LUND UNIVERSITY

SCHOOL OF ECONOMICS AND MANAGEMENT

Department of Economics
Course code: NEKH02
Bachelor thesis
Spring 2021

Working from home and mental health: Evidence from the UK during the COVID-19 pandemic.

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Abstract

As the Coronavirus started to spread around the world in 2020, governments had to respond. Lockdowns and other restrictions were implemented to minimize the virus spread and people falling ill from COVID-19. In the United Kingdom, a lockdown was enforced from March to June 2020 whereafter restrictions eased, even though social distancing and other measurement still remained. There have been great concerns of increased loneliness among people due to increased isolation as a consequence of the COVID-19 response. Additionally, a large share of the workforce has had to adjust to work from home, which entails other challenges. This thesis aimed to study whether working from home is associated with a higher probability of feeling lonely during the pandemic, in a sample of middle-aged citizens living in the UK. The analysis shows no significant relationship between working from home and feeling lonely during the pandemic. Not working however, is found associated with feeling lonely, meanwhile prior mental wellbeing and household size show no relationship to feeling lonely.

Key words: COVID-19, Coronavirus, pandemic, United Kingdom, lonely.

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1. Introduction

After the Coronavirus outbreak, governments all over the world implemented various response strategies in order to prevent its spread. Substantial parts of the society have been affected by these measurements, not least how people socialize and perform their work. In the UK, large parts of the workforce have been working from home since or sometime during the COVID-19 outbreak. Not leaving one's home in the mornings and physically not socializing with colleagues etc. are great changes in people's everyday routines. Social distancing and isolation due to the COVID-19 pandemic, can be suspected to have increased effect on people feeling lonely. However, research do not show as large increase in loneliness as expected, according to Luchetti et al. (2020). Instead, the greatest increase of loneliness is found among young adults (Luchetti et al., 2020). Also, when combining age and gender looking at people feeling lonely, research shows higher odds for women to feel lonely compared to men, in all age categories below 60 years of age (Wickens et al., 2021).

Is there an association between working at home and feeling lonely? This thesis will study a group of individuals born in 1970 and living in the UK, before the Coronavirus outbreak as well as in May and September 2020, using data from the British Cohort Study. The 1970's cohort have belonged to the labor market for a long period of time and are presumably used to traditional ways of work. Data from these individuals will be used to analyze and compare feelings of loneliness between people working from home and those working elsewhere. Other explanatory and control variables such as previous mental wellbeing, household size, virtually and physically socializing and being a key worker are also included in the study.

The question this report will try to answer is: Is there an association between working from home and feeling lonely during the COVID-19 pandemic among UK citizens? The hypothesis is that there is a strong relationship between individuals feeling lonely while working from home. Performing the analysis, multivariable regressions were run, using data from May and September 2020 as well as the 1970 British Cohort Study: Age 46 retrieved a few years earlier. The results of the thesis's regressions show no significant association between working from home and feeling lonely. Although, not working were instead found to have a relationship to feeling lonely. Additionally, household size and prior mental wellbeing were found to have no association to feelings of loneliness during the COVID-19 pandemic.

2. Background

2.1 COVID-19

On December 31th 2019, Chinese authorities reported several pneumonia cases with unknown cause, which was reported to the World Health Organization (WHO). Days later it was found that a new virus (the Coronavirus) was the cause of the infection spread in Wuhan, China.

Chinese scientists then joined forces researching the virus and its spread. On January 20th the virus was found outside China and by the end of January, the first two cases of COVID-19 were found in the UK. At this point, WHO declared a world health emergency evoked by thousands of COVID-19 cases in China (Aspinall, 2021). The Coronavirus which causes the infectious disease COVID-19, is a new strain of Coronavirus previously not found in humans. Different Coronaviruses circulate among animals where for example bats and camels can host and pass on Coronaviruses to humans. The Coronavirus is primarily transmitted between humans via respiratory droplets and aerosols from an infected person, thus being close to inflected people when sneezing, coughing, breathing or speaking. The contagious droplets can also be inhaled or end up laying on various surfaces which other people come in contact with, whereafter touching one's eyes, mouth or nose. Depending on what surface the Coronavirus ends up on, it can survive between a few hours up to several days. Although, the amount of viable Coronavirus decreases over time and there may not always be enough virus quantities to be infectious. Due to the Coronavirus being new to human infections, there are uncertainties regarding the COVID-19 disease. The incubation period is estimated to be somewhat between one and fourteen days. What types of symptoms contributing to transmission is unclear, however an infected person can be transmitted two days before showing symptoms (European Centre for Disease Prevention and Control, 2021).

Among the infected people who develop symptoms, around 80% recover without requiring hospital treatment. About 15% fall seriously ill and require oxygen to help their breathing while 5 % become critical needing intensive care. COVID-19 complications leading to death may include respiratory failure, septic shock, sepsis, and/or multiorgan failure and so on (World Health Organization, 2020). During the first three months after the COVID-19 outbreak, close to one million people were infected, causing the death of 50,000 people. After six months, these numbers increased to over 10 million infected people and 500,000 deaths (NIH NIAID, 2020). According to WHO (n.d.a), the most efficient way to slow down and prevent the spread of COVID-19 is to be well informed about the Coronavirus, COVID-19 and how it is transmitted. Then people are able to protect themselves and others by following the guidelines of hygiene and social distancing (World Health Organization, n.d.a).

To end the COVID-19 pandemic, scientists all over the globe have come together developing and innovating tests, treatments and vaccines. Safe and effective vaccines will have an extensive impact on the COVID-19 spread. From February 2021, at least seven different vaccines have been distributed across countries (World Health Organization, n.d.b). In the UK, 34 million citizens have in May 2021 gotten at least one dose of vaccine, while 15 million people have received both doses. Accordingly, the UK vaccinations are shown to have significant impact reducing deaths and hospitalizations, as more than 25 percent of adults in the UK have received maximum protection available against COVID-19 (GOV.UK, 2021).

2.2 Spread & restrictions in the UK

Since the Coronavirus outbreak, there have been over 4,4 million confirmed cases of COVID-19 and more than 127,000 people have died within 28 days after having tested positive for the Coronavirus in the UK (BBC News, 2021). From March until June 2020, the death toll in the UK rose much higher compared to the average over the last five years (Office of National Statistics, 2020). However, the spread is assumed to be even higher than evidence shows due to limited testing, and therefore not able to detect the actual number of daily cases (BBC News, 2021). There is a clear peak in COVID-19 cases and related mortality during the spring 2020. From June until the beginning of September 2020, there were approximately 61 thousand confirmed COVID-19 cases in England (Public Health England, 2020).

From April 2020 and forward, millions of UK workers were supported by the Coronavirus Job Retention Scheme as their employer's business had not been able to operate as normal due to the COVID-19 policies and restrictions. As the Coronavirus spread decreased over the summer, eased restrictions allowed various sectors to increase their operations, gradually reducing the workforce proportion needing the Coronavirus Job Retention Scheme (Office of National Statistics, 2020).

To prevent the spread of COVID-19, social distancing is important. Therefore, the National Health Service (NHS) declare the official recommendations for people to only be in close contact with one's household members. Since COVID-19 can be transmitted despite not experiencing any symptoms, it is crucial to take responsibility and do what one can to not spread the virus. One should therefore stay two feet away from anyone outside one's household, coughing and sneezing into one's arm or a tissue, and immediately throwing away used tissues. People should also air one's home as often as possible, and often (especially when coming home) wash one's hands using soap and water for at least 20 seconds, as well as use hand sanitizer if not having access to soap and water. When able to, people are recommended to wear something over their mouth and nose, however, it is mandatory to wear face covering in shops, on public transports and when going for one's hospital appointment or visiting someone in the hospital. Although, children under three years of age and people with breathing difficulties are excluded from the face covering constraint (NHS, 2021).

In the middle of March, UK's prime minister Boris Johnson started making daily press conferences in regard of COVID-19, urging people to work from home and to avoid restaurants and pubs. The government announced that schools would be closed followed by all gyms, restaurants, pubs and social venues (Aspinall, 2021). A nationwide lockdown was enforced March 23, 2020 where the government took drastic measures to restrict people's movement and gatherings. The public should stay home except for only a few reasons justifying people to leave their residence (Beadsworth & Walawalkar, 2020). Citizens were later advised to only go outside when needing to get groceries or exercise once a day, as well as when getting to and from work, if not able to work from home. Not complying with these restrictions would result in police fines

(Aspinall, 2021). On March 25, 2020 the Coronavirus Act 2020 gave the government and further authorities extended powers in order to keep people safe from COVID-19. The health secretary was able to prohibit people gatherings, trying to prevent and decrease the COVID-19 transmission. Police, health officials and immigrant officers were able to detain people possibly infected by the Coronavirus disease (Beadsworth & Walawalkar, 2020).

The UK's prime minister revealed a three-step plan of easing the lockdown restrictions on May 10, 2020. Firstly, people not able to work from home were from this period on encouraged to attend work. Recommendations of ways to commute and COVID-19 secure standards regarding public transport where made. Also, citizens were encouraged to perform outdoor exercise. Step two and three included hopes of during the summer being able to reopen schools, shops and other public places (Beadsworth & Walawalkar, 2020). By June 23, 2020 changes to the lockdown restrictions were made, helping people get back to work, to physically socialize more with friends and family as well as helping businesses to recuperate. Hairdressers, pubs and restaurants were able to reopen by July 24, 2020, as well as some facilities within the cultural and arts sector who were able to comply with COVID secure guidelines. As the economy was starting to reopen, it was crucial to not enlarge the risk of COVID-19 spread. Thus, venues without greater distances between individuals were continuously kept closed. Moreover, two households were by the same date allowed to meet up and socialize in settings where social distancing measures could be taken. The government however, kept urging the public to follow the social distancing guidelines in order to keep the Coronavirus spread under control (GOV.UKa, 2020).

Later in the summer of 2020, restrictions were further eased as indoor theaters, bowling alleys etc. were reopened by August 14. Yet, exactly one month later (September 14), the rule of only six people attending social gatherings in indoor and outdoor settings was enforced (Institute for Government analysis, n.d.). This rule excluded schools, workplaces and COVID-19 safe organized team sport events, weddings and funerals. Not complying would result in fines (BBC News, 2020). The prime minister of the UK declared further measures in order to manage the national COVID-19 spread on September 22. First off, the importance of washing hands, keeping distance from others and face coverings were highlighted together with some additional rules when needed to wear face coverings. Secondly, office workers and other employees who were assessed being able to efficiently work from home should do so over the following winter months. Being either essential workers or simply not being able to work from home were allowed to keep attend their place of work. Moreover, some restrictions were added for different types of business to follow, from September 24 onwards. For example, only being allowed to order and serve foods and drinks from a seated table as well as businesses selling foods and drinks needing to be closed between 10 pm and 5 am, including takeaways but not delivery services. Lastly, other changes were made to what types and sizes of gatherings being allowed (GOV.UK, 2020b). On September 31, the prime minister announced the COVID-19 situation to be at a critical state which the government would not hesitate to act upon moving forward. By

November 5, a second lockdown in the UK came into effect (Institute for Government analysis, n.d.).

2.3 Loneliness & Mental health

There is not a single definition of loneliness. Loneliness is a unique and complex emotion which plays out differently for different people. Since there can be a variety of causes to this feeling, it can be difficult to prevent and treat, as people will have different needs. To understand someone experiencing loneliness, it is important to find out what the individual means by feeling lonely and its symptoms, causes, potential treatments etc. (Cherry, 2020). The organization What Works Wellbeing (n.d.) however, defines loneliness as follows in their briefing of COVID-19 and loneliness: "Loneliness is a feeling that the quantity and quality of our relationships are not as good as we would like them to be. This is different from being isolated or alone, which are more objective measures of how much time we spend with how many other people, or solitude, which can in fact be positive and restorative for wellbeing. Loneliness can be social, where we feel a lack of social connections, emotional, where we feel like we lack meaningful relationships to the extent that we don't belong, and/or existential, where we might feel entirely separate from other people" (What Works Wellbeing, n.d., p.1). One does not have to be all alone to feel lonely. Rather, loneliness is a state of mind making one feel alone, isolated, empty, unwanted etc. People can feel lonely due to various causes however, contributing factors are aspects such as physical isolation, moving and depression. Internal factors such as low self-esteem and lack of confidence can also increase the risk of feeling lonely (Cherry, 2020).

The COVID-19 outbreak has made it difficult to consort with others. Missing one's prior social connections and/or family and friends is natural, especially as many people spend a large amount of time at home. Social and leisure activities are limited and restricted which can cause people to feel lonely and isolated (Every Mind Matters, n.d.). Feeling lonely during short periods should not have any substantial effect on people's mental health. Yet, the longer the COVID-19 pandemic lasts, the loneliness feelings become long-term which increases the risk of mental health issues such as depression, anxiety and stress. These complications due to loneliness can be hard to manage (Mental Health Foundation, 2021a).

During the COVID-19 pandemic, people have had to rely on technology to stay in contact with people and one's social network. Despite it being a very valuable and useful tool, it might get tiresome using the same systems all day, every day. Trying new ways to connect or use a variety of technological communications systems can enhance people's urge and ability to manage their social interactions. Mixing the use of video calls, ordinary phone calls, messaging etc. between work and private interactions is a good way to keep the urge of staying in touch with other people (Mental Health Foundation, 2021a). Additionally, the NHS mental health resource Every Mind Matters (n.d.) provides other ways to ease the feeling of loneliness. People can join various social clubs online or take part in online live events. One can try to form everyday routines

regarding reaching out to one's social network, as having contact with someone familiar and being able to tell another person one's feelings eases the sense of loneliness and isolation. Furthermore, doing things one enjoys can distract people from loneliness and increase one's wellbeing. Exercise, podcasts, books and meditation are some examples of things that can make people feel better. Other ways to stay occupied is to volunteer and help others meanwhile complying with the COVID-19 restrictions and guidelines. Thereto, there are various support groups and communities which people can join in order to seek higher level of mental health (Every Mind Matters, n.d.).

While staying home during the pandemic, the need to prioritize self-care has become more important to support one's mental wellbeing, according to the Mental Health Foundation (2021b). Thereto, access to updated high-quality information about the COVID-19 spread, guidelines etc. can calm feelings of anxiety. The pandemic has affected almost every aspect of society prior to the virus outbreak. Thereof, many are experiencing uncertainty regarding work life and one's financial situation, which also can affect people's mental health (Mental Health Foundation, 2021b).

2.4 Working from home

A prominent effect of the COVID-19 pandemic is the change and adjustment to working from home. Before the Coronavirus outbreak, few could imagine themselves turning their kitchen or living room into a full-time office instead of physically attending one's workplace. For many, the conversion from physical to online communication and ways of working is or have been somewhat tiresome and challenging. The isolation, the heavy use of technology work procedures etc. can all effect people's mental health, increasing feelings of depression, anxiety and so on. Many longs back to a time when having a chat with colleagues by the coffee maker and standing in line for the copy machines where normality. In addition, many worries about the privacy and security within certain work sectors and aspects of liability (Usborne, 2020).

A study including 1500 UK citizens, shows that 60% of that sample are eager to return to work as soon as possible. It is also presented that 35% would want to alternate between working from home and in the office when this is possible (Business Matters, 2020). Furthermore, the proportion of UK citizens within the labor force, who mainly worked from rose from 4% to 5% from 2015 until 2019. Hence, there is little research of the effects of working from home since this became a larger phenomenon as the COVID-19 pandemic arose. Thereto, in 2010, a Chinese travel agency tried the concept of letting parts of its personal work from home. Productivity wise, the performance result from the personal working from home was higher compared to the ones at the office. Yet, the staff itself where not as satisfied with the working from home arrangement. A large proportion of the personal working from home wanted to return to the office. Loneliness was the main reason creating this desire. As to put in perspective, while these people worked from home there were no lockdown or social restrictions in place, allowing these

individuals to physically socialize with others in any way they pleased. Still, many felt lonely working from home (Usborne, 2020).

Working from home causes no need to commute however, it can induce stress, anxiety, boredom etc. among individuals. To try to uphold a good mental health status, it is advised to set and stick to a daily routine even if not leaving your home, and to keep one's normal sleep and work patterns. Creating a dedicated workspace away from distractions and noises is also beneficial. Other useful tips in order to successfully work from home would be to take breaks, stay connected in order to reduce isolation, establishing boundaries, thinking long term and not forget to prioritize oneself and one's needs (Better health, n.d.).

3. Previous research

Several papers have studied whether restrictions associated with the pandemic have led to increased feelings of loneliness. Luchetti et al. (2020) thereof looked into a study, researching loneliness within the US. These online surveys were distributed at three occasions during the winter/spring months of 2020, to a nationwide sample of adult Americans, comparing changes in loneliness as of the social restrictions enforced due to the pandemic. The participants were to recall their feelings of loneliness during the last two weeks prior to them answering the survey. In opposite to the expected result, there were no significant mean-level difference in loneliness throughout the three assessments. Despite the impacts the response and restrictions enforced, no high levels of loneliness could be reported. Instead, people conveyed experiences of increased support from others in time of the pandemic. The largest change in feeling lonely was measured among young adults. Older adults experienced overall low levels of loneliness. The ones feeling the loneliest at baseline, were individuals in single household and those who suffer from at least one chronic disease. Due to the COVID-19 social distancing measurements, there were however no established increase in feeling lonely among this group of people (Luchetti et al., 2020). In addition to the US study, Groarke et al. (2020) studied a COVID-19 online psychological wellbeing survey which was distributed to UK adults in March/April 2020. As in the US, higher risk of loneliness was found among younger age groups (Groarke et al., 2020).

Others have looked at how loneliness due to the COVID-19 pandemic is associated to age and gender, as for instance Wickens et al. (2021). As they studied how gender and age together are associated to loneliness due to the pandemic, they also controlled for other sociodemographic variables such as employment, education, marital status, income and living arrangements. Over 3,000 English speaking adults in Canada answered an online survey between May and June 2020. The participants were to respond how often they felt lonely the week prior to answering the survey. Around 8.4% of the sample described themselves feeling lonely at a minimum 5 days. Looking at gender, women was found lonelier than men which might be explained by women relying more on social and emotional-focused support, which social distancing makes

more inaccessible. As for age and gender, women showed higher odds of feeling lonely compared to men in all age groups under 60 years of age (Wickens et al., 2021).

From the employers' point of view, the COVID-19 pandemic and measurements taken to prevent the spread, have had great effect on work life and work organizations. Employees, students etc. has in a large extent worldwide been forced/asked to work from home. Depending on the sector, along with individual characteristics, the performance outcome and experience may differ among various people. Bolisiani et al (2020) studied the Italian part of an international study, looking at people's experiences of working from home in times of the COVID-19 pandemic. Almost 1,000 Italians participated in the online survey, executed in March 2020. When studying indications of Italian employee's involvement, usefulness, knowledge sharing, knowledge management, attitudes etc. it was difficult to determining a positive nor a negative conclusion regarding the working from home outcome. The same applies for the efficiency and effectiveness. Instead, the participants' varied opinions of the overall experience along with the importance and difficulties maintaining work contacts could be established (Bolisani et al., 2020).

As for loneliness and mental health, previous research has studied its associations to one another due to the COVID-19 pandemic and its response. Killgore et al. (2020) studied loneliness and mental health in the US, in time of the pandemic and compared the findings to previous published data. The study's sample were proportionally chosen to its state, resulting in over 1,000 English speaking US adults from 50 states between the age of 18-35 years old, participating in the survey distributed in April 2020. The results showed significantly higher loneliness scores as compared to prior published work. Thereto, lonely individuals were found to feel significantly more depressed than the non-lonely people. The study declared its findings to align with the suggestion that the prolonged stay at home measurements due to the pandemic, has an enhanced effect on loneliness (Killgore et al., 2020).

Overall, previous research has found shared opinions about working from home, yet not been able to established whether it is associated with feelings of loneliness or not. People in their fifties were not found to be particularly vulnerable to feelings of loneliness during the pandemic. However, this age group has belonged to the labor market for quite a long time, and perhaps the conversion to work from home due to COVID-19 restrictions is associated with feeling lonely? This thesis contributes to this literature by focusing on feelings of loneliness while working from home. Studying BCS70 participants during the pandemic, data from two time periods can be combined and compared. Also, previous data of this cohort can be included and controlled for. Thus, the thesis will study whether there is an association between working from home and feeling lonely in times of the pandemic. Finally, several new papers have studied more in general the mental health effects associated with the pandemic. For instance, women feel lonelier than men, and people feeling lonely prior to the pandemic are found feeling the loneliest also during the pandemic. This thesis contributes to previous literature by analyzing middle age UK citizens, whether working from home is associated to feeling lonely. By controlling for prior mental

wellbeing, the result will indicate whether it has any relation to the individuals feeling lonely and working from home during the pandemic.

4. Methodology

4.1 Data

The Centre for Longitudinal Studies (CLS) has conducted the 1970 British Cohort Study (BCS70), which includes over 17,000 people born during a particular week in 1970 and originate from England, Scotland and Wales. At birth, the study had a strict medical focus, but with time the variation of information has broadened to include economic circumstances, social and educational development etc. (UK data service, n.d.a). Until today, there has been a total of eight waves gathering additional data from the whole cohort, the last one occurring when the cohort members were of 46 years of age (UK data service, n.d.b).

At two occasions in 2020, CLS and the MRC Unit for Lifelong Health and Ageing (LHA) constructed two surveys investigating the lives of selected individuals from the British Cohort Study as well as from four other longitudinal studies during the COVID-19 pandemic, including the individuals physical and mental health and wellbeing, family, education, work, finances and relationships. The first survey (wave one) was carried out in May 2020, a time where the UK had strict lockdown restrictions. This wave one survey focused on the changes in people's lives prior to the pandemic, reaching the UK in March 2020 and the peak of restrictions in May 2020. The second survey (wave two) instead concentrated on people's lives from June 2020 as the restrictions in the UK eased, until when the survey was carried out in September/October 2020 (Brown et al. 2020).

In this report, the COVID-19 surveys one and two have been used to study whether the COVID-19 pandemic and national restrictions forcing certain people to work from home, has had any effect on the BCS70 cohort's mental wellbeing, particularly measured in loneliness. The 1970 British Cohort Study: Age 46 has also been used in order to compare the COVID-19 surveys results with participants prior mental wellbeing status recorded years before the COVID-19 pandemic.

The sample used to construct the analysis for this report, BCS70 cohort members from the 1970 British Cohort Study: Age 46 participating in both COVID-19 surveys where included. The only individuals for this selection that were excluded were the emigrant participants from the COVID-19 surveys. Handling the three datasets in Stata, the data from the COVID-19 surveys were appended after which the 1970 British Cohort Study: Age 46 data were merged. Prior to the analysis, the BCS70 cohort members participating were selected and the cross sectional, May and September variables were constructed as stated in previous sections. Then summary

statistics, correlation matrixes and multivariable regressions where run/conducted. These where then used to analyses whether a relationship between the dependent and independent variables were to be found. Especially if working from home effects feeling lonely.

4.2 Sample

The interviews for the 1970 British Cohort Study: Age 46 survey were distributed between July 2016 and July 2018, where a total of 8,581 participant's answers were recorded (Brown & Peters, 2019). In the COVID-19 surveys wave one and two, parts of the BCS70 cohort were asked to participate. In wave one, a sample of 10,458 BCS70 cohort participants were invited whereof 4,223 (40.4%) people completed the questionnaires. In wave two, a total of 12,133 members of the BCS70 cohort were requested to participate in the survey, of which 5,320 (43.9%) people did. Out of the BCS70 cohort members participating in the COVID-19 survey wave two, 3,389 of these (64%) also completed the wave one survey, implying 1,931 (36%) new respondents in the second wave survey. In wave one, 499 emigrant interviews were achieved and 695 in wave two (Brown et al. 2020).

4.3 Questionnaires

In the 1970 British Cohort Study: Age 46, mental wellbeing is measured by the Warwick Edinburgh Mental Wellbeing Scale, consisting of 14 positively worded questions covering most aspects of positive thoughts and feelings. The respondents have five categoric answers to choose from on each question (Brown & Peters, 2019). Its sum then creates a wellbeing score from 14 to 70, where a higher number indicates enhanced mental wellbeing. However, this wellbeing score is only calculated if all questions in the Warwick Edinburgh Mental Wellbeing Scale are completed (Peters, 2019). Using this as a reference while investigating the mental state of loneliness among the BCS70 cohort in May and September 2020, it will provide indications of the mental wellbeing before the COVID-19 pandemic.

In the COVID-surveys wave one and two, three out of UCLA's 20 item loneliness scale were included in the questionnaires. Loneliness among the BCS70 cohort is thereof measured by the following three questions in the two COVID-19 surveys:

- How often do you feel that you lack companionship?
- How often do you feel left out?
- How often do you feel isolated from others?

When answering each question, the participants had three answers of frequency to choose from: hardly ever, some of the time and often, indicating the individual's level of loneliness (Brown et al. 2020).

Moreover, the COVID-19 surveys had a question regarding place of work. This however, is only applicable to those cohort members with an employment. The same applies to whether an

individual is a key worker/has a critical classified job during the pandemic or not. Thus, all survey participants will not have responded to these two questions.

4.4 Variables

Handling the different datasets, recorded answers to the 1970 British Cohort Study: Age 46 questionary had already been converted to numerical responses. When conducting this thesis analysis, this derived data was used. From the 1970 British Cohort Study: Age 46, the Warwick Edinburgh Mental Wellbeing Scale and household size are the selected variables included in this report. Regarding the two COVID-19 surveys, there were no derived data (answers in numerical form) available, whereof the variables used from these two datasets have had to be rearranged into numerical form in order to conduct the analyses. Firstly, the four questions measuring loneliness each portray certain ordinal interpretation however, not that much of a cardinal interpretation. Therefore, a binary lonely variable was created from these four numerical answers. Individuals were considered lonely if having answered one of the questions with the highest value option to each question and not lonely otherwise. The new lonely variable taking value one if considered lonely and zero otherwise.

From the question regarding occupation in each COVID-19 survey, participants where either considered as working or not working. Individuals having any sort of employment, apprenticeship or performing unpaid/volunteer work were considered working meanwhile being unemployed, permanently sick/disabled, studying, looking after home or family, being retired or doing something else were categorized as not working. The binary variable working taking value one if considered working and zero if not, and vice versa for the not working variable. For those individuals working, there were a follow up about being considered a key worker/critical to the COVID-19 response. The binary variable key worker thereof takes one for being a key worker/critical to the pandemic's response, and zero otherwise. As for place of work, the response options were not exactly identical between COVID-19 survey one and two. Since the goal is to study whether working from home and the isolation that it entails affects feelings of loneliness, participants solely working from their home were categorized as working from home in the binary variable named "working from home". Those working elsewhere or splitting their time between their home and the office, were considered as not working from home. The binary variable working from home were given the value one if working from home and value zero otherwise.

Household size was not measured only in the 1970 British Cohort Study: Age 46, but also in the COVID-19 surveys wave one and two. These variables have all kept their numerical values sating the total number of household members in each participant's homes, including themselves. Furthermore, participants' average time spent on different activities was included in the two COVID-19 surveys. Two of those questions regarded time spent virtually and physically socializing with people outside one's household. To equally compare these two, variables in one

dataset were adjusted, rounded to whole hours which the other dataset answers were in. Lastly, in all variables there are missing values if a question was not applicable and for those not responding to a certain question, either due to not knowing what to answer, not wanting to answer or simply leaving a question blank.

4.5 Data limitations

The main data limitations of the observed data for the analysis are the following. The dependent and independent variables studied are all bound to the questions included in the three different questionnaires used in this study: the 1970 British Cohort Study: Age 46 and the two COVID-19 surveys. The existent variables available to study are strictly the ones included in the questionaries. This limit both the number of independent variables and control variables to include in the analysis. For example, gender differences would be of interest to perform an analysis and include in this report. Thereto, the predetermined options of answers also make up how loneliness and other variables are defined, which affects the approach of the analysis. The sample is also limited to certain individuals since not all members of the BCS70 cohort have participated/been requested to participate in all three studies used. Missing data are also a form of limitation as it does not provide a fully covering set of data for all participants.

4.6 Empirical strategy

4.6.1 Regression framework

The following parameters have been estimated in the Ordinary Least Square (OLS) regression model to explain the relationship between loneliness and working from home. The two regressions referring to either the May or September data, has been analyzed using the estimated model below:

$$L_{i,t} = \beta_1 + \beta_2 WH_{i,t} + \beta_3 NW_{i,t} + \beta_4 x_{i,t} + \delta_t + \varepsilon_{i,t}$$

Feeling lonely is the dependent variable denoted $L_{i,t}$ for individuals within the BCS70 cohort in May or September 2020. $WH_{i,t}$ is the indicator representing the people working from home, taking value one if working at home, and zero otherwise. The variable $NW_{i,t}$ denotes the people not working, where the value one stands for the people not working and zero otherwise. People's prior mental wellbeing, household size, being a key worker and time spent socializing, are all individual aspects affecting feeling lonely, which are presented by $x_{i,t}$. Survey time fixed effects are displayed by δ_t and the error term is denoted $\varepsilon_{i,t}$.

Secondly, the regression model used for analyzing combined data from May and September 2020 is displayed below:

$$L_i = \beta_1 + \beta_2 WH_i + \beta_3 NW_i + \beta_4 x_i + \delta_i + \varepsilon_i$$

The dependent variable L_i stands for feeling lonely among members within the BCS70 cohort. The independent variable WH_i is the indicator representing the people working from home, where people working from home takes the value one and zero otherwise. Next variable NW_i represents the individuals not working which adopt the reverse numerical values; one if not working and zero otherwise. Being a key worker, one's household size, prior mental wellbeing and time spent socializing, are other personal aspects affecting feelings of loneliness which are displayed by x_i. The surveys time fixed effects are represented by the index δ_i and lastly ε_i denotes the error term. As of a longitudinal analysis, exploiting variation for the given individuals over time is included when adding the individual fixed effects in the regression for the combined May and September data.

To analyze whether working from home effects feeling lonely, three multivariable regressions were conducted using the OLS. The first regression related the lonely variable with working from home, whereafter the explanatory variables were included one by one. In the last five regressions, mental wellbeing was included as a control variable. These courses of actions were applied on all three multivariable regressions, first using May data, then September data and lastly variables of combined May and September data. Furthermore, studying repeated observations from the same individuals at different points in time, the standard errors will have correlation. In order to acknowledge these correlating, clustered standard errors and to account for that the observations are not independent, the individuals BCS research ID was included in column (13) in the longitudinal multivariable regression, which is displayed in table 8.

Basic knowledge of the OLS is assumed when reading the report, whereof the statistical method will not be deeply discussed in detail. However, the OLS assumptions assumed in this report includes random sampling, regression being linear in parameters and no multicollinearity. Thereto, the regressions were check for heteroscedastic and misspecification, as White's test and Ramsey's RESET-test were performed. Both results indicate the null hypothesis to be rejected which signify the data to be neither heteroscedastic or mis specified.

5. Results

5.1 Statistics

5.1.1 Summary statistics

The tables 1-3 below present an overview of the summary statistics from the report's selected data sample. Table 1 displays the COVID-surveys wave one (May), table 2 the second wave (September) survey and table 3 the 1970 British Cohort Study: Age 46. In table 1 and 2, the first five variables are binary ones meanwhile the last two and all in table 3 are numerical.

Table 1. Summary statistics of included variables: May

Variable	N	Mean	Std. Dev.	Min	Max
Lonely	3,993	.126	.332	0	1
Working	4,059	.886	.318	0	1
Not working	4,059	.114	.318	0	1
Working from home	7,997	.203	.403	0	1
Key worker	7,993	.177	.382	0	1
Household size	4,045	3.120	1.362	1	20
Hours socializing virtually	4,096	1.299	2.088	0	24
Hours physically socializing	4,096	.160	.995	0	24

Table 2. Summary statistics of included variables: September

Variable	N	Mean	Std. Dev.	Min	Max
Lonely	5,073	.121	.326	0	1
Working	5,320	.849	.358	0	1
Not working	5,320	.117	.322	0	1
Working from home	8,488	.154	.361	0	1
Key worker	8,482	.236	.425	0	1
Household size	5,278	2.959	1.305	1	11
Hours socializing virtually	4,865	1.294	2.241	0	24
Hours physically socializing	4,865	1.012	2.326	0	24

Table 3. Summary statistics of included variables: Age 46

Variable	N	Mean	Std. Dev.	Min	Max
Prior mental wellbeing	7,818	50.960	8.428	14	70
Household size	8,263	3.229	1.263	1	11

Looking at the lonely variable, the mean in May and September are very similar, despite a larger number of observations in September. Thus, the feelings of loneliness are not that much higher in May during full lockdown compared to September when restrictions where eased. The mean of the variables working and not working are very similar in May and September, and therefore does not show any large changes in people being employed or not. Regarding working from home, May shows slightly higher values indicating a bit smaller group of individuals working from home in September. Also in September, a higher number of people are or have had a position as key worker/critical to the COVID-19 response. Regarding household size, it takes a much higher maximum value in May compared to both before the pandemic and in September when restrictions where eased. As people during lockdown only physically could spend time with individuals within their household, many moved in with family and friends in order to decrease the isolation which results in larger household sizes. As for virtually socializing, the means in May and September are very similar. People seem to socialize using virtual technical solutions almost equally much in May and September. Even though restrictions in September

have eased compare to the lockdown in May, finding that people still socialize virtually in almost the same extent indicates the remaining restrictions being somewhat followed. The variable socializing in person has heavily increased from May until September, which is a given effect moving from the lockdown in May to the situation in September. Lastly, table 3 displays the variable mental wellbeing, matching the Warwick Edinburgh Mental Wellbeing scale. The mean is fairly high while comparing it to the maximum and minimum values, indicating a fairly good mental wellbeing status among the BSC70 cohort participants.

5.1.2 Correlation

In this section, correlation matrixes between the different variables for May and September are displayed in tables 4 and 5 below.

(observations=2,442) **Table 4. Correlation matrix (May)**

	Lonely	Working from home	Key worker	Household size	Hours socializing virtually	Hours physically socializing
Lonely	1.000					
Working from home	0.024	1.000				
Key worker	0.001	-0.436	1.000			
Household size	-0.127	0.007	-0.017	1.000		
Hours socializing virtually	0.027	-0.002	0.013	-0.017	1.000	
Hours physically socializing	-0.021	-0.0487	0.015	0.013	0.083	1.000

Viewing the May correlation matrix table 4 above, working from home and feeling lonely show weak correlation. There is moderate negative correlation between working from home and key worker. As few key workers or the ones critical to the pandemic response are able to work from home, this moderate correlation value was somewhat expected. Throughout the rest of the matrix, the correlation between all other variables shows extremely low correlation.

(observations=3,872)

Table 5. Correlation matrix (September)

	Lonely	Working from home	Key worker	Household size	Hours socializing virtually	Hours physically socializing
Lonely	1.000					
Working from home	-0.003	1.000				
Key worker	0.021	-0.317	1.000			
Household size	-0.112	-0.011	-0.016	1.000		
Hours socializing virtually	0.019	-0.039	0.017	-0.041	1.0000	
Hours physically socializing	0.016	-0.043	0.001	-0.051	0.428	1.000

In the table 5 above, working from home and feeling lonely show negative, very weak correlation. The correlation between working from home and key worker is still stronger than most other variables yet, somewhat weaker in table 5 compared to table 4. The largest difference from table 4 is the correlation between virtually socializing and socializing in person which in September is moderate positively correlated. The strongest correlated variables in table 5. Otherwise, the correlations between the rest of the variables are extremely weak.

5.2 Multivariable regressions

Tables 6-8 below, presents the statistical relationship between feeling lonely and the study's explanatory variables. Prior mental wellbeing is included in columns (6) to (10) in each regression as a control variable. In the first multivariable regression showed in table 6, data from May 2020 is used. September data is used in the next regression displayed in table 7, and a combination of data from both May and September in table 8.

Table 6. Lonely (May): Multivariable regression

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Working from home	0.014	0.017	0.018	0.018	0.017	0.017	0.016	0.016	0.015	0.014
	(0.012)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)
Key worker		0.005	0.007	0.007	0.007		-0.003	-0.002	-0.003	-0.003
		(0.013)	(0.013)	(0.013)	(0.013)		(0.014)	(0.014)	(0.014)	(0.014)
Household size			-0.027***	-0.027***	-0.027***			-0.026***	-0.026***	-0.026***
			(0.004)	(0.004)	(0.004)			(0.005)	(0.005)	(0.005)
Hours socializing virtually				0.004	0.005				0.005	0.006
				(0.004)	(0.004)				(0.004)	(0.004)
Hours physically socializing					-0.006					-0.009
					(0.006)					(0.006)
Prior mental wellbeing						-0.009***	-0.009***	-0.008***	-0.008***	-0.008***
						(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.089***	0.085***	0.165***	0.161***	0.162***	0.548***	0.550***	0.592***	0.589***	0.593***
	(0.009)	(0.014)	(0.020)	(0.020)	(0.020)	(0.042)	(0.043)	(0.044)	(0.044)	(0.044)
Observations	2,493	2,490	2,447	2,442	2,442	2,173	2,170	2,133	2,128	2,128
R-squared	0.001	0.001	0.017	0.018	0.018	0.056	0.056	0.067	0.068	0.068
Adj. R^2	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
Mean (Lonely)	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 6 show the May multivariable regression, displaying the results of whether the explanatory variables are associated with the dependent variable feeling lonely. The explanatory variables are added into the regression one by one in both column (1) to (5), as well as column (7) to (10). However, prior mental wellbeing is included as a control variable in columns (7) to (10). While running the May regression, the variable not working was omitted due to collinearity, whereof the not working variable is not displayed in table 6.

Column (1) displays the relation working from home has on the lonely variable. This association is positive and suggestive that working from home is correlated with a higher probability of feeling lonely. The coefficient presents a 0.014 mean change in the dependent variable (feeling lonely) as the working from home variable change one unit, holding the other explanatory variables constant. The relationship is not significant, and we can therefore not reject the null hypothesis that there is no association between working arrangements and loneliness. In column (2), the key worker variable is added to the regression which displays a positive relationship to the lonely variable. Household size is added in column (3), which presents a negative and significant relationship, at a 1% significant level. Household size is then found to have a negative association to the lonely variable. Column (4), includes hours socializing virtually, which presents a positive relationship to the lonely variable. In column (5), hours physically socializing is added to the regression and a negative relationship is found.

The remaining columns (6) to (10) includes prior mental wellbeing as a control variable. Prior mental wellbeing is found to have a negative and significant (at a 1% significant level) association to the lonely variable throughout the columns. Thus, increased mental wellbeing score indicates less feelings of loneliness. In column (6), working from home still shows a positive relation to the dependent variable feeling lonely. Column (7) includes key worker, which in difference to column (2) shows a negative association. In column (8), household size is still displayed to have a negative and significant relationship to the lonely variable. Column (9) presents a positive association between lonely and hours virtually socializing. Hours physically socializing displayed in column (10) presents a negative relationship to the variable lonely. The adjusted R^2 in columns (1) to (10), all indicates the explanatory variables to respond to 6.5% of the dependent variable.

Table 7. Lonely (September): Multivariable regression

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Working from home	-0.002	0.002	0.002	0.002	0.002	0.006	0.009	0.008	0.008	0.009
	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Not working										
Key worker		0.015	0.014	0.012	0.012		0.012	0.010	0.009	0.009
		(0.010)	(0.010)	(0.010)	(0.010)		(0.010)	(0.010)	(0.010)	(0.010)
Household size			-0.024***	-0.026***	-0.026***			-0.019***	-0.021***	-0.021***
			(0.004)	(0.004)	(0.004)			(0.004)	(0.004)	(0.004)
Hours socializing virtually				0.002	0.002				0.002	0.002
				(0.002)	(0.003)				(0.002)	(0.003)
Hours physically socializing					0.001					0.001
					(0.002)					(0.002)
Prior mental wellbeing						-0.009***	-0.009***	-0.009***	-0.008***	-0.008***
						(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.102***	0.093***	0.165***	0.166***	0.165***	0.569***	0.562***	0.601***	0.581***	0.580***
	(0.006)	(0.008)	(0.014)	(0.014)	(0.014)	(0.032)	(0.033)	(0.034)	(0.034)	(0.034)
Observations	4,050	4,046	4,033	3,872	3,872	3,500	3,497	3,489	3,362	3,362
R-squared	0.000	0.001	0.011	0.013	0.013	0.060	0.060	0.066	0.065	0.065
Adj. R^2	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063	0.063
Mean (Lonely)	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 7 above, show the results of the September multivariable regression. Column (1) to (5) show the coefficients of the explanatory variables, added one by one into the regression. In column (6) to (10), the same explanatory variables are showed together with prior mental wellbeing as a control variable. The variable not working is however not displayed in table 7 due to generating omitted values when running the multivariable regression as a cause of collinearity.

Column (1) in table 7, displays a negative relationship between working from home and feeling lonely. The mean change in the dependent variable feeling lonely as working from home changes one unit is -0.002, while keeping all other variables constant. Thus, the null hypothesis is rejected as no relation between working from home and feeling lonely can be found. In column (2), the variable key worker is added which displays a positive relationship to feeling lonely. Column (3) shows a negative and significant association between feeling lonely and household size. This implies that the household size has a negative association to the dependent variable feeling lonely. In column (4) and (5), loneliness is found to have positive relationships with both hours socializing virtually and hours physically socializing.

In column (6) to (10), prior mental wellbeing is included as a control variable. A negative and significant (at a 1% significant level) relationship between the dependent lonely variable and prior mental wellbeing is showed throughout the table. Column (6) displays a positive relationship between working from home and loneliness. Likewise for the variable key worker in column (7), a positive relation is shown. In column (8), household size remains negative and

significant at a 1% significant level. Column (9) and (10) displays positive relationships between both hours socializing virtually and feeling lonely as well as hours physically socializing and loneliness. The adjusted R^2 displays 6.3% of the explanatory variables responds to the dependent lonely variable, a slightly lower value than in the May regression shown in table 6.

Table 8. Lonely (Longitudinal analysis): Multivariable regression

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Working from home	-0.023**	-0.004	-0.002	0.001	0.003	0.001	-0.004	0.007	0.009	0.011	0.013	0.012	0.012
	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)
Not working		0.132***	0.130***	0.132***	0.124***	0.124***		0.085***	0.084***	0.089***	0.084***	0.084***	0.084***
		(0.011)	(0.011)	(0.011)	(0.011)	(0.011)		(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.016)
Key worker			-0.012	-0.009	-0.007	-0.008			-0.009	-0.007	-0.005	-0.006	-0.006
			(0.010)	(0.010)	(0.010)	(0.010)			(0.010)	(0.010)	(0.010)	(0.010)	(0.009)
Household size				-0.028***	-0.030***	-0.030***				-0.022***	-0.023***	-0.023***	-0.023***
				(0.003)	(0.003)	(0.003)				(0.003)	(0.003)	(0.003)	(0.003)
Hours socializing virtually					0.002	0.003*					0.003*	0.004**	0.004**
					(0.002)	(0.002)					(0.002)	(0.002)	(0.002)
Hours physically socializing						-0.003						-0.002	-0.002
						(0.002)						(0.002)	(0.002)
Prior mental wellbeing							-0.011***	-0.011***	-0.011***	-0.010***	-0.010***	-0.010***	-0.010***
							(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.127***	0.108***	0.109***	0.191***	0.190***	0.192***	0.686***	0.653***	0.653***	0.690***	0.676***	0.677***	0.677***
	(0.004)	(0.004)	(0.004)	(0.009)	(0.009)	(0.009)	(0.022)	(0.022)	(0.022)	(0.023)	(0.023)	(0.023)	(0.033)
Observations	8,670	8,656	8,656	8,562	8,333	8,333	7,461	7,450	7,450	7,374	7,191	7,191	7,191
R-squared	0.001	0.017	0.017	0.031	0.030	0.031	0.085	0.091	0.091	0.097	0.096	0.096	0.096
Adj. R^2	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095
Individual FE	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Mean (Lonely)	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 8 above, show the results from the multivariable regression based on the combined data from May and September. Column (1) to (6) show the regressions of the dependent variable adding the explanatory variables one by one. The rest of the columns (7) to (13) displays the same, only the variable prior mental wellbeing is included as a variable in each regression column. Thereto, incorporate individual fixed effects clustered standard errors are included in column (13).

In table 8, column (1) presents a negative and significant (at a 5% significance level) association between working from home and feeling lonely. The dependent lonely variable is found to have a mean change of -0.023 as working from home changes one unit, all other explanatory variables kept constant. This is not in line with the hypothesis, as the result purpose that people working from home has a lower probability of feeling lonely. The null hypothesis can so be rejected. Column (2) shows a positive relationship between not working and feeling lonely, significant at a 1% level throughout table 8. As of the COVID-19 restrictions, it is simple to imagine an association between not working and feeling lonely, which the results display. Also, as the

variable not working is added in column (2), working from home is no longer significant, indicating not working to have a stronger relationship with feeling lonely compared to working from home. Contrary to the previous results in table 6 and 7, column (3) shows a negative relationship between key worker and loneliness. Column (4) includes household size in the regression, which again is found to have a negative and significant relationship to feeling lonely, at a 1% significant level. Column (5) includes hours virtually socializing which shows a positive relationship. In column (6) hours physically socializing displays a negative relation to feeling lonely. As hours physically socializing gets added in the regression, the relation between loneliness and hours virtually socializing stays positive but also becomes significant at a 10% significant level.

Prior mental wellbeing is included as a control variable in column (7) to (13), which displays a negative and significant relation to the lonely variable throughout these columns. Therefore, prior mental wellbeing is found to be associated with feeling lonely. In column (7), working from home is presented to have a negative relationship to loneliness. The null hypothesis can therefore be rejected as no strong association between working from home and loneliness is found. Column (8) includes the variable not working, which as previously stated shows a positive and significant relationship to loneliness. In column (9), a negative relation between feeling lonely and being a key worker is displayed. Column (10) includes the variable household size, which still presents a negatively and a 1% significant level association to feeling lonely. In column (11), hours socializing virtually are included in the regression which shows a positive and significant relationship to loneliness at a 10% significant level. Hours physically socializing is displayed in column (12) which presents a negative association to lonely. Simultaneously, the relationship between lonely and hours socializing virtually becomes significant at a 5% level. Column (13) include individual fixed effects as the BCS research ID is added to the regression. The values in column (13) are almost identical to column (12), indicating that the residue variation regarding the dependent variable not explained by the regression concludes with the previously run regression. The adjusted R^2 in table 8, indicates the explanatory variables to answer to over 9% of the dependent lonely variable. This is a somewhat larger percentage compared to the May and September regressions showed in table 6 and 7.

6. Discussion

Working from home, is in the May regression found to have a positive relation to feeling lonely. The September results show a negative association whereas the longitudinal regression presents a negative and significant relationship. The hypothesis predicts a significant association between feeling lonely and working from home, which were not found throughout the results. Therefore, the null hypothesis is rejected as no association among these two variables are found. Moreover, the not working variable were omitted in the May and September regressions, whereas a positive and significant relationship were displayed in the longitudinal analysis. A clear relation between not working and feeling lonely is however displayed, indicating that these variables are

associated. Throughout the three regressions, household size is found to be negatively and significantly associated to the dependent variable lonely. Household size therefore show a negative relationship, implicating the probability of individuals to feel less lonely as household size increases. Likewise, the results show a negative and significant relationship between prior mental wellbeing and feeling lonely throughout the regressions. Prior mental wellbeing is found to have a negative association to feeling lonely, implicating that a higher mental wellbeing score is associated with less probability of feeling lonely.

As shown in the summary statistics, people spend almost the same amount of time socializing through virtual communication systems in May and September 2020. As restrictions and lockdown forbid unnecessary physical socialization in May, people had to use other channels in order to reach people. This seems to have continued throughout the eased restrictions. As long as the COVID-19 continuous to infect people, these ways of communication is most likely to continue and perhaps even longer. The parts of the population suffering from technological exclusion, one could imagine this proportion having decreased since the pandemic has promoted the use of certain technology. Quite possibly, this could also decrease feelings of loneliness as knowledge in technology opens up doors for further technical use, communication, education etc.

Since the UK having different COVID-19 measures in place in May versus September, the individuals working from home during these time periods are presumably a bit different. The work position as well as within what industry/sector an individual work, will affect whether that personal will attend work or work from home, if possible. As the UK was in lockdown in May 2020, key workers and workers crucial to the pandemic response would be the main part of the labor force not staying/working from home. In September, part of the society where again up and running, allow larger parts of the population to attend place of work away from your residence. These differences among population working from home can affect the results of working from home's relationship to loneliness, as the people working from home versus elsewhere might have joint explanatory variables associated with feeling lonely. Gender dominated professions could be one example of such a variable. Moreover, the large increase in household size during lockdown in May has presumably counteracted feelings of loneliness among parts of the society. Being isolated while living alone versus being able to physically socializing with another person within one's household are likely to have an effect on feeling lonely and/or how lonely someone feels. These are all fascinating aspects which would be of interest to study in further studies.

Furthermore, what could be potential reasons that might explain why no significant relationship between working from home and feeling lonely is observed? Working from home does not seem to be related to feeling lonely. Perhaps there is little difference to the way people work at home compared to in their normal work location. Communication and levels of interactions might also be close to the same, keeping people from feeling lonely. Also, as not working is shown to have an association to feeling lonely in the longitudinal analysis, perhaps working from home provide

people with social interaction and things to occupy their minds with, not increasing feelings of loneliness. Studying middle age people, these workers will in general have a lot of work experience. If not newly employed, these individuals most likely are able to perform their work tasks more independently then younger individuals, who more recently entered the labor market. This might affect whether people feel lonely or not, working from home due to the pandemic.

6.1 Sources of error

The data from the three surveys: the COVID-surveys wave one and two and the 1970 British Cohort Study: Age 46 may contain errors or deficits already when accessing the data. This could affect all statistics and analysis results, implicating deceptive conclusions. Thereto, there is no available information about how the selection of BCS70 cohort members requested to participate in the two COVID-19 surveys was determined. Random sampling is therefore assumed yet the risk of some other form of selection is a potential cause for error. For that to be the case, the OLS assumption of random sampling would no longer be fulfilled and the need to use another model would arise. The report's estimated models for the regressions might be to simplified compared to the existing relationship among variables. Additionally, human errors are also not to be forgotten when handling and processing the data for this report.

7. Conclusion

The thesis has aimed to study whether individuals working from home due to the COVID-19 pandemic and its response in the UK, have experienced increased feelings of loneliness. The result of the multivariable regressions implicates there being no significant association between working from home and feeling lonely. Not working was however found to have a relation to loneliness. Thereto, household size and prior mental wellbeing were found to have association to feeling lonely in times of COVID-19 pandemic measures in the UK. Lastly, to answer the question of study: there is no statistically proven relationship found between working from home and feeling lonely.

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