

ARTICLE TEMPLATE

WFH and broadband speed (title needs rework)

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ARTICLE HISTORY

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ABSTRACT

TBC

KEYWORDS

covid; internet; working from home; broadband speed; time series clusters

1. Introduction

our Google doc

During the pandemic, working from home using Information and Communication Technologies (ICT), whether partially or exclusively, was transformed from a niche means of accessing work, albeit one that had been on a slow, upward trend, to a widespread way of life in many countries. The ability to work from home or telecommute meant millions retained their jobs and, to a varying extent, maintained productivity during periods of strict lockdown around the world. However, this ability was not evenly distributed socially or spatially, creating a new type of digital divide – one of economic resilience and personal safety on one side and unemployment or essential front-line work on the other. The ability to telecommute is partly a product of whether the majority of work tasks in an occupation can be performed independently of being in a particular location or co-locating with colleagues. It is also a product of the quality of ICT services, particularly home internet connections, sufficient to successfully complete work tasks with a minimum of delay or interruption. Therefore, in this paper, we look at patterns of broadband speed tests and upload speeds in the UK in order to gain insights into both the quality and reliability of broadband services across the country and the distribution of telecommuting at the time when the population were told to work from home if possible. To do so, we employ unique data regarding individual broadband speed tests and state of the art time series clustering methods. Our analysis enables us to better understand how telecommuting and technology intersect at a time of extreme demand, and what lessons this time has for a future where telecommuting is likely to remain a common means of accessing work and broadband services, as well as infrastructure, must be fit for purpose. **I THINK WE NEED A MORE CLEAR RESEARCH QUESTION**

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The shift towards telecommuting during various stages of lockdown around the world has been drastic and, importantly, speculations indicate that the post-Covid tendency to work from home will be much higher than the pre-Covid one. A back of the envelope calculation suggests that up to 40% of the working force could work from home in the UK (Batty 2020). Observational data pointed an even higher share of people in employment in the UK who worked from home in April 2020 (47%), while the same figure only reached 5% the year before (ONS 2020a,b). Similar figures have been reported for other countries around the world (Felstead and Reuschke 2020). For instance, 37% of the workforce worked from home in Europe in April 2020 with countries like Finland reaching 60% (Eurofound 2020). In the US almost half of the working population worked from home during the same period because of the pandemic (Brynjolfsson et al. 2020). More broadly, a recent estimate indicated that 37% of all jobs in the US can be permanently performed entirely from home (Dingel and Neiman 2020).

There is a consensus that opportunities for working from home especially during the current pandemic are not equally spread across the workforce. Dingel and Neiman (2020) indicated that in the US managers, educators, as well as those working in computer-related occupations, finance, and law can easily work from home. On the contrary, workers in farming, construction, and manufacturing do not have such opportunities. Not surprisingly, occupations with opportunities to telecommute are associated with higher earnings. This is not the case for the workforce occupied in less footloose occupations as they tend to be lower-income, non-white, without a university degree, live in rental accommodation and lack health insurance (Mongey, Pilossoph, and Weinberg 2020). Although these figures refer to the US, similar trends can be observed for other countries. For example, 75% of workers with tertiary education worked from home in Europe during spring 2020, while the same share for workers with secondary and primary education dropped to 34% and 14% respectively. Moreover, employees living in cities, women and younger employees were have worked from home (Eurofound 2020).

None of these changes could have happened in the absence of ICT infrastructure – both in terms of software and hardware. But while innovations in software are easily diffused across space and society¹, the same does not apply for ICT hardware infrastructure such as internet broadband connectivity. The literature exemplifies digital divides in terms of internet access and its quality. For instance, Riddlesden and Singleton (2014) highlighted the broadband divides in the UK, while the systematic review from Saleminck, Strijker, and Bosworth (2017) reinforced our understanding for the infrastructure quality differences between urban and rural areas.

Our framework to understand telecommuting as a function of occupations and quality of ICT infrastructure is aligned with current debates on digital divides. While the, so-called, first level digital divides are associated with access and quality of internet connectivity, the second level ones are linked to the necessary skills to effectively utilise ICT and the internet (Blank and Groselj 2014; Van Deursen and Van Dijk 2011). Importantly, the differentiated capacity to telecommute, which to a certain extent are related to the first and second level digital divides, leads to differentiated outcomes regarding the economic resilience of people and places against the current pandemic. And to the extent that the quality of the internet infrastructure and occupation variation are spatially dependent and clustered in space, the spatial footprint of telecommuting is of great interest. In a way similar to the third level digital divide,

¹See for example the huge success of videoconferencing apps (Marks 2020).

which focuses on the differentiated returns of internet use (Stern, Adams, and Elsasser 2009; Van Deursen and Van Dijk 2014; Van Deursen and Helsper 2015) places with high rates of telecommuting during the Covid pandemic illustrate higher economic resilience against the current pandemic. This is aligned with the regional economic resilience literature, which underlines the differentiated capacity of cities and regions to escape or recover from economic crises (Martin 2012; Kitsos and Bishop 2018).

The long-term effects of such drastic changes in telecommuting and attitudes towards working from home are difficult to predict. Nevertheless, they might span through various aspects of economy and society: from changes to transportation planning due to changes in commuting patterns to changes in land use and urban planning to accommodate people who work from home (Budnitz, Tranos, and Chapman (2020)); and from productivity and innovation changes to a change in agglomeration externalities and the attraction of large cities (Nathan and Overman 2020) just to name a few. This paper is positioned to support such endeavours by providing an explanatory [NOTE SURE ABOUT THIS] framework based on the quality of internet connectivity and the frequencies of occupations within Local Authorities in the UK.

MORE SOURCES:

- <https://www.coronavirusandtheeconomy.com/question/why-has-coronavirus-affected-cities-more-rural-areas>
- EPB commentaries
- <https://www.coronavirusandtheeconomy.com/question/what-has-coronavirus-taught-us-about-working-home>
- <https://www.coronavirusandtheeconomy.com/question/who-can-work-home-and-how-does-it-affect-their-productivity>
- <https://www.coronavirusandtheeconomy.com/question/how-will-economic-effects-coronavirus-vary-across-areas-uk>
- <https://www.coronavirusandtheeconomy.com/which-parts-uk-have-been-hit-hardest-covid>
- <https://www.coronavirusandtheeconomy.com/question/why-has-coronavirus-affected-cities-more-rural-areas>

PARA5: Data and methods

PARA6: Contribution:

2. Literature review

2.1. *broadband studies, divides, broadband tech stuff*

2.2. *from telecommuting to #WFH*

Some new papers google recommended to me:

- https://urbanstudies.uva.nl/binaries/content/assets/subsites/centre-for-urban-studies/working-paper-series/wps_43.pdf
- <https://link.springer.com/article/10.1007/s11116-020-10136-6>
- <https://www.sciencedirect.com/science/article/pii/S0966692319311305>
- check who cites the above and what they cite

In this analysis, the terms ‘teleworking’ and ‘working from home’ are used interchangeably. An appropriate definition of teleworking is ‘the remote provision of labour

that would otherwise be carried out within company premises' (European Commission, 2020b). In practice, during the COVID crisis, most such work was carried out in the homes of individual employees rather than any other location.

PARA about Contention

3. Time series clustering

Description of the method

4. Data and descriptive statistics

Data details and some figures, descriptive stats

5. Results

Clusters, cluster description and aux regressions

6. Conclusions

Acknowledgement(s)

An unnumbered section, e.g. `\section*{Acknowledgements}`, may be used for thanks, etc. if required and included *in the non-anonymous version* before any Notes or References.

Funding

An unnumbered section, e.g. `\section*{Funding}`, may be used for grant details, etc. if required and included *in the non-anonymous version* before any Notes or References.

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7. Appendices

Any appendices should be placed after the list of references, beginning with the command `\appendix` followed by the command `\section` for each appendix title, e.g.

```
\appendix
\section{This is the title of the first appendix}
```

`\section{This is the title of the second appendix}`

produces:

Appendix A. This is the title of the first appendix

Appendix B. This is the title of the second appendix

Subsections, equations, figures, tables, etc. within appendices will then be automatically numbered as appropriate. Some theorem-like environments may need to have their counters reset manually (e.g. if they are not numbered within sections in the main text). You can achieve this by using `\numberwithin{remark}{section}` (for example) just after the `\appendix` command.

Please note that if the `endfloat` package is used on a document containing appendices, the `\processdelayedfloats` command must be included immediately before the `\appendix` command in order to ensure that the floats in the main body of the text are numbered as such.

Appendix A. Troubleshooting

Authors may occasionally encounter problems with the preparation of a manuscript using L^AT_EX. The appropriate action to take will depend on the nature of the problem:

- (i) If the problem is with L^AT_EX itself, rather than with the actual macros, please consult an appropriate L^AT_EX 2_ε manual for initial advice. If the solution cannot be found, or if you suspect that the problem does lie with the macros, then please contact Taylor & Francis for assistance (latex.helpdesk@tandf.co.uk).
- (ii) Problems with page make-up (e.g. occasional overlong lines of text; figures or tables appearing out of order): please do not try to fix these using ‘hard’ page make-up commands – the typesetter will deal with such problems. (You may, if you wish, draw attention to particular problems when submitting the final version of your manuscript.)
- (iii) If a required font is not available on your system, allow T_EX to substitute the font and specify which font is required in a covering letter accompanying your files.

Appendix B. Obtaining the template and class file

B.1. *Via the Taylor & Francis website*

This article template and the `interact` class file may be obtained via the ‘Instructions for Authors’ pages of selected Taylor & Francis journals.

Please note that the class file calls up the open-source L^AT_EX packages `booktabs.sty`, `epsfig.sty` and `rotating.sty`, which will, for convenience, unpack with the downloaded template and class file. The template calls for `natbib.sty` and `subfigure.sty`, which are also supplied for convenience.

B.2. *Via e-mail*

This article template, the `interact` class file and the associated open-source L^AT_EX packages are also available via e-mail. Requests should be addressed to

`latex.helpdesk@tandf.co.uk`, clearly stating for which journal you require the template and class file.