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Covid-19, Occupational Social Distancing and Remote Working Potential: An Occupation, Sector and Regional Perspective

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ABSTRACT

A key question regarding the Covid-19 pandemic and the uncertainty around the implications of social distancing measures and remote working is how it will economically impact people and places differently. We generate two indices which capture (i) social distancing potential and (ii) remote working potential. This is accomplished using occupational level data from O*NET. The paper identifies that social distancing and remote working potential differs considerably across occupations, sectors and places. At a town level – more affluent, dense and highly populated, better educated, and better broadband provisioned towns have greater potential for social distancing and remote working.

KEYWORDS

Covid-19; social distancing index; remote working index; occupations; regions.

JEL Classification

R11, J21, R58.

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1. INTRODUCTION

Ireland experienced its first confirmed case of Covid-19 on the 29th of February 2020. At the time of writing, 27th of July 2020, there have been a total of 1,764 Covid-19 related deaths and 25,881 confirmed cased of Covid-19 in Ireland (Government of Ireland, 2020). The impact of the virus has varied geographically, with the capital city Dublin accounting for approximately 51% of deaths and 49% of cases, while incidence rates are higher in Cavan but much lower in the second city Cork, relative to Dublin. In Appendix 1 we provide two figures which display the cases and deaths per million individuals from the 1st of March to the 26th of July and the incidence rates by county per 100,000 individuals as of the 17th of July 2020. The impact of Covid-19 resulted in the Irish Government introducing a range of measures to slow down the spread of the virus, including restrictions on travel and social gatherings on the 20th March 2020. Subsequently, on the 27th March, the Government ordered all non-essential businesses to close their premises. The Government introduced a phased re-opening of the economy commencing on the 18th of May 2020 and progressing with incremental opening of the economy up to the 10th of August 2020.

The measures taken by governments throughout the world to suppress the spread of the Covid-19 virus had instantaneous impacts on labour markets. The sudden and large international collapse of labour demand and supply means that there is no previous economic crisis in living memory that compares with this one. More jobs are being lost in the U.S. due to the Covid-19 pandemic, than were lost over the entire Great Recession (Coibion, Gorodnichenko, & Weber, 2020). In Ireland, over one million people became fully or partly reliant on the state for income support in only a few weeks since the first known

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Irish case of Covid-19. In March, 2020, the Economic and Social Research Institute (ESRI) predicted the Irish economy would contract by 7.1 per cent with 350,000 job losses (McQuinn, O'Toole, Allen-Coghlan, & Coffey, 2020). By late April, the Irish government predicted an even larger GDP contraction of 10.5 per cent with unemployment to rise to an unprecedented 22 per cent (Department of Finance, 2020) . A significant variation in employment exposure to Covid-19 is predicted across Ireland's regions (Regional Assemblies of Ireland, 2020). As time passes, there are indications that modern economies are less resilient to the covid-19 pandemic than at first forecasted and that the economic impact will be uneven across regions.

The focus of this paper is to analyse the extent to which social distancing and remote working is possible across Irish occupations, sectors and towns. The consideration of the ability of occupations to engage in social distancing is intermixed with the engagement with remote working as these measures are forcing non-essential workers to work from home. Prior to the Covid-19 crisis, only 14 per cent of the Irish workforce worked remotely at least one day a week. Education, ICT and the Finance sectors contained the highest percentages of employees working remotely, whilst the sectors of other, administrative, health, construction, retail, transport and accommodation and food had less than 1 out of every 10 employees homeworking (Redmond & McGuinness, 2020). Previous research has identified a stark regional divide in the distribution of occupations across Irish regions (Crowley & Doran, 2019), which has implications for the ability of workers across Ireland to return to work and practice social distancing or to remote work. This paper specifically addresses the issue of identifying the occupations, sectors, and regions across Ireland which have the ability to transition their workers into a workplace which can either effectively practice

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social distancing or engage their workforce remotely. Any regional imbalances observed across Irish towns in their abilities to achieve these two objectives will have implications for regional policy development.

Two indices are generated in this paper, which capture the potential impact of Covid-19 through identifying (i) the occupations which have the greater relative potential to engage in social distancing procedures and (ii) the occupations which have the potential greatest scope for remote working. This is accomplished using occupational level data from O*NET which provides very detailed information of the tasks performed by individuals with their occupations. We use these indices to provide insights into how different sectors of the economy and regions may be impacted by social distancing measures and the extent to which this may be offset (exacerbated) by the potential (inability) to work from home. This O*Net data is combined with Irish Census data from 2016 which provides information on the regions we focus on, which are the 31 regional administrative areas of Ireland and the 200 towns in Ireland which have a population of over 1,500 people.

In doing so, we make two contributions to the literature. Firstly, examining occupational social distancing, alongside remote working potential will provide a more comprehensive understanding of Covid-19 impacts on the Irish labour market. There are industries where social distancing and remote work indicators may collide and or diverge (Avdiu & Nayyar, 2020) and combining both indicators provides more clarity on employment risk. For example, most agricultural, construction and manufacturing work cannot be completed remotely but also many work tasks in these areas may not require much face to face interaction or physical proximity. The analysis further examines the impact at three different

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levels: the national level; the industry level; and at the regional level. This will provide a greater understanding around the unequal impact Covid-19 will have across people and places, which is particularly of relevance for Covid-19 policy responses.

In the next section we will discuss the emerging literature and the impact of Covid-19 on remote working and social distancing. We discuss the data used in this analysis and the rationale underlying the construction of the two indices in Section 3. Section 4 presents the results of our analysis. Section 5 concludes the study with a discussion on policy implications.

2. LITERATURE REVIEW

This section discusses the emerging literature on how Covid-19 is impacting regional economies and transforming the working environment into one which incorporates the need for social distancing and the transition to remote working. These issues are increasingly becoming the focus of analysis by academics and policy makers alike. From the labour supply side Mongey and Weinberg (2020) highlight that returning to work is likely to be slow for workers where their jobs require a high degree of physical proximity to others. They further highlight that the characteristics of jobs that cannot be conducted from home and that require close physical proximity are systematically different from those which can be conducted at home or that have a low physical proximity requirement. From the perspective of labour demand, Leibovici, Santacreu, and Famiglietti (2020) highlight that consumption activities requiring high degrees of face to face contact are likely to be viewed as risky by consumers. As a result consumers will reduce their demand for goods and services requiring high face to face contact as they practice social distancing. Therefore,

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workers employed in occupations requiring physical proximity to customers are more exposed to negative employment shocks which in turn will likely lead to layoffs within these occupations.

There is rapidly expanding literature examining the economic consequences of the Covid-19 pandemic. At the outset of the crisis, there was widespread consumer panic in a vast number of countries (Keane & Neal, 2020). Social distancing measures are having a significant impact on the quantity of labour which in turn is significantly reducing output worldwide (Barrot, Grassi, & Sauvagnat, 2020; Koren & Pető, 2020). It is estimated that six weeks of drastic social distancing rules will reduce GDP output from 4.3 per cent in Denmark to 9.2 per cent in Bulgaria, where cross-country differences are a result of national sectoral differences and remote work potential (Barrot et al., 2020). There are geographical effects evidently emerging from the crisis. Particularly economic contagion and supply chain disruptions across urban-rural divides, regions, and countries are a significant problem. For example, scenarios of Tokyo under a lockdown state for a month, results in a GDP decline of 5.3 per cent of annual GDP in Japan, where the indirect effects on other Japanese regions is twice as large as the direct effect on Tokyo (Inoue & Todo, 2020). Further, social distancing measures are currently impacting occupations, sectors and places unequally. In the U.S. retail, hotels and restaurants, arts and entertainment, and education providers are the most affected sectors (Baker, Farrokhnia, Meyer, Pagel, & Yannelis, 2020; Kong & Prinz, 2020; Koren & Pető, 2020; Muro, Maxim, & Whiton, 2020). Sforza and Steininger (2020) show using a general equilibrium framework that the global nature of supply chains, trade linkages and the geographic distribution of industries across regions result in vastly different outcomes for sectors, regions and countries as a result of the Covid-19 shock.

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Since the lockdown, although the extent is unknown, a greater proportion of the workforce have adapted in some capacity to working from home. In the U.S., recent research identified that 37 per cent of jobs can be performed entirely at home, but with significant differences across industries and cities (Dingel & Neiman, 2020). The substitution effect from workplace to remote work has limited the economic impact of the Covid-19 shock and has limited the further spread of the virus (Fadinger & Schymik, 2020). However, the empirical evidence so far suggests that the potential to work from home is quite limited across many occupations and sectors, particularly in developing economies (Delaporte & Peña, 2020; Gottlieb, Grobovšek, & Poschke, 2020; Hatayama, Viollaz, & Winkler, 2020; Saltiel, 2020). Saltiel (2020) identified that working from home was limited in a cross-country study for ten developing economies, with only 13 per cent of jobs across the economies having the capacity to be conducted remotely. Delaporte and Peña (2020) found that the proportion of individuals that can work from home varies from 7 per cent to 16 per cent across 23 Latin American and Caribbean countries. Hatayama et al. (2020) indicated that working from home increases with the level of economic development of the country, where jobs in poorer countries involve more manual tasks, less ICT and workers suffer from poor internet availability. They identify significant sectoral differences which will in turn deepen existing inequities between and within countries. Whilst initially the Covid-19 pandemic was portrayed as the 'great equalizer' and a virus that does not discriminate, work by Galasso (2020) highlights how low income, low educated and blue collar workers have suffered much worse labour market outcomes and suffered higher psychological costs relative to higher income-individuals. In the Irish case, Crowley, Doran, and Ryan (2020) identified that Covid-19 restrictions are likely to have unequal impacts across workers with younger, male,

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less educated, non-nationals and the self-employed more likely to find it difficult to work remotely and to practice social distancing in the workplace. Crowley, Daly, Doran, and Ryan (2020) also find that those who commute by car have a relatively high potential for remote work, but they are less likely to be able to engage in social distancing in their workplace.

We contribute to this growing literature by considering the sub-national aspect of social distancing and remote work potential and its possible impact on regional inequality. Next, we discuss the data used in this paper.

3. DATA

We begin by discussing the use of O*Net data in the Irish context in Section 3.1. Section 3.2 discusses the information available from the Central Statistics Office of Ireland (CSO). Section 3.3 discusses considerations for generating an index. Section 3.4 presents the construction of the Social Distancing Index. Section 3.5 presents the construction of the Remote Working Index. Section 3.6 discusses the overlap between the indices.

*3.1 Occupational Codes and O*NET*

The O*NET database provides classifications, definitions and detailed information on a large number of occupations. The questionnaires used in the O*NET Data Collection Program collect detailed occupational data on the abilities, background, education, training, work activities, knowledge, skills, work context and work styles from workers associated with different occupations. More specifically for our interests, we exploit data from the generalized work activities and work context components to formulate the social distancing and remote work indices, which we will discuss later.

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O*Net provides 968 occupational codes which match to 2010 US Standard Occupational Classifications (SOCs). These occupational codes do not directly match to Irish occupational codes as the Irish Central Statistics Office (CSO) bases their occupational classifications on the UK SOC system. We apply a crosswalk in the same way as Crowley and Doran (2019). The US and UK SOC are not directly comparable and there is no direct conversion available. Therefore, in order to convert the US codes to their UK counterparts (which are approximately identical to the Irish codes used by the CSO) we transform these data using a series of established international classifications. This is accomplished through the use of the International Standard Occupational Classifications (ISOC). The US SOCs can be converted using the Bureau of Labour Statistics official conversion (Bureau of Labor Statistics, 2012). The codes available from O*Net are 6-digit US SOCs. When converting these to the ISOC there is not a one to one match. This is due to the ISOC codes being at a higher aggregation level. Therefore, in some instances, two or more of the US SOC codes are combined into one ISOC code. Where this occurs, any data on occupations is averaged to provide a single value. Once the codes are in ISOC format it is possible to convert these ISOC codes to the UK SOC codes using a conversion framework developed by the Office for National Statistics (2010). In doing so, again there are a small number of occupations which have more than a one for one match and therefore there is a need to average any occupational details associated with these occupations. It is possible, once this process has been completed, to translate these UK SOC codes to Irish SOC codes in a perfect one for one match.

When the merge process is complete, out of a possible 327 SOC codes available in Ireland we have occupational level data for 318 of these. Therefore, our analysis begins with, what

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the CSO define as, the detailed occupational classifications for Ireland of which we have occupational information associated with 318 detailed occupations.

3.2 Overview of the Irish Census 2016 data

In this paper we use data from the 2016 Irish census. This is the most recent data available which contains detailed occupational data on workers nationally and regionally. We use data at national, regional, and town level to perform our analysis. At the national level we can match the occupational codes from the US O*Net data to 318 detailed occupational codes. We only consider those who indicated that they were in employment in the 2016 census. Therefore, when we perform our analysis at the national level it is at the highest level of disaggregation available to us. The same is the case for regional data (31 regions of Ireland). This data is also available at the detailed occupational codes level. However, data at town level is only available at the intermediate occupational level. This is at 25 occupational codes. Therefore, our index data must be aggregated from 318 detailed occupations to 25 intermediate occupations at the town level. This aggregation is weighted by the proportion of individuals employed in each occupation. This is a similar procedure to that undertaken by Dingel and Neiman (2020) when considering variations in remote working potential across countries.

It should also be highlighted that the data we use is based on place of residence, not place of work. Place of work data is not available with sufficient occupational detail to facilitate this analysis. This should be kept in mind as a limitation of this analysis, but is only relevant for the regional level analysis at town level.

3.3 Considerations when generating an index

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When generating an index, in our case to measure social distancing and remote work potential, there are a number of significant steps. The first is the identification of the variables to include in the index. This is usually a 'judgment' exercised by the researchers after a review of the factors which may impact the outcome of the index. Linked with this is the measurement of these variables of relevance i.e. how the dataset available quantifies the variable. We discuss our variable choices and measurement for each index in detail in Sections 3.4 and 3.5 below. The third consideration is the normalisation or scaling of the variables of interest. This typically takes two formats; scaling the data from 0 to 1 or normalising the variables based on their standard deviation. As our data is provided ranging from 0 to 100 and is consistent in its unit of measurement we simply rescale this to take a value between 0 and 1 for our index construction. The final stage is the decision on how to weight each individual variable in the construction of the index. In broad terms this takes one of two forms; an unweighted index or a weighted index (Lockwood & Redoano, 2005). In our case we use an unweighted index as existing literature places equal importance on each of the variables utilised from O*NET [see (Dingel & Neiman, 2020); Koren and Pető (2020) Béland, Brodeur, and Wright (2020) Mongey, Pilossoph, and Weinberg (2020) for examples of similar approaches using O*NET data and Saltiel (2020) using STEP survey data].

3.4 Measuring Social Distancing Potential by Occupation

When we consider the construction of an index measuring the extent to which social distancing may impact on individuals' abilities to undertake their occupations we base this index on the work of Koren and Pető (2020) who develop a social distancing index based on occupational level data from O*Net. The index is comprised of 15 questions from O*Net which provide insights into the degree to which face-to-face contact is required for the role

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the individual undertakes. These can be divided into three broad categories (i) teamwork requirements, (ii) customer orientation, and (iii) physical presence. In addition to these elements we also add the extent to which the job requires individuals to work in close physical proximity to others. Each variable takes a value ranging from 0 to 100. In constructing our index we get the unweighted average of the 15 individual indicators. A value closer to 0 indicates that social distancing potential is low while a value close to 100 indicates that social distancing potential is high. Full definitions of the 15 variables are provided in Appendix 2.

3.5 Measuring Remote Working Potential by Occupation

To measure the potential for remote work we follow the approach adopted by Dingel and Neiman (2020). Again, this utilises data from O*Net to construct an index of the potential for different occupations to work from home. This is based on 17 variables from O*Net and again an unweighted average is taken to provide our index. These 17 variables relate to issues such as the ability to use e-mail rather than face-to-face communication, does the individual need to use or service specialized equipment, does the job require the use of protective equipment, among other factors. A full definition of the 17 variables as well as their coding is displayed in Appendix 3.

3.6 Overlap between the indexes

There is an inherent overlap between the two indexes in terms of some of the variables used from O*Net. Some variables which are indicators of the ease at which social distancing may take place overlap with some indicators of whether it is possible to work remotely. Indeed we observe a correlation of approximately 0.55 between our social distancing index

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and our remote work index. This is built into the definitions of our indices due to the variable choice for each index.

4. RESULTS

In this section we discuss the results derived from analysis of our indices. We begin with a discussion at the national level, moving to the regional level, and finally the town level.

4.1 Social Distancing and Remote Work Potential at National Level

We begin our analysis at the national level at detailed occupational codes of which we possess 318. For each occupation we have a specific value for social distancing potential and remote work potential. At a national level the two indices display a degree of correlation as has been discussed in the previous section.

Figure 1 shows a scatter plot of the social distancing and remote work indices with the points weighted by the importance of that occupation to the economy (in terms of number of people employed). What can be observed is that occupations which have a high degree of social distancing potential also possess a high degree of remote work potential. In addition to this the size of the bubble indicates the proportion of the workforce employed within that occupation. What we observe is that there are occupations with large proportions of employment at either end of the spectrum of our indices. These are the occupations which offer opportunities for continued work at lower levels of risk (through either social distancing or remote working) and occupations which will prove challenging (as it will be difficult to social distance and/or remote work). Examples of large employment

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occupation which have relatively high indices are teaching occupations at secondary and third level and programme and software developers. While occupations which have large employment but which possess relative low indices are nurses and midwives and care workers.

Figure 1: Social Distancing and Remote Work Potential Indexes (weights – proportion employed in each occupation)



Further insights into the national level picture emerge when one aggregates occupations to broad occupational classification and also considers the spread within these occupations. For example one can clearly observe in Figure 2 below that individuals employed in the protective services occupation classification have the lowest potential for remote work on average. Which is closely followed by those in Health and social care associate professionals occupations. We note there is a spread between the minimum and maximum values in these occupations which indicates the degree of variability within these areas. Although in

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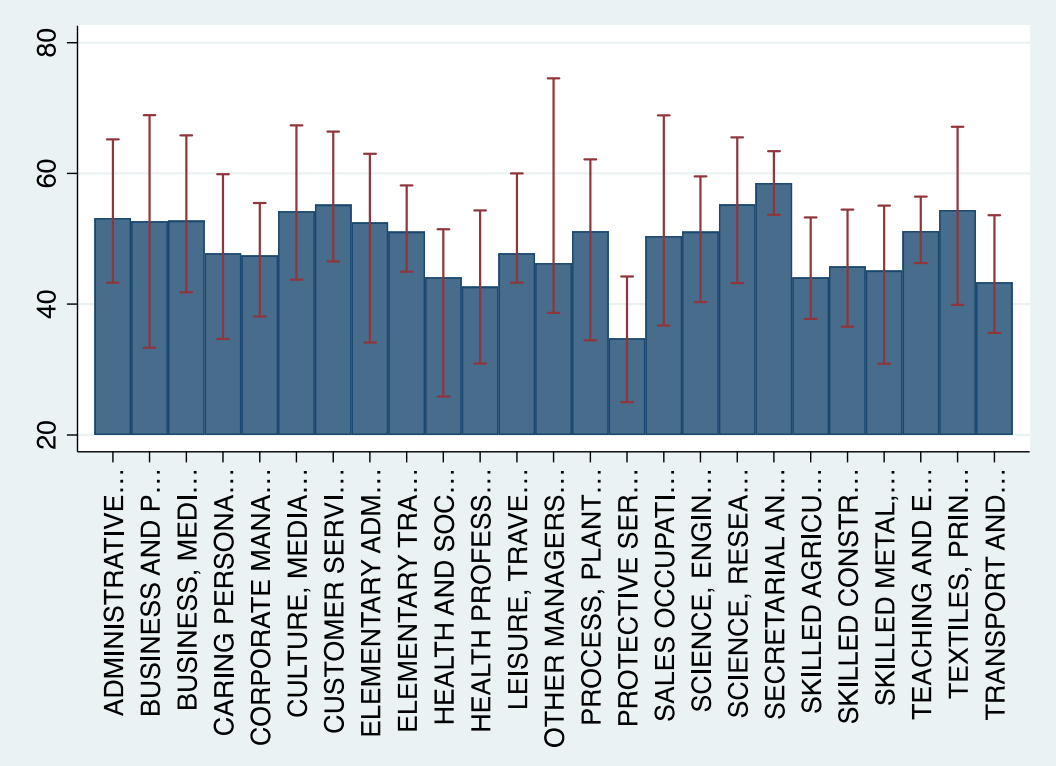
the case of *protective service occupations*, which include occupations such as firefighters and police officers the values, despite having some degree of spread, are all relatively low. The other managers and proprietors occupational category has a large spread across minimum and maximum values in our social distancing potential index. One of the best placed occupations within this broad occupational category to social distance is *Managers and proprietors in forestry, fishing and related services* while some of the occupations with the least ability to socially distance are *residential, day and domiciliary care managers and proprietors* and *health care practice managers*,

Progressing to the remote working potential index in Figure 3 we observe a similarly low index value for protective services occupations. But other occupations, such as Elementary trades and related occupations which had a relatively high potential for social distancing in this case possess a low remote working potential index. Teaching and educational professional occupations which were at the middle of the ranking for social distancing potential have significant potential for remote working. We note that within Health and social care associate professional occupations there is a large degree of variation in the degree of remote work potential. In this instance councillors have the potential for remote work, while occupations such as paramedics have limited ability.

Figure 2: Social Distancing Potential by Broad Occupation (unweighted)

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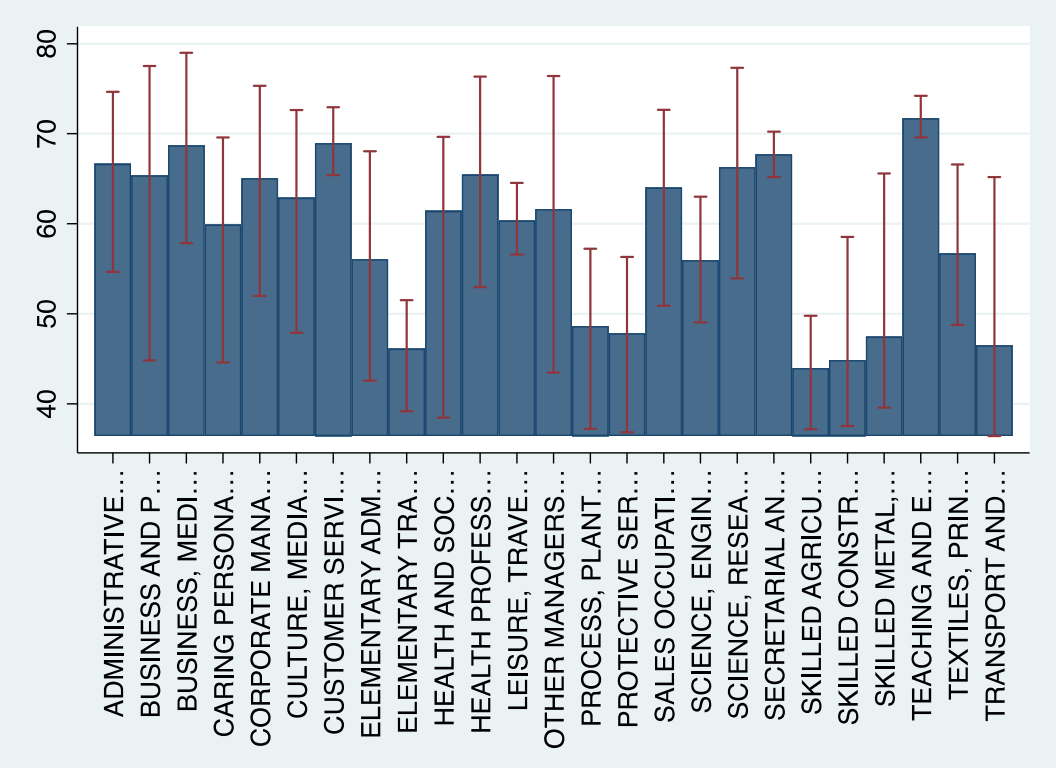


Note 1: The average social distancing index value is taken when aggregating to the broad occupational category. 318 detailed categories are aggregated to 25 intermediate categories.
Note 2: Error bars show the minimum and maximum index value within that intermediate occupational category.
Note 3: Full titles of occupations in order from left to right are: 1) Administrative occupations, 2) Business and public service associate professionals, 3) Business, media and public service professionals, 4) Caring personal service occupations, 5) Corporate managers and directors, 6) Culture, media and sports occupations, 7) Customer service occupations, 8) Elementary administration and service occupations, 9) Elementary trades and related occupations, 10) Health and social care associate professionals, 11) Health professionals, 12) Leisure, travel and related personal service occupations, 13) Other managers and proprietors, 14) Process, plant and machine operatives, 15) Protective service occupations, 16) Sales occupations, 17) Science, engineering and technology associate professionals, 18) Science, research, engineering and technology professionals, 19) Secretarial and related occupations, 20) Skilled agricultural and related trades, 21) Skilled construction and building trades, 22) Skilled metal, electrical and electronic trades, 23) Teaching and educational professionals, 24) Textiles, printing and other skilled trades, 25) Transport and mobile machine drivers and operatives.

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Figure 3: Remote Working Potential by Broad Occupation (unweighted)



Note 1: The average remote working index value is taken when aggregating to the broad occupational category. 318 detailed categories are aggregated to 25 intermediate categories.
Note 2: Error bars show the minimum and maximum index value within that intermediate occupational category.
Note 3: Full titles of occupations in order from left to right are: 1) Administrative occupations, 2) Business and public service associate professionals, 3) Business, media and public service professionals, 4) Caring personal service occupations, 5) Corporate managers and directors, 6) Culture, media and sports occupations, 7) Customer service occupations, 8) Elementary administration and service occupations, 9) Elementary trades and related occupations, 10) Health and social care associate professionals, 11) Health professionals, 12) Leisure, travel and related personal service occupations, 13) Other managers and proprietors, 14) Process, plant and machine operatives, 15) Protective service occupations, 16) Sales occupations, 17) Science, engineering and technology associate professionals, 18) Science, research, engineering and technology professionals, 19) Secretarial and related occupations, 20) Skilled agricultural and related trades, 21) Skilled construction and building trades, 22) Skilled metal, electrical and electronic trades, 23) Teaching and educational professionals, 24) Textiles, printing and other skilled trades, 25) Transport and mobile machine drivers and operatives.

Aggregating our occupational data to broad industry level gives an indication of the extent to which broad sectors of the economy have the potential to transition to work from home. Much of the discussion of the re-opening of the economy focuses on sectors as opposed to occupations, and there can be a large degree of variability in the ability to social distance and remote work within a given sector due to the different characteristics of occupations. If

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we consider the Agriculture, forestry and fishing sector of the economy we note significant potential for social distancing, but very limited potential for remote working. Other sectors have low scores for both indices such as Water supply; sewerage, waste management and remediation activities.

Table 1: Remote Work Potential by Sector

NACE Sector	Social Distancing	Remote Working
Agriculture, forestry and fishing (A)	0.89	0.03
Mining and quarrying (B)	0.3	0.26
Manufacturing (C)	0.61	0.31
Electricity, gas, steam and air conditioning supply (D)	0.54	0.57
Water supply; sewerage, waste management and remediation activities (E)	0.33	0.35
Construction (F)	0.24	0.15
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	0.24	0.59
Transportation and storage (H)	0.27	0.23
Accommodation and food service activities (I)	0.27	0.53
Information and communication (J)	0.85	0.86
Financial and insurance activities (K)	0.67	0.78
Real estate activities (L)	0.32	0.69
Administrative and support service activities (N)	0.53	0.41
Professional, scientific and technical activities (M)	0.75	0.82
Public administration and defence; compulsory social security (O)	0.55	0.6
Education (P)	0.66	0.92
Human health and social work activities (Q)	0.26	0.86
Arts, entertainment and recreation (R)	0.56	0.76
Other service activities (S)	0.21	0.84

4.2 The Regional Perspective

Progressing from the national context to the regional context, Figure 4 presents a map of Ireland with social distancing potential across administrative areas. What can be noted is that the regions which have the highest potential social distancing indexes are in the regions around Dublin, Cork City, Galway City and Donegal. However, what is important to note here is that this index is based on where people live, not where people work. Therefore,

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while the regions around Dublin City have high values of these indices it is highly likely that many of these individual work in Dublin City itself. Occupational data is not available at a sufficiently detailed level to use place of work data to recreate this type of analysis. Regarding remote working potential a similar pattern is observed in Figure 5.

In the context of the major cities of Dublin, Cork and Galway, the concentration of highly skilled occupations in these regions explain their relatively high values for social distancing and remote working in our indices. For example in the case of Dublin the high concentration of employment in occupations such as “accountants”, “software developers”, “lawyers, “accounting associated professional”, and “administrative and excitative secretaries” results in a significantly high proportion of the workforce having the potential to remote work and/or socially distance themselves in work. This pattern is replicated across the other major urban areas of Ireland.

Donegal is a bit exceptional, in that it is a relative rural county, yet it is classified in our analysis as possessing a high potential for remote working and social distancing. This is again due to the nature of the occupations present in Donegal which, although significantly different from those found in the major urban cities, possess characteristics which facilitate remote working and social distancing. Specifically, Donegal possess a relatively high concentration of employed in occupations such as “Clerical support workers not elsewhere classified”, “secondary education teachers”, “Administrative and executive secretaries”, “general office clerks”, and “Programmers and software development professionals”.

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Figure 4: Social Distancing Potential by County

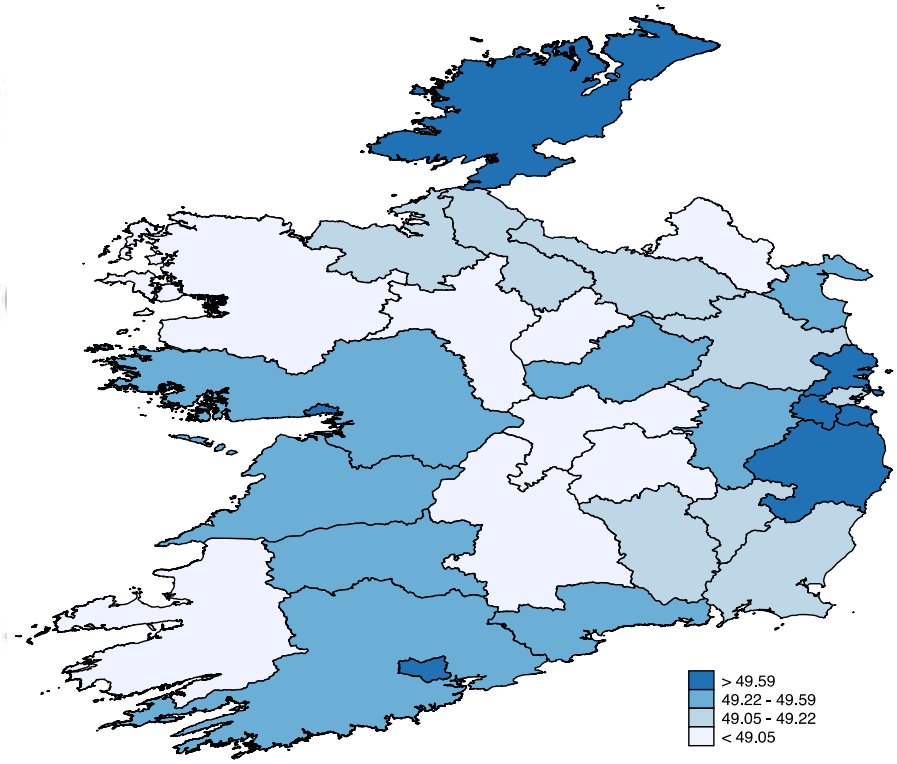
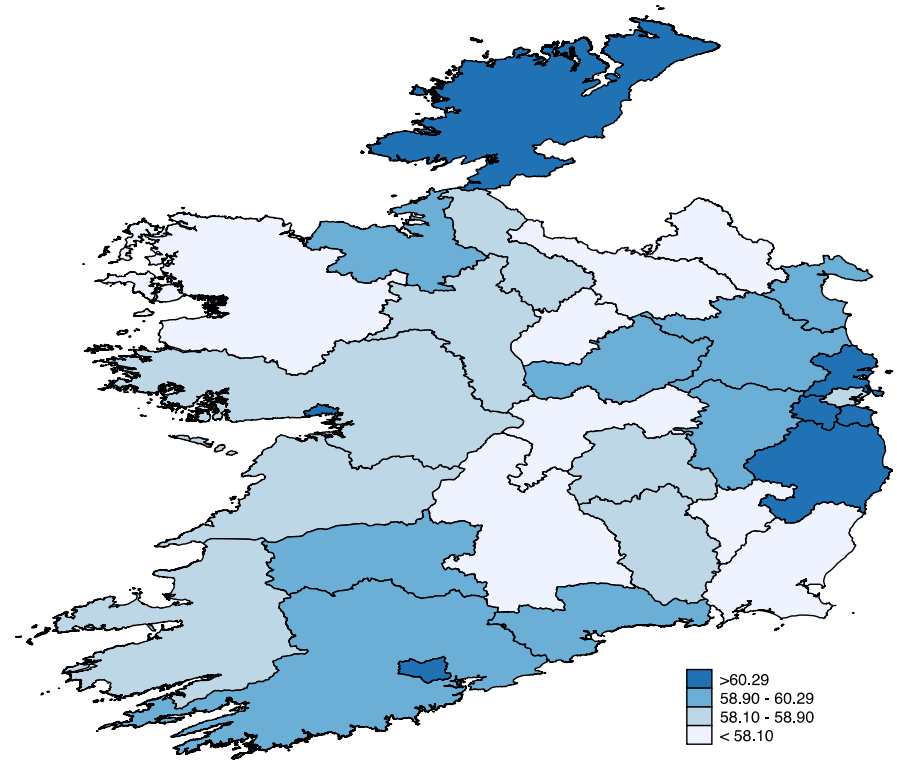


Figure 5: Remote Working Potential by County



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In addition to assessing the variation of our indexes at county level we also compare the death rate and infection rate of Covid-19 at county level with our indices in Figures 6 and 7 below. What we observe is a moderately strong positive correlation between social distancing and number of deaths and infections per 100,000 population across counties. This suggests that those regions which have been worst effected by Covid-19, in terms of deaths and infections, have the highest potential for socially distanced work. Therefore, during the Government's reopening strategy, those regions which have previously been most impacted by the virus may be better able to supress new infections through their ability to return to workplaces which can practise social distancing. There is no relationship observed between the death and infection rates per 100,000 population and our remote working index.

Figure 6: Social Distancing and Remote Work Potential and Log of Deaths by County

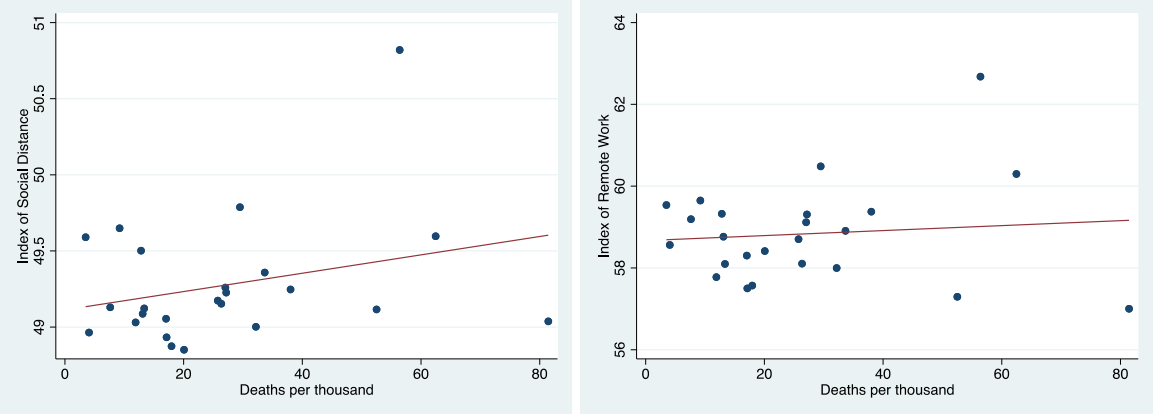
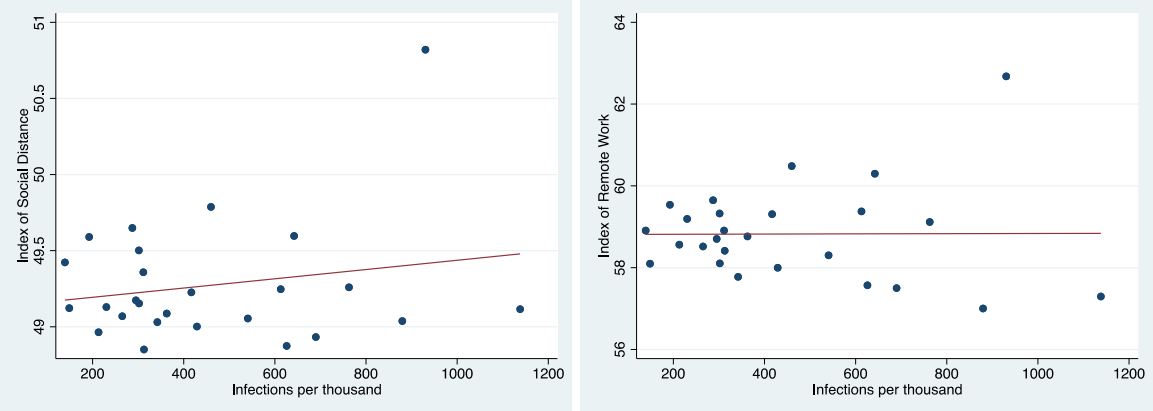


Figure 7: Social Distancing and Remote Work Potential and Log of Infections by County

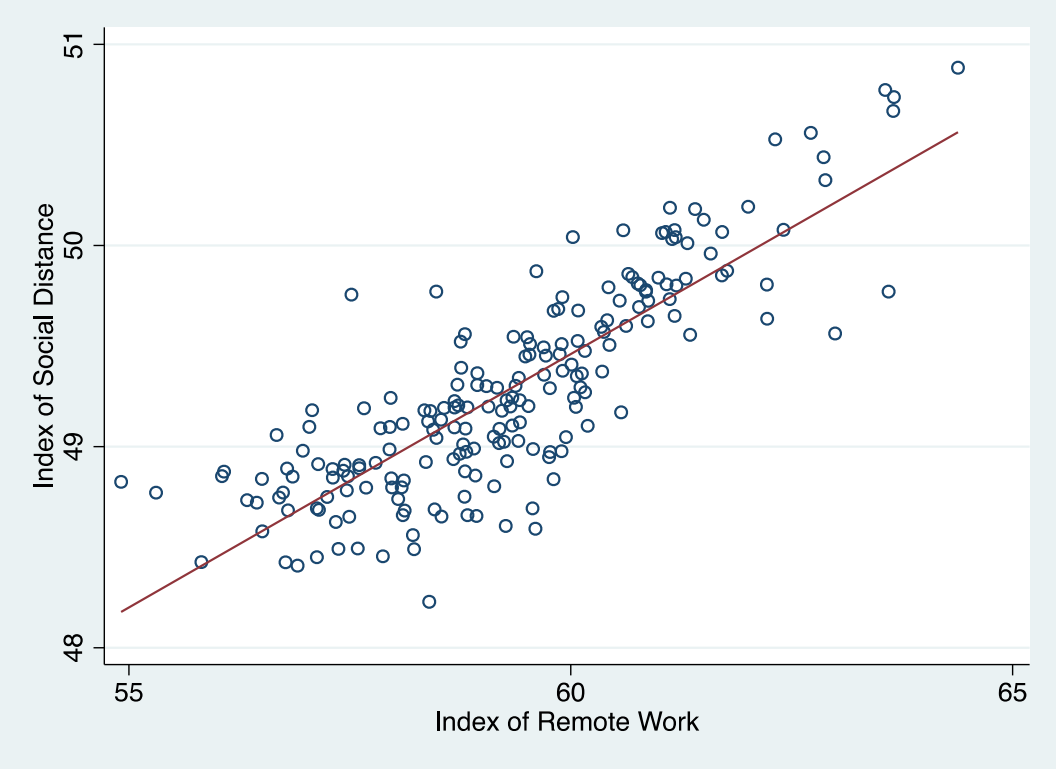


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4.3 Remote Work Potential at Town Level

When we progress to town level we consider all towns with a population of 1,500 or more in the 2016 census. It should again be highlighted that to calculate town values an aggregation method must be applied to the index as only broad occupational codes are available at town level. Therefore, we generate a weighted average by broad occupational codes of our social distancing and remote working index. We observe that both social distancing and remote work at the town level are again correlated. Again, this is not surprising and is to be expected given the variable construction of these indices.

Figure 8: Social Distancing and Remote Work Potential by Town



When we consider the potential for social distancing and remote work across towns by the median gross income of individuals within that town (Figure 9), we observe that towns which have a higher median gross income per individual have higher levels of our social

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distancing and remote working potential index. This suggests that relatively more affluent towns are more likely to be able to return to a greater degree of economic normality through social distancing measures or continuation of work via remote working. There is a certain degree of endogeneity here as occupations which are relatively higher paid have a higher degree of social distancing and remote work potential.

There is also a pattern of larger towns possessing higher values for our social distancing and remote working indices. This pattern is also present when one considers population density (which is the population per square kilometre of the town size) presented in Figure 11. Towns where more households have access to broadband also possess greater potential to socially distance and remote work based on our index (Figure 12). This particular graph is interesting as it appears to show that there is a correlation between towns which have the potential to remote work (based on our index) and also the capacity to do so (based on the proportion of households which have broadband). Regarding educational attainment, we also observe that towns with a higher concentration of third level educated individuals also possess higher levels of our social distancing and potential for remote working indices (Figure 13).

This paints a picture of unequal potential to reengage fully in the economy across Irish towns, with larger, better educated, higher income, better broadband provisioned towns being better positioned from a social distancing and remote working occupational basis.

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Figure 9: Social Distancing and Remote Work Potential and Median Gross Income



Figure 10: Social Distancing and Remote Work Potential and Town Size (by Population)

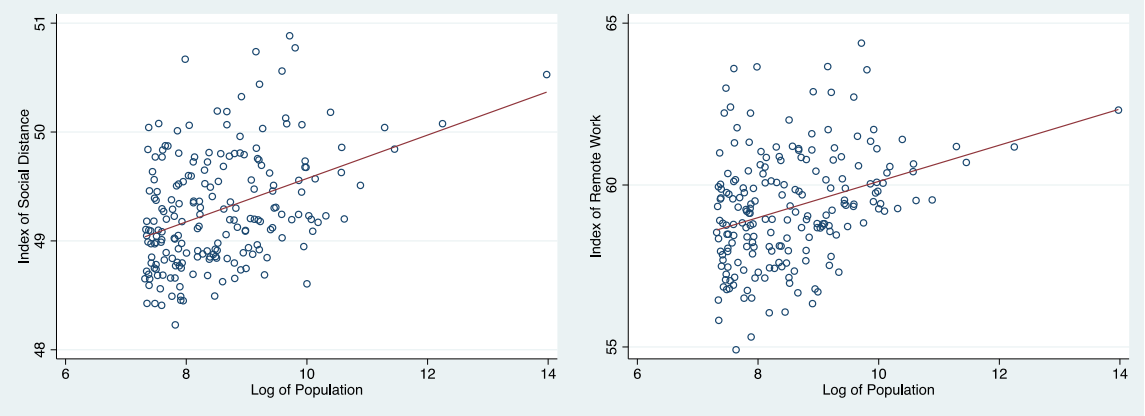
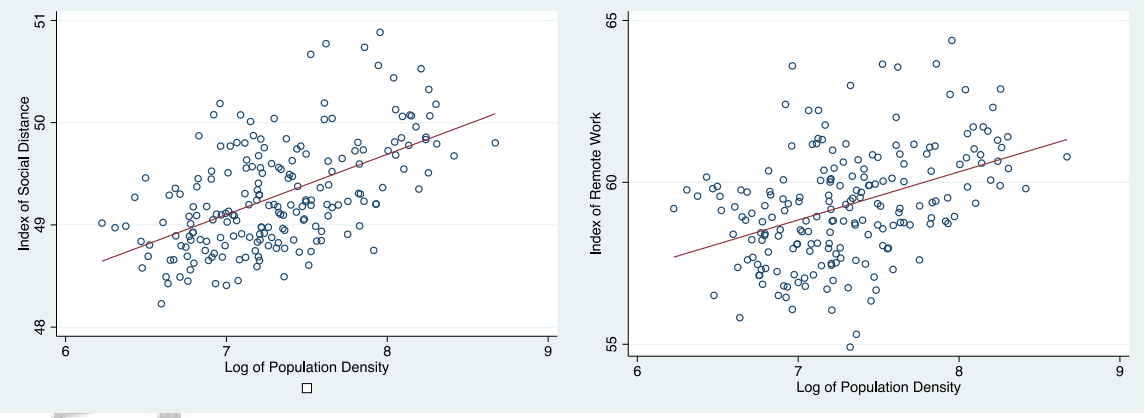


Figure 11: Social Distancing and Remote Work Potential and Population Density



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Figure 12: Social Distancing and Remote Work Potential and Proportion of Households with Broadband

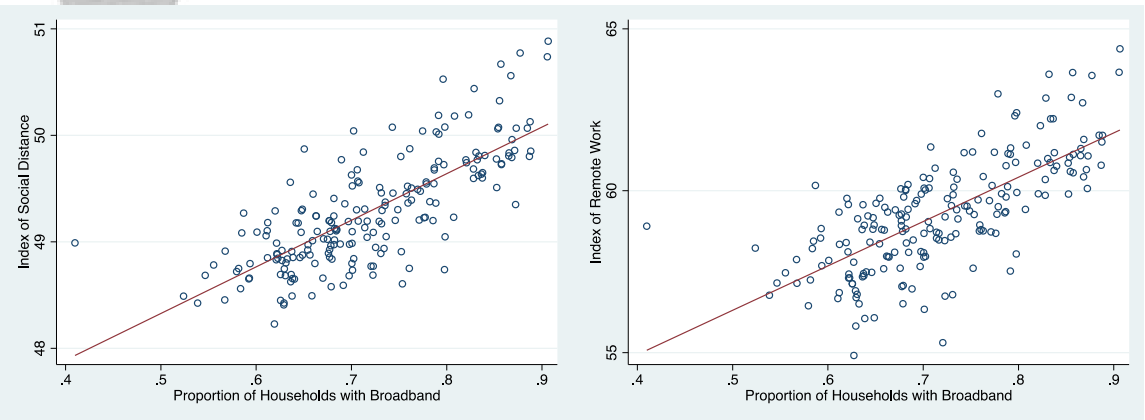
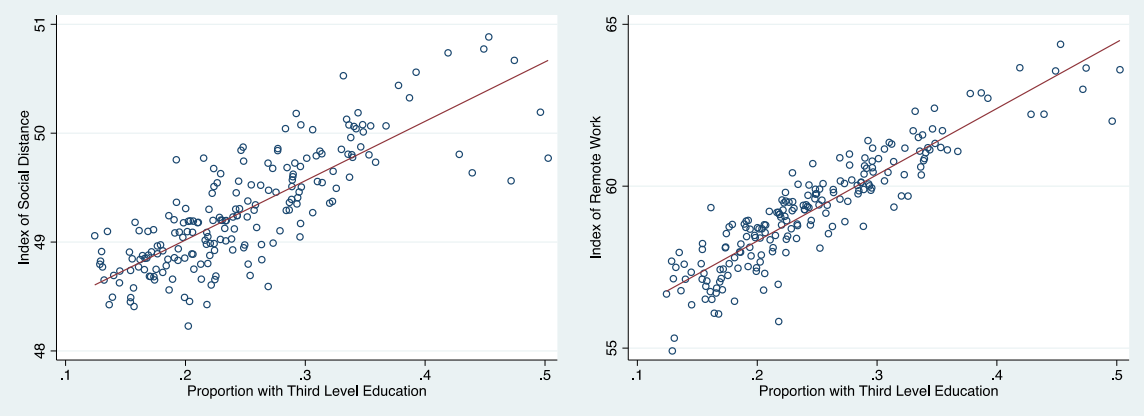


Figure 13: Social Distancing and Remote Work Potential and Proportion Third Level Education



5. CONCLUSIONS

The Covid-19 pandemic has had a sudden and drastic impact on labour supply and output In Ireland. There is considerable uncertainty around the implications of social distancing measures and remote working for the Irish labour market. As the Irish government responds, a key question is how Covid-19 will impact people and places differently. The objective of this paper is to get a better understanding of the social distancing and remote working potential at an occupational, sector and regional level in Ireland.

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This paper identifies that social distancing and remote working potential broadly (0.55 correlation) move in the same direction; that is, if social distancing potential in an occupation, sector or place is high, then it is also likely that remote working potential is high. However, we note that the construction of these indices contributes to this. There is a wide variation of social distancing and remote working potential across occupations and within industries. Potential for social distancing and remote work favours workers located in the Dublin region and provincial city regions and these measures are also higher in more affluent, larger, more densely populated, better educated and better broadband provisioned towns. Notably, the Dublin region which has previously been heavily impacted by the virus may be better able to supress new infections through the ability of workers to return to workplaces which can practise social distancing.

The key characteristics underlying the occupational, sector and regional differences are driven firstly, by the unique implications of social distancing for tasks that involve high degrees of face to face communication, customer facing interaction and physical proximity, and secondly, by the unique working conditions with some conditions representing an impossibility for remote work such as working outdoors or with the operation of vehicles and machinery. Occupations in the hospitality, wholesale and retail trade, transportation, and construction sectors are the most affected. This pattern aligns with data of individuals in receipt of the Irish government's Covid-19 pandemic unemployment payment since March 2020. This policy measure has been critical in supporting the people in the most vulnerable occupations and sectors. Unfortunately, over the medium to longer term of the pandemic crisis, the scope for remote working potential in these sectors, particularly in construction and transportation, is also considerably lower relative to other sectors. In other

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words, remote working is not going to be a panacea for social distancing concerns in many sectors. A key issue in the short to medium term is the implication for these sectors, if the Covid-19 pandemic unemployment payment is curtailed. Further, since we know the sectors that will be hardest hit, sector specific interventions such as business rates and tax holidays are likely to be on the policy and lobbying agendas (Overman, 2020).

Due to occupational and industrial clustering and the associated social distancing and remote working potential required; the economic crisis is likely to play out differently across places. Regional context effects such as population size, density, regional education levels and broadband availability will also be important in determining medium and long term regional inequalities. The Greater Dublin city region will be the least affected by social distancing measures and will likely be better insulated due to greater remote working potential for the population living there. Consequently, a one size fits all policy approach to the crisis, is unlikely to resolve regional inequalities. For example, given the dependence of some peripheral and smaller urban areas on the tourism and hospitality industry, the economic contagion effect at the local level may have devastating consequences for these communities. As Ireland is one of the most centralized states in Europe, a rethink and redesign of local and regional policy institutions may be required to minimize regional inequalities accruing from the crisis. This is a consideration that may have application to other centralized states in Europe and worldwide.

We would like to note a few limitations of the study. Firstly, by using O*NET data we are relying on data from U.S. occupations as an approximation of working conditions across occupations for Ireland. While working conditions are likely to be slightly different between

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the U.S. and Ireland, the estimates should provide a close approximation of social distancing and remote working potential in Ireland. Also, the most detailed analysis below local authority level can only be conducted on the occupations of towns with a population of greater than 1,500. Consequently, the rural surrounds are not included in the town level analysis. Despite, these minor limitations, the current study provides a robust and the most comprehensive analysis to date on occupational social distancing and remote working in Ireland.

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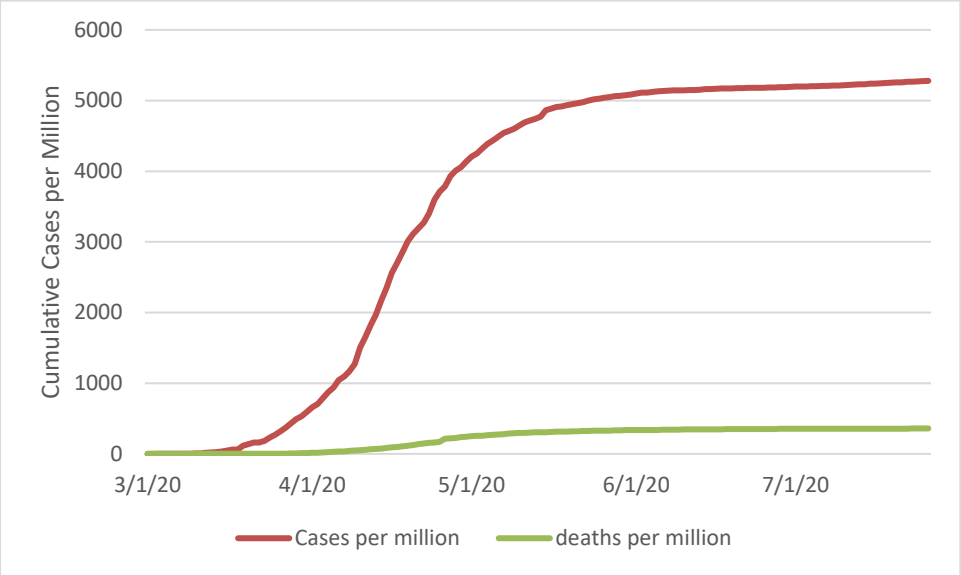
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APPENDIX

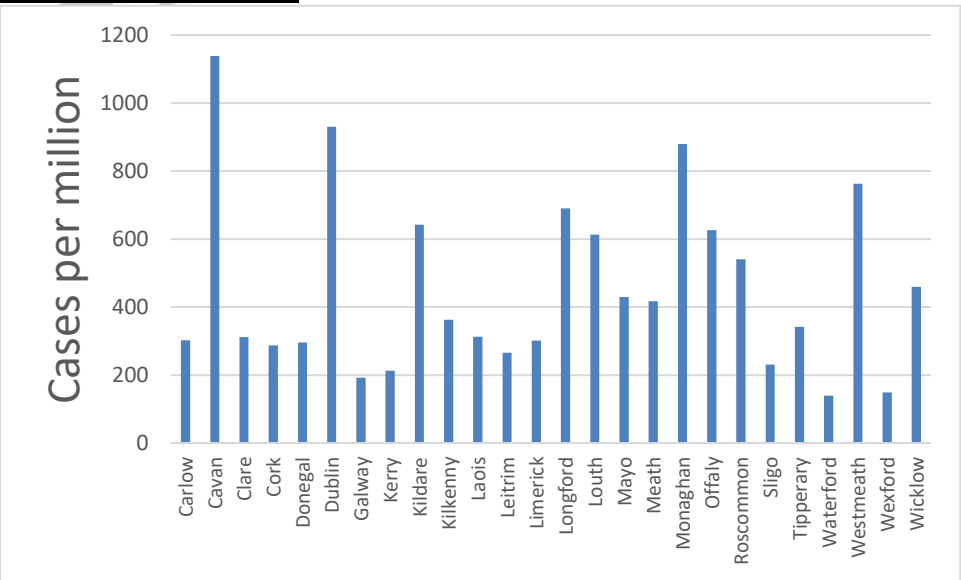
Appendix 1: The timeline and geographical spread of Covid-19 in Ireland

Figure A1.1: Covid-19 Cases and Deaths per million from the 1st of March to the 26th of July 2020



Source: https://covid19.who.int/table?tableChartType=heat

Figure A1.2: Covid-19 Incidence rates of confirmed cases per 100,000 population by County as of the 17th July 2020



Source: Covid-19 infection numbers https://www.cso.ie/en/releasesandpublications/br/b-cdc/covid-19deathsandcasesseries8/ Population numbers based on 2016 Census data.

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Appendix 2: Definition of elements of Social Distancing Index

Variable	Original Coding	Recoding	Context
How important is it to work with others in a group or team in this job?	0 - Not important at all 25 - Fairly important 50 - Important 75 - Very important 100 - Extremely important	0 - Extremely important 25 - Very important 50 - Important 75 - Fairly important 100 - Not important at all	Face to face discussions several time a week and often more than e-mails, letters, and memos.
Providing guidance and expert advice to management or other groups on technical, systems-, or process-related topics.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Getting members of a group to work together to accomplish tasks.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Providing guidance and direction to subordinates, including setting performance standards and monitoring performance.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Encouraging and building mutual trust, respect, and cooperation among team members.	0 – Not important 100 – Important	0 – Important 100 – Not important	
How important is it to work with external customers or the public in this job?	0 - Not important at all 25 - Fairly important 50 - Important 75 - Very important 100 - Extremely important	0 - Extremely important 25 - Very important 50 - Important 75 - Fairly important 100 - Not important at all	Face to face discussions several times a week
Performing for people or dealing directly with the public. This includes serving customers in restaurants and stores, and receiving clients or guests.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Providing personal	0 – Not important	0 – Important	

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assistance, medical attention, emotional support, or other personal care to others such as coworkers, customers, or patients.	100 – Important	100 – Not important	
Developing constructive and cooperative working relationships with others, and maintaining them over time.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.	0 – Not important 100 – Important	0 – Important 100 – Not important	Density of co-workers like shared office or more
Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or water craft.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Servicing, repairing, calibrating, regulating, fine-tuning, or testing machines, devices, and equipment that operate primarily on the basis of electrical or electronic (not mechanical) principles.	0 – Not important 100 – Important	0 – Important 100 – Not important	
Inspecting equipment, structures, or materials to identify the cause of errors or	0 – Not important 100 – Important	0 – Important 100 – Not important	

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other problems or defects.			
To what extent does this job require the worker to perform job tasks in close physical proximity to other people?	0 - I don't work near other people (beyond 100 ft.) 25 - I work with others but not closely (e.g., private office) 50 - Slightly close (e.g., shared office) 75 - Moderately close (at arm's length 100 - Very close (near touching)	0 - Very close (near touching) 25 - Moderately close (at arm's length 50 - Slightly close (e.g., shared office) 75 - I work with others but not closely (e.g., private office) 0 - I don't work near other people (beyond 100 ft.)	Physical Proximity

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Appendix 3: Definition of elements of Remote Working Index

Variable definition	Original coding	New coding
How often do you use electronic mail in this job?	0-Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week 75 - Once a week or more but not every day 100 - Every day	same as original
How often does this job require working outdoors, exposed to all weather conditions?	0 - Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week 75 - Once a week or more but not every day 100 - Every day	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week 75 – Once a year or more but not every month 100 - Never
How often does this job require working outdoors, under cover (e.g., structure with roof but no walls)?	0 - Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week 75 - Once a week or more but not every day 100 - Every day	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week 75 – Once a year or more but not every month 100 - Never
How frequently does this job require the worker to deal with physical aggression of violent individuals?	0 - Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week 75 - Once a week or more but not every day 100 - Every day	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week 75 – Once a year or more but not every month 100 - Never
How much does this job require wearing common protective or safety equipment such as safety shoes, glasses, gloves, hard hats or life jackets?	0 - Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week 75 - Once a week or more but not every day 100 - Every day	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week 75 – Once a year or more but not every month 100 - Never
How much does this job require wearing specialized protective or safety equipment such as breathing apparatus, safety	0 - Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week

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harness, full protection suits, or radiation protection?	75 - Once a week or more but not every day 100 - Every day	75 – Once a year or more but not every month 100 - Never
How much does this job require walking and running?	0 – Never 25 - Less than half the time 50 - About half the time 75 - More than half the time 100 - Continually or almost continually	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week 75 – Once a year or more but not every month 100 - Never
How often does this job require exposure to minor burns, cuts, bites, or stings?	0 - Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week 75 - Once a week or more but not every day 100 - Every day	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week 75 – Once a year or more but not every month 100 - Never
How often does this job require exposure to disease/infections?	0 - Never 25 - Once a year or more but not every month 50 - Once a month or more but not every week 75 - Once a week or more but not every day 100 - Every day	0 – Every day 25 – Once a week or more but not every day 50 – Once a month or more but not every week 75 – Once a year or more but not every month 100 - Never
Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials.	0 – Not important 100 – Important	0 – Important 100 – Not important
Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.	0 – Not important 100 – Important	0 – Important 100 – Not important
Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).	0 – Not important 100 – Important	0 – Important 100 – Not important
Running, maneuvering,	0 – Not important	0 – Important

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navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, aircraft, or water craft.	100 – Important	100 – Not important
Performing for people or dealing directly with the public. This includes serving customers in restaurants and stores, and receiving clients or guests.	0 – Not important 100 – Important	0 – Important 100 – Not important
Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.	0 – Not important 100 – Important	0 – Important 100 – Not important
Servicing, repairing, calibrating, regulating, fine-tuning, or testing machines, devices, and equipment that operate primarily on the basis of electrical or electronic (not mechanical) principles.	0 – Not important 100 – Important	0 – Important 100 – Not important
Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.	0 – Not important 100 – Important	0 – Important 100 – Not important

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Appendix 4: Full titles of broad occupations

Full titles of broad occupations
Administrative occupations
Business and public service associate professionals
Business, media and public service professionals
Caring personal service occupations
Corporate managers and directors
Culture, media and sports occupations
Customer service occupations
Elementary administration and service occupations
Elementary trades and related occupations
Health and social care associate professionals
Health professionals
Leisure, travel and related personal service occupations
Other managers and proprietors
Process, plant and machine operatives
Protective service occupations
Sales occupations
Science, engineering and technology associate professionals
Science, research, engineering and technology professionals
Secretarial and related occupations
Skilled agricultural and related trades
Skilled construction and building trades
Skilled metal, electrical and electronic trades
Teaching and educational professionals
Textiles, printing and other skilled trades
Transport and mobile machine drivers and operatives

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