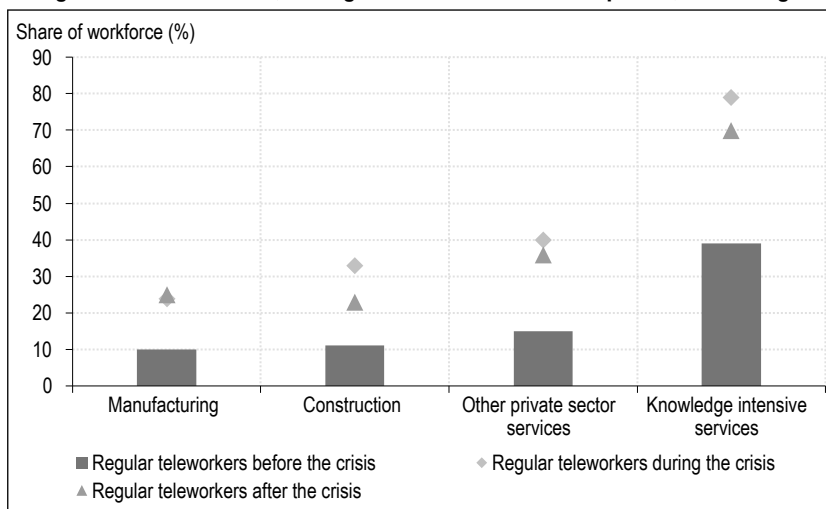
19. Altig *et al.* (2020) report, using US survey data, that work-from-home will triple, from 9.7% to 27% of the workforce.

Figure IX – Both managers and workers expect more widespread telework in the future compared to the pre-COVID period



Source and sample: Telework survey, OECD GFP. Number of observations are 866 Managers and 2,516 Workers.

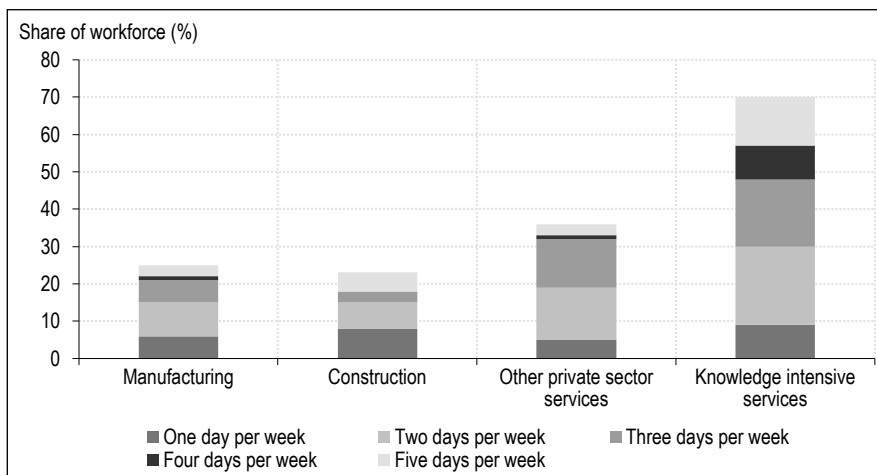
Figure X – Regular telework before, during and after the COVID-19 period, according to managers



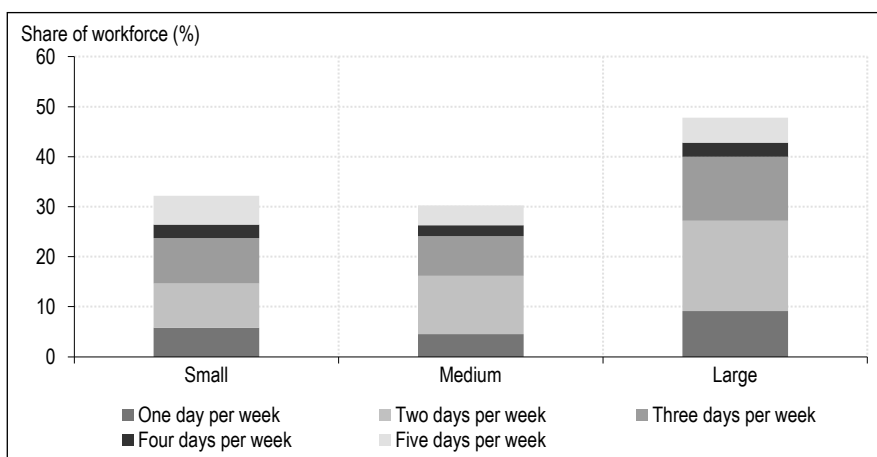
Source and sample: Telework survey, OECD GFP. Sample is 823 managers (“Before the crisis”); 813 managers (“During the first wave”); 797 managers (“After the crisis”).

Figure XI – Desired adoption rate of telework at the intensive margin

A – Sector



B – Size



Source and sample: Telework survey, OECD GFP. Sample 797 managers (Panel A) and 831 managers (Panel B).

expected to maximise firm productivity involves hybrid teleworking. Even though in the pre-pandemic period the relationship peaked around

1-2 working days (cf. Figure IV), the positive experience during the large scale telework adoption could easily have raised the number

of days at the peak, moving the top of the curve to the right.²⁰

Comparing managers' and workers' expectations, their expectations about the future share of telework differ, with workers being more drastic than managers (Figure XII). However, both agree on considering hybrid teleworking (around 2-3 days per week) most desirable. For instance, managers consider that 42% of the workforce should have teleworking arrangements, but only 5% works completely from home, 22% two or three times per week and 7% less than once per week (irregular teleworkers).

To better accommodate telework, managers (38%) foresee and workers (50%) desire that teams' schedules should be coordinated, meaning that during office days teams should meet (Figure XIII). While keeping the advantages of telework – in terms of higher flexibility and lower costs – this measure could be helpful to maintain appropriate knowledge flows within each team and allow team members to learn and

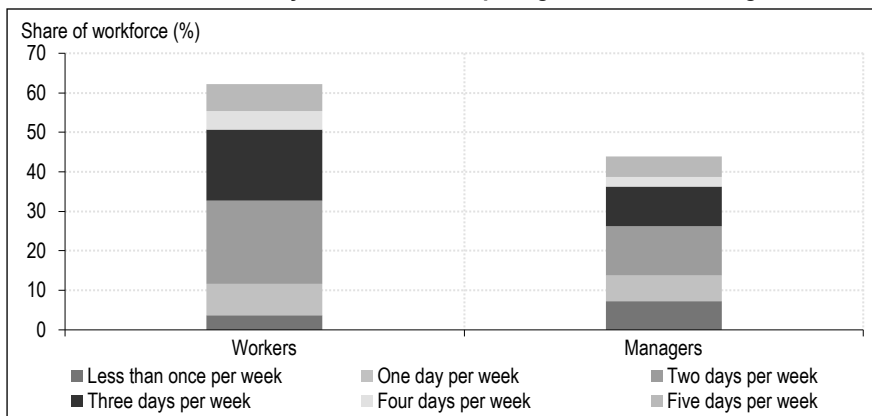
socialise – and mitigate the most salient risks of telework coming from isolation and lack of team engagement, both from the managerial and worker point of views.²¹

Notwithstanding the efforts made during the pandemic, more than half of workers (30% of managers) think companies should invest more in the provision of ICT equipment. Additionally, more than 30% of workers (20% of managers) wish to see introduced technical training on ICT as well as soft skill training for both executives and employees on how to manage remote teams and how to work independently from home. Interestingly, firms that were initially more productive are also more likely to introduce these measures (Figure XIV), risking to increase

20. Unfortunately, we do not have information on productivity during and post-pandemic to fit the hump-shaped inverted-U relationship.

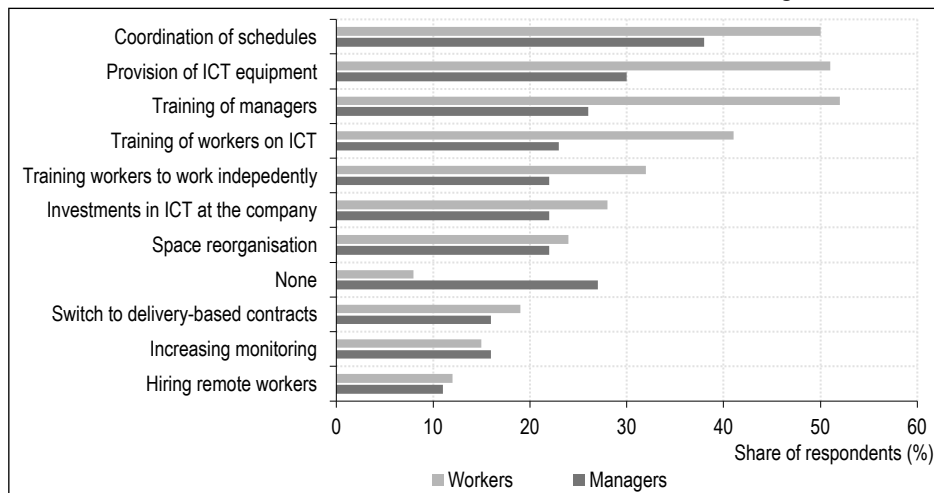
21. Previous evidence supports the relevance of these concerns: Jaravel et al. (2018) establish the relevance of team-specific capital that results from tight-knit teams. Agrawal et al. (2008) show that spatial and social proximity increase the probability of knowledge flows between individuals.

Figure XII – The desired intensity of telework: comparing the views of managers and workers



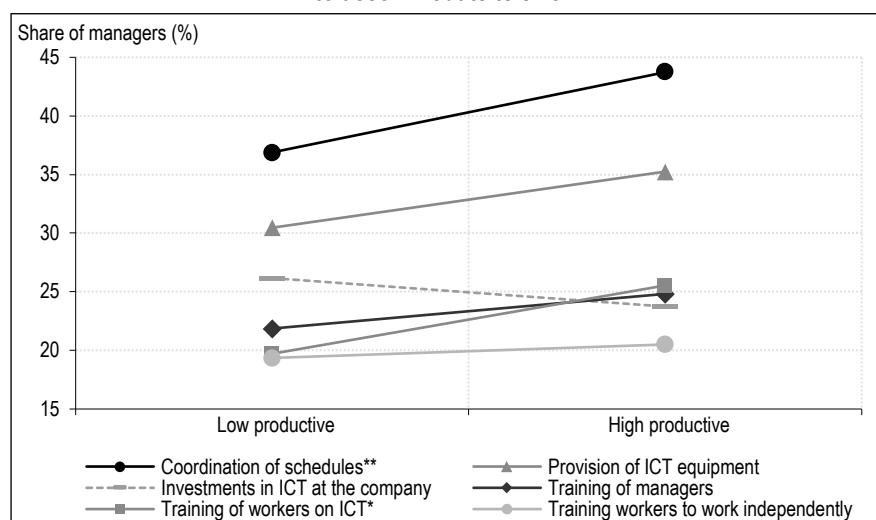
Source and sample: Telework survey, OECD GFP. Sample is 890 managers and 2,386 workers.

Figure XIII – Additional measures that workers and managers feel the need to introduce in the future to better accommodate teleworking



Source and sample: Telework survey, OECD GFP. Sample is 1,009 managers and 2,654 workers.

Figure XIV – Initially more productive firms tend to envisage more adaptive measures to accommodate telework



Note: Low productive firms are in the bottom 50% of the productivity distribution, high productive firms in the top 50%. * and ** indicate that the difference between high and low productivity firms is statistically significant at 5% or 1%, respectively, after controlling for country x sector fixed effects. See more details in Appendix Table A1-4.

Source and sample: Telework Survey, OECD GFP. Sample is 537 managers.

performance gaps with less productive firms even further.²²

Less than 20% of managers and workers plan or desire to change the contractual structure of the work relation introducing delivery-based instead of hour-based agreements. Just around 15% of managers and workers would like to introduce/see introduced in the future new technologically advanced ways to better monitor employees' activity. Consistently with the conclusion that telework in the future will rarely be carried out five days per week, only around 11% of managers want (and 12% of workers would like) to hire fully remote workers.

* *
*

Within the data limitations mentioned earlier, this article brings significant contributions to the discussion on the future of labour markets after the COVID-19 pandemic. If the telework "revolution" spurred by COVID-19 carries the persistent effects we documented in this paper, its implications could be far reaching, carrying consequences not only for productivity but also in an array of other fields.

Given that not all occupations and sectors are equally amenable to teleworking, the move towards more teleworking can exacerbate existing inequalities along several dimensions, such as firm size and sector; the income and skill levels of workers (see Adams-Prassl *et al.*, 2020a, 2020b;

Bartik *et al.*, 2020; Dingel & Neiman, 2020; OECD, 2021; Sostero *et al.*, 2020). Moreover, within those who can possibly telework, additional inequalities may stem from the housing conditions under which telework takes place – indicated by workers to be an important factor. Another crucial dimension of heterogeneity is initial firm productivity: more productive firms, with better managers and more skilled workers, seem to be better placed to reap the productivity advantages of telework, and this may contribute to increasing the gap with less productive firms.

Telework may also have significant implications for cities and the geographic concentration of economic activity. OECD (2020b) documents the *teleworkability* of cities and finds that capital cities have the highest potential for teleworking. It also showcases the presence of an urban-rural gap insofar as telework is generally easier in more densely populated areas, partly thanks to better quality internet connections (broadband) (Criscuolo, 2021). Drawing on our survey evidence, we do not predict a mass shift of workers from city centres to distant rural areas given that telework will in most cases not be carried out on a full-time basis (Davis *et al.*, 2021). Instead, it is more likely that many workers will move from expensive and overcrowded areas in city centres to the outskirts and suburbs, thus creating a sort of "doughnut effect" (Ramani & Bloom, 2021) and leading to a hybrid working mode. □

22. The only exception is "ICT investments at the company", of which the less productive firms plan to carry out more.

Link to the Online Appendix:

www.insee.fr/en/statistiques/fichier/7647321/ES539_Criscuolo-et-al_Online-Appendix.pdf

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APPENDIX

ADDITIONAL TABLES AND FIGURES

Table A1-1 – Observations and median employment by sector

Sector	Total observations (1)	Of which: Managers (2)	Of which: Workers (3)	Median nb. employees of the firm (4)
Construction	122	53	69	273
Knowledge-intensive services	563	173	390	500
Manufacturing	778	452	326	252.5
Other private sector services	365	150	215	245
Public sector	498		498	1,000
Sector unavailable	2,384	478	1,906	
All	4,710	1,306	3,404	

Note: In each column the number of observations includes all responses to the question about the sector he/she works in.
Source: Telework Survey, OECD GFP.

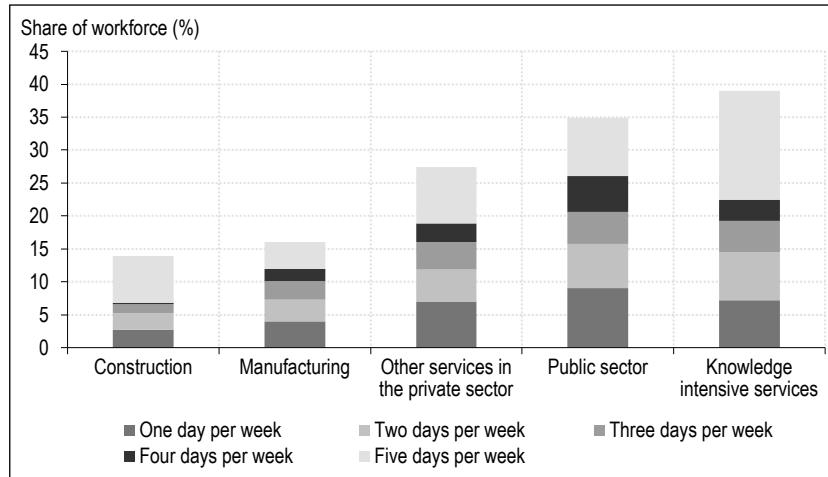
Table A1-2 – Observations and median employment by country

Country	Total observations (1)	Of which: Managers (2)	Of which: Workers (3)	Median size (employees) (4)
Australia	23		23	26
Austria	18		18	3,000
Belgium	610		610	500
Brazil	87	87		140
Colombia	11	11		600
Costa Rica	29	29		700
Denmark	12		12	75
Finland	66		66	750
France	1,234		1,234	2,800
Germany	387	44	343	1,000
Greece	72	72		200
Hungary	33		33	80
Ireland	88		88	450
Italy	844	686	158	80
Japan	174	42	132	1,100
Luxembourg	44		44	500
Malaysia	240	123	117	108
Netherlands	58		58	597.5
New Zealand	77		77	225
Portugal	147	79	68	111
Spain	324	83	241	600
Sweden	38	28	10	212.5
Switzerland	18		18	1,000
United Kingdom	54		54	400
United States	22	22		1,200
All	4,710	1,306	3,404	

Note: A total of 4,181 answers from workers, including responses from multiple workers in the same companies, were received. To equalise the weight of each company, we average across multiple observations (workers) coming from the same company for the question that refer to more factual, objective issues; whereas for those that reflect subjective views (experience, expectations), each response by workers counts equally (in particular, in Figures V-VI-VII, IX, XII-XIII in the main text and Figures A1-II-III-IV in the Appendix). All observations were associated with a specific country since this information could be retrieved from the associated IP code whenever the respondents did not supply the country where they were located.

Source: Telework Survey, OECD GFP.

Figure A1-I – Adoption rate of telework before the crisis at the intensive margin



Source and sample: Telework Survey, OECD GFP. Sample is 1,440 firm-level observations from workers (averaging answers of workers coming from the same firm); 823 managers.

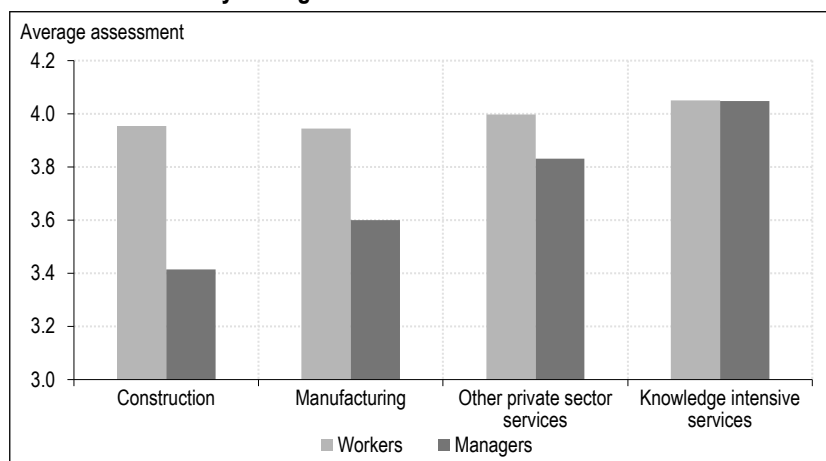
Table A1-3 – The persistence of telework adoption at the firm level before and during COVID-19

First Wave (Dependent Variable: Adoption rate of telework during the first wave)					
Variable	(1)	(2)	(3)	(4)	(5)
Adoption rate of telework before the crisis	0.51*** (0.01)	0.44*** (0.02)	0.44*** (0.02)	0.48*** (0.01)	0.40*** (0.02)
Constant	43.17*** (0.92)				
Country FE	No	Yes	No	No	No
Section FE	No	No	Yes	No	No
Size FE	No	No	No	Yes	No
Country x Sector FE	No	No	No	No	Yes
Observations	3,067	3,067	3,067	3,067	3,067
Adjusted R ²	0.23	0.76	0.77	0.75	0.79
Second Wave (Dependent Variable: Adoption rate of telework during the second wave)					
Variable	(1)	(2)	(3)	(4)	(5)
Adoption rate of telework before the crisis	0.58*** (0.01)	0.50*** (0.02)	0.53*** (0.01)	0.55*** (0.01)	0.47*** (0.02)
Constant	35.75*** (0.90)				
Country FE	No	Yes	No	No	No
Section FE	No	No	Yes	No	No
Size FE	No	No	No	Yes	No
Country x Sector FE	No	No	No	No	Yes
Observations	3,067	3,067	3,067	3,067	3,067
Adjusted R ²	0.29	0.75	0.75	0.75	0.76

Note: Robust standard errors in parentheses. * p < 0.05 ** p < 0.01, *** p < 0.001.

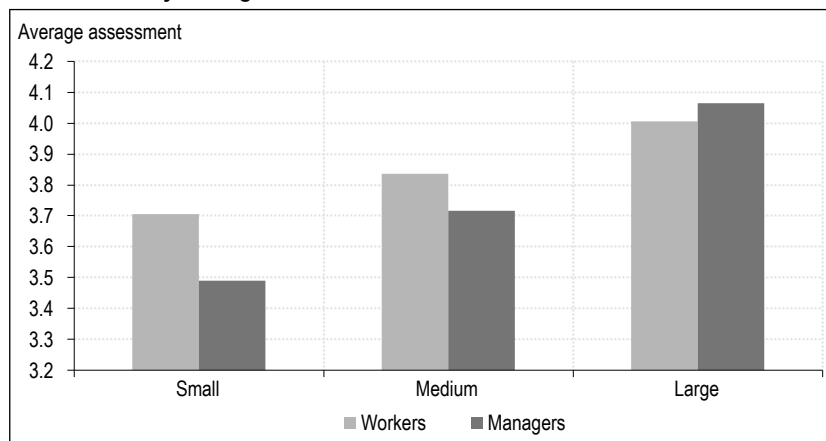
Source: Telework Survey, OECD GFP. Manager and worker sample combined, workers averaged by firms if several workers respond from the same company.

Figure A1-II – Assessment of the teleworking experience during the COVID period by managers and workers for each sector



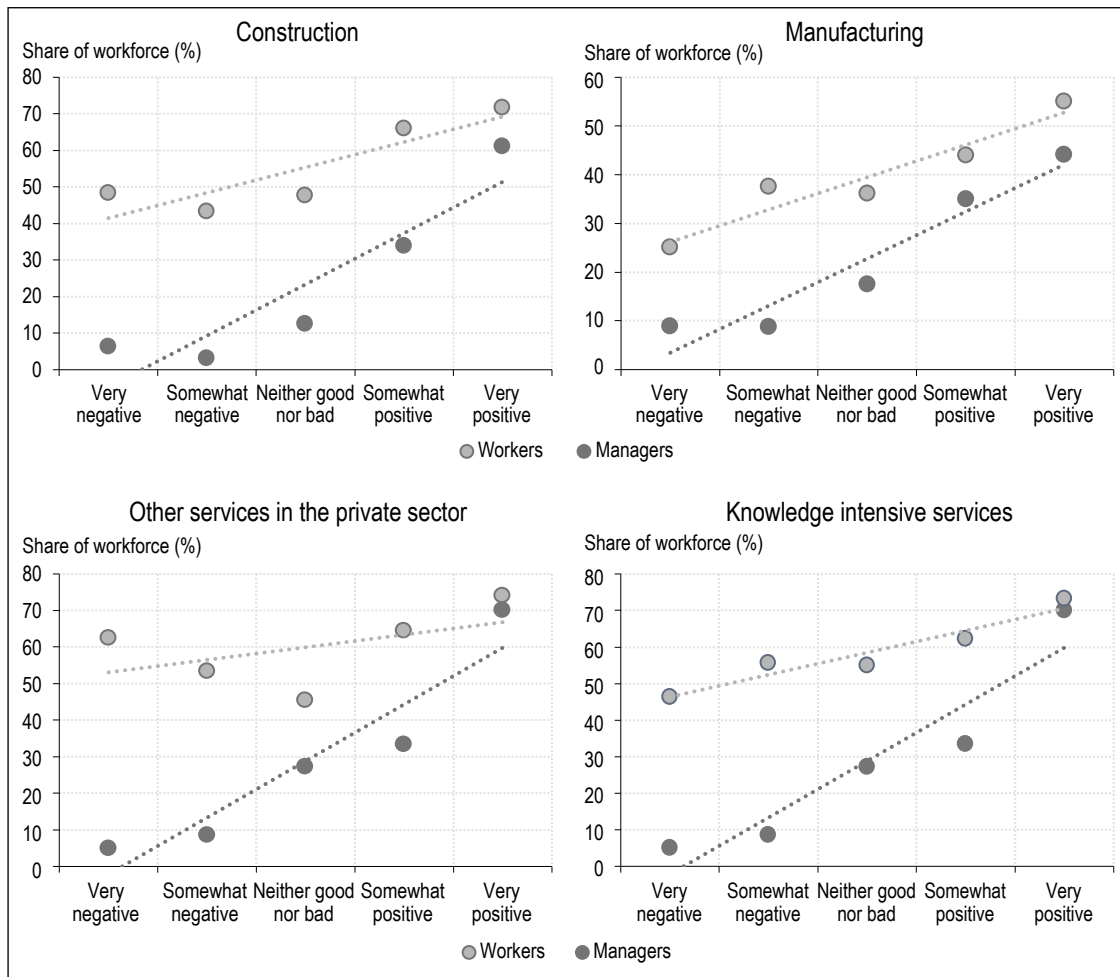
Note: Average assessment measured on a scale from 1 (very negative assessment of the period) to 5 (very positive assessment of the period). Source and sample: Telework Survey, OECD GFP. Sample is 1,353 workers and 725 managers.

Figure A1-III – Assessment of the teleworking experience during the COVID period by managers and workers for each different firm size



Note: Average assessment measured on a scale from 1 (very negative assessment of the period) to 5 (very positive assessment of the period). Source: Telework Survey, OECD GFP. Sample is 1,989 workers and 756 managers.

Figure A1-IV – Relation between assessment during the pandemic and desired adoption rate of telework after the pandemic, by sector



Source and sample: Telework Survey, OECD GFP. Sample is 750 managers and 1,326 observations for workers.

Table A1-4 – Robustness of the relation between productivity level (measured as revenues per employee) and future organisational changes

Variable	Coordination of schedules	Training of workers on ICT	Train workers to work independently	Training of managers	Provision of ICT equipment	Investments in ICT at the company
Log Labour Productivity (Sales/Employment) before the crisis	0.42** (0.14)	0.36* (0.15)	0.22 (0.16)	0.16 (0.15)	0.18 (0.14)	-0.12 (0.14)
Country x Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	524	514	523	532	529	525
Pseudo R ²	0.07	0.05	0.08	0.08	0.05	0.05

Note: Logistic regression results, with robust standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.
Source: Telework Survey, OECD, GFP, the sample of managers.