Cultural and Economic Discrimination by the Great Leveller

Annie Tubadji[1], Don J Webber[2] and Frédéric Boy[1,3]

[1] *Swansea University, UK*
[2] *Sheffield University, UK*
[3] *University College London, UK*

Abstract

The UK has experienced substantial income and wealth inequalities at the individual and regional levels. The COVID-19 pandemic reveals how inherited domestic economic and cultural disparities lead to greater vulnerability, even in front of the 'Great Leveller'. We argue that the geography of the pandemic in the UK follows the geography of deprivation and cultural and economic discrimination that existed before the pandemic. We demonstrate this through analysis of multiple deprivation and cultural (ethnic) concentration data, unemployment claims, and small business statistics, as well as lung cancer deaths in non-pandemic times and weekly death statistics during the early part of the pandemic (3/1/2020 until 27/03/2020) across England and Wales. We apply data decomposition analysis to detect this discrimination and map it against the geography of the pandemic. Our study not only illustrates the geography of the pandemic disease but also demonstrates how past cultural and economic discrimination creates vulnerable groups and places among the general public in times of exogenous shocks. Finally, we discuss our findings in light of the emerging impact of Brexit.

Keywords: COVID-19; mortality; cultural discrimination; economic discrimination; deprivation; initial conditions; shock;

JELs: Z10; R11

1. Introduction

The COVID-19 pandemic is an unprecedented, unanticipated global phenomenon that gave scholars the opportunity to understand how a sudden shock affects groups of the population differentially. Scheidel (2017) poses the argument that "catastrophic levellers" (such as the Black Death, the Russian revolution, or World Wars) tend to periodically mop out tens of millions of lives globally, and then debates whether such 'Great Levellers' no longer exist in industrial societies. COVID-19 appeared three years after Scheidel's contribution but, unlike previous Levellers, the COVID Great Leveller seems to have become only a 'partial leveller', because it is unevenly affecting people in poorly redistributive social democracies, where one part of the population is healthy, resilient, and benefits from excellent socio-economic infrastructure, and another part is doomed with the opposite.

The very first UK COVID-19 death statistics depict how a shock affects a system plagued with inequality. Some of the highest numbers of deaths were reported in London, but we all know that cities are also the most economically unequal places (Mingione 1996; Glaeser, Resseger and Tobio 2009). How does the picture change if we look closer at which Londoners actually contracted COVID-19? What was their socio-economic background? A more filigree insight into the association between spatial inequalities in socio-economic development and the Great Leveller is possible through analysis of available regional data. That investigation is necessary as it is well-known that deprivation in the UK is not only an individual issue but also a very prominent regional issue. For instance, Houston (2020) finds that the unemployment dynamics during the COVID-19 period had a clear geographical unevenness that was associated with past levels of unemployment.

The current paper takes inspiration from the seminal work of Schiedel (2017) and his thoughts on the connections between pandemics and inequality throughout history. Schiedel dealt with violent shocks, to which Schiedel uses the biblical metaphore Four Horsemen of Levelling or the Great Levellers (Schiedel 2017, p.6). Schiedel's ambition was to:

"… treat violent shocks as discrete phenomena that act on material inequality. This approach is designed to evaluate the significance of such shocks as forces of levelling in the very long term, regardless of whether there is enough evidence to establish or deny a meaningful connection between these events and prior inequality" (Schiedel 2017, p.11).

In light of the findings of Houston (2020) briefly described above, the current study explores a more filigree version of Schiedel's research question, by assessing whether the Great Leveller affects the world equally or whether the impact of this pandemic actually deepens existing prior inequalities. We aim to disentangle the importance of various prior forms of inequality on the impact of that shock, especially in terms of prior economic deprivation and cultural discrimination. We argue that the COVID-19 Great Leveller perpetuates economic and social inequalities. Our paper sets two aims: (i) to map the geography of the COVID-19 pandemic in the UK, and (ii) to reveal the relationship between this geography of the pandemic and the geography of prior deprivation and cultural discrimination. If a spatial relationship exists between these two patterns then

this will identify the places that experienced an increase in economic vulnerability due to the early part of the COVID-19 shock and potentially also for other economic shocks, such as Brexit.

The geographies of deprivation have been cautiously analysed in attempts to identify the patterns of the Brexit vote (Rodríguez-Pose 2018; McCann 2019). Similar geographies are associated with more precarious socio-economic conditions and higher levels of uncertainty and stress, which lowers the immune system for the citizens in more deprived places (Zaman et al. 1997; Bray et al. 2008; Berry et al. 2012; Kim et al. 2013; Mazner 2013).

In addition to the divergence in morbidity patterns that occurs between people living in the most affluent and the most deprived areas, the socioeconomic deprivation in the latter is also associated with intensified mental health pathology (Barnett et al. 2012). The pandemic is likely to exacerbate and deepen these previously existing inequalities at the threshold of expected negative economic shocks due to Brexit (Los et al. 2017). Our study identifies which places are likely to experience further increases in perceived grievances from being left-behind, this time not only because of policy but also in front of the COVID-19 death toll. Beyond the moral implications of the latter, growing economic inequality is known to be associated with social unrest (Hirschman and Rothschild 1973; Benabou and Tirole 2006, 2009, 2011, 2016), and therefore urgent spatially-aware policy measures are needed to support and alleviate the economic loss and psychological trauma for left-behind places if we are going to avoid aggravated inequality and growing social unrest.

Initial conditions are particularly important stepping stones for the development of inequality (Blume, Durlauf and Lukina 2020). Culture-Based Development (CBD) (Tubadji 2012, 2013, 2020a) is a research paradigm which has been accumulating extensive evidence for the culture-driven initial conditions of the socio-economic system rooted in the prior culturally fed belief system that drives individual choice and cooperative behaviour. The CBD stand expects that man-made distinctions creating socio-economic groupings and inequality perpetuate in time through a stickiness created by the culturally created initial conditions of all socio-economic processes. Put differently, the culturally established groups of rich and poor, ethnically praised or ethnically discriminated, create socio-economic conditions which determine how strongly a violent shock will affect each culturally defined group. In order to clearly empirically identify this CBD expectation of the initial conditions effect, our study focuses on the case of the early impact of the COVID-19 shock in the UK.

This study applies a data decomposition analysis, using a composite dsataset of historical and contemporary data on regional development, cultural and economic disparities, and COVID-19 mortality rates across England and Wales from the very start of the pandemic. The results contribute to the understanding of regional disparities in the COVID-19-related death toll, and we explain this outcome in terms of (i) the socio-economic milieu of deprivation and (ii) the interaction of deprivation with earlier measures of cultural and economic class. In this setting, it is particularly important to understand where the very first blow of the pandemic hit the hardest, as this creates the initial conditions of the process of suffering from the pandemic that unfolds thereafter.

The structure of the current paper is as follows. Section 2 provides i) a brief overview of the literature on economic inequality in the UK and ii) a summary of what is known about the geographies of deprivation and the Brexit vote and how these link to what we know

about inequality and the unrest-generating tunnel effect. Section 3 explains our adoption of the CBD methodology for analyzing inequality in front of death across the UK regions. It outlines the economic and cultural discrimination mechanisms that lead to disparities in the COVID-19 death toll, after which we state our hypotheses. Section 4 presents the empirical results, while Section 5 concludes and discusses some important potential policy implications.

2. Literature review

2.1. Historical Roots of Inequality in the UK

The UK is traditionally and historically a society with deep economic and social class divisions. Stobart (2011) reveals the economic behaviour of the high economic class through historical household consumer behaviour data for the period 1710–1790. The study describes the lavish Veblenian consumption of goods that signal social status and outlines the quality of life of the well-off through a detailed emersion in the case of the Leigh family of Stoneleigh Abbey, Warwickshire. Similarly, Perry (2005) and Gazeley and Verdon (2014) depict the dire conditions of hoseholds living in poverty in 18th century England, and Smith and Middleton (2007) illustrate that the overarching dynamics of poverty continue into the modern day in the UK. Not only were the historical roots of economic inequality never successfully erased, they also developed new nuances that reflect new trends in socio-economic marginalization of different gender or age groups, and these old and new discriminatory practices continue into the 20th century (see Lindert 2000; Niemietz 2009; Davies and Joshie 2018; Cribb, Keiller and Waters 2018).

Geographical inequality is one of the most severe signs of the deep roots of this problem. Although regional inequality in historic context is very well documented, some of these studies reveal the inequality of endowments and investment, illustrated through the progressive construction of the motorway network (Merriman 2009). There are many other aspects of spatial inequality in the country, especially cultural dimensions (Massey 1979; Lindert 1996; Hall 1997; Martin 2004; Wei 2015), and this regional inequality carries a spatial persistence into the modern day (Hills 2010).

The economic history of pandemics, and specifically the ones in the UK, reveal important lessons too. There is a wealth of evidence from economic history studies that show how prior economic deprivation and inequality was reflected in the death toll during epidemics. The plague in London and its grave-digging practices is a famous example (Howson 1961; Hardling 1989; Mack 1991). There are even cases of 'manufactured' disease outbreaks among the needy in Great Britain, such as the case of the foot-and-mouth disease (Woods 2013). However, the effects of health crises are not irreversible. Proper policy-making interventions can be the real drivers of socio-economic development, such as the exploration of the effects of malaria on the development of Southern European countries, which demonstrates that the health parameter did not determine the developmental path of countries of that region thanks to economic policy (Bowden, Michailidou and Pererira 2008). This suggests that path dependencies can be interrupted by economic interventions.

The connections between inequality and vulnerability are not unique to Britain. The fall of empires has often been accompanied by pandemics, such as plagues. It is argued that growing inequality leads to deteriorating health conditions for the poor and increased exposure to foreign germs by the increasingly more mobile rich (Kohn 2007; Turkin 2007).

The relevance of these historic studies has been raised in the context of the COVID-19 case (see Turkin 2020; Spinney 2020), and the role of social factors has been demonstrated for other global diseases, such as Ebola (Grépin, Poirier and Fox 2020). Thus, historic or path-dependent inequality is likely to be associated with the uneven spread of COVID-19.

There is existing historical evidence on how the deprived have been exploited in times of pandemics, such as the growth in the Black labour market during pandemic times in South Africa (Packard 1989), and similar tendencies seem not far from modern reality when construction workers continued to work on sites in spite of COVID-19 social distancing and lockdowns. This is not an ethnic inequality as in Packard (1989), but it is a group-identity based inequality, with the only difference being that in this case the group is indentified by economic-class.

Thus, historic lessons seem to exist, pointing to the fact that existing inequalities lead to exacerbated inequalities in front of the death toll from pandemics. These inequalities often lead to the fall of the unjust and unequal empires that created them.

2.2. Contemporary Geographies of Deprivation in the UK

The geographies of deprivation in the UK have been one of the most widely debated potential explanations for the Brexit vote. It has been documented multiple times through different quantitative indicators and methodologies that the regions which are socio-economically backward are the ones that voted for Brexit (Rodríguez-Pose 2018; McCann 2019). While the Brexit vote might have had other complex triggering mechanisms, protest voting as a form of mutiny by those left-behind does not come as a surprise in the economic literature. Hirschman and Rothschild (1973) termed the fact that perceived economic inequality leads to unrest as "the tunnel effect". In this classic paper, they suggest that the imbalanced increasing inequality is bound to create feelings of being 'left behind' (p. 551) and a brewing ground of future social unrest.

Further theoretical work and empirical evidence for the tunnel effect is provided in the work of leading cultural economists (Benabou and Tirole 2006, 2009, 2011; Alesina and Fuchs-Schündeln 2007; Acemoglu and Robinson 2010, 2012; Passarelli and Tabellini 2013), political economists (Scheve and Stasavage 2006), and other high-profile contributions (see Kerr 2014).

The association between the sentiment of being left-behind and other socio-economic factors in the context of radical voting, such as migration and human capital concentration across space, has been documented for the UK (Tubadji, Colwell and Webber 2020) and the Netherlands (Tubadji, Burger and Webber 2020)[1]. Building on Hirschman and Rothschild's (1973) and Tiebout (1956)'s models, the main argument of these two papers is that existing deprivation and lack of outmigration triggered (among the autochtonous population) a signalling of increasing perceived deprivation in an increasingly less appealing cultural milieu without opportunity for outward and upward mobility. This 'stuck-behind' situation exacerbated the left-behind feelings; feelings that were, in turn, expressed in a generalized political protest vote. Similar forms of protest might be expected if such feelings of being left behind escalate further due to inequality in the

[1] Similar link between socio-economic development and ultra-right voting exists for the case of Greece and the vote for the Golden Dawn (Chrisy Avgi) (Tubadji and Nijkamp 2019).

COVID-19 death toll and which follow examples through history (see Ponticelli and Voth 2020). That is why identifying where this inequality escalation of social tension might start is of paramount importance.

Houston (2020) presents evidence on the relationship between past levels of unemployment across regions and the experienced unemployment dynamics during the COVID-19 shock. He demonstrates that the labour market resilience of a place is dependent on its conditions from pre-pandemic times. Thus, it is essential to identify other potential forms of past inequalities that create spatial pockets of threats to current and future local resilience and to the trajectory of development after an exogenous pandemic shock.

3. Culture-Based Hypothesis about the UK Geographies of COVID-19

Culture Based Development (CBD) is a novel paradigm which has been growing in attention and accumulating a substantial body of empirical literature over the last decade. CBD has demonstrated empirically that initial conditions are established by the local cultures where idividuals originate from and live, which then determine the geograpical spread and benefits from immigration (Tubadji and Nijkamp 2015). The same culturally determined initial conditions affect the development of knowledge diffusion (Tubadji and Nijkamp 2016), trade and tourism flows (Tubadji and Nijkamp 2018), and the emergence of new busineses (Tubadji, Angelis and Nijkamp 2016; Tubadji et al. 2019). The critical point from these papers is that culture determines the initial conditions for socio-economic processes observed at any given point of time, and therefore it can be regarded as a protoinstitution, which in the hierarchy of institutions precedes all other institutions and endogenous resources. These are the reasons why CBD claims that any model is underspecified if the cultural factor is not taken into consideration (Tubadji 2014) and fixed effects alone do not fully or correctly account for the cultural impact (Tubadji 2020b). The main premise of the CBD paradigm that unites these studies is that the cultural bias of economic choices predetermines the operation and outcome of any socio-economic system (Tubadji 2012, 2013, 2020a).

Starting from this CBD premise, this study focusing on the UK suggests that we need to take a deeper look at cultural and economic disparities in order to identify the reasons for the experienced inequality in front of the COVID-19 pandemic death toll. The short-run socio-economic aftermaths of this experienced inequality are firstly the aggravated economic situation of individuals and businesses in deprived areas, expressed as disproportionately increasing unemployment and business failure in poorer regions (see evidence for similar aftermaths in Norway, as described in Mamelund, Ingelsrud, and Steen 2020[2]). According to theory and practice as discussed above, the aggravation of the economic deprivation of those already left-behind may lead to pockets of social unrest throughout the country on the basis of a path-dependence from existing cultural and

[2] See Alnes Haslie, N and S. Nøra (2020) for an English translation.

economic inequalities (which we know to be important as a factor for local development in the UK[3]; see Huggins and Izushi 2007, McCann 2016).

The way the CBD approach views cultural and economic discrimination can be summarized in the following postulates:

1) Cultural (ethnic) and economic discrimination create different regional initial conditions that effect an area's socio-economic response to an exogenous shock, such as the outburst of a pandemic disease;
2) Cultural (ethnic) and economic discrimination create feelings of left-behind among people and regions;
3) Feelings of being left-behind have a cumulative effect and create path-dependencies, as the past experience of discrimination cannot be immediately efficiently and technically removed through a policy intervention;
4) Policy intervention against discrimination, however, can create a new path-dependence chain;
5) Correcting for present discrimination is essential for preventing the escalation of previous left-behind-feelings and preventing future left-behind-driven social unrest.

Thus, the CBD take on the current geographies of the pandemic, its causes and aftermaths, can be summurized in two testable hypotheses:

H01: The past geographies of deprivation in the UK predict the mortality from COVID-19 at the dawn of the pandemic.

H02: The geographies of cultural discrimination within regions predict the regional disparity in mortality from COVID-19.

As the health crisis unfolds, peaks and resolves, further policy decisions (such as region specific lockdowns for example) can moderate the initial vulnerability of the system. Therefore, in order to test the above hypotheses that past inequalities and discrimination create differences in the initial vulnerability across the economic system under exogenous shocks, we need to use data from the very dawn of the pandemic. Only this data can allow us to identify clearly the initial conditions without further noise from policy interventions during the pandemic.

Next, if the validity of these hypotheses is confirmed, the identified initial conditions can become instrumental in understanding more precisely the development of the pandemic in response to the policy interventions during the pandemic. Specifically, different initial conditions may create different opportunities for people and places to respond to the same challenges even under conditions of identical economic and policy tools. The interaction between the initial conditions studied here and further policy interventions during the pandemics is a pertinent topic for future research.

[3] On the role of cultural path dependence for regional development in other countries, see Audretsch and Fritsch 2002; Fritsch and Mueller 2007; Fritsch et al. 2019; Fritsch, Pylak and Wyrwich 2019; and Fritsch et al. 2020.

4. Empirical Evidence on the CBD Hypotheses about COVID-19 in the UK

Data

In order to empirically identify the initial conditions, we need a short period of time on the border between the inherited state of local inequality and the initial experience of the pandemic which can be considered as an initial condition of the impact of the shock for the longer run. Our empirical aim is to demonstrate that these initial conditions for the work by the Great Leveller are in effect different across space due to the prior socio-economic inequalities in space. This special data requirement is necessary because a longer time series may contain a variety of noise and bias as well as additional factors that would disturb the precise identification of the difference in the initial conditions from the impact of the pandemic.

The data used in this analysis satisfies this requirement as it covers the period from the beginning of January to end of March 2020 for NUTS1 regions across England and Wales. This applies for most indicators, except for the Multiple Deprivation Index, which is available only for England. Similar index exists for Wales yet it is incompatible as a definition, and separate estimations for Wales are not advisable due to the low number of observations[4]. Most of the data is obtained from the Office of National Statistics (ONS), NOMIS or related data sources (see *Appendix 1* for information on the sources and descriptive statistics for each variable).

To quantify the COVID-19 deaths we use ONS data on weekly deaths. The information is used alternatively in levels and as a percentage of the population in a region in January 2020. As the percentages are very small, we multiply them by 1000 for the needs of visualization and explicit interpretation of the magnitudes of the effects. To compare the regional vulnerability and propensity to death from COVID-19 with pre-pandemic conditions, we use the number of lung cancer patients from the previous year. We obtain the percentage of patients per population and use this as an instrumental variable in our regressions.

We have the data on the share of Black, Asian, other non-White, other groups, and Whites per region. To quantify cultural discrimination, we first sum the percentages of Black and Asian and other non-White, and we use the mean value of this sum to identify the status of a region as culturally and ethnically more diverse than the rest of England. We generate a dummy variable equal to 1 when the sum of Black, Asian, and other non-Whites in the region is above the national average. We used this variable to calculate the cultural and ethnic decomposition and respective cultural discrimination.

To quantify economic deprivation in a region, we use three approaches. First, we use the Index of Multiple Deprivation (IMD) at the average level for the region. This variable however is a better statistical indicator for deprivation at lower administrative spatial divisions than a region. Therefore, secondly, we also employ both the percentage of the urban population and the above average regional concentration of the rural population in order to identify rurality as an alternative potential indicator for higher deprivation. Thirdly, as is well known, the pro-Brexit vote in the 2016 elections was associated with

[4] We address this in a robustness check based on rural/urban division as a relevant proxy for deprivation, available also for Wales, as explained below. Similarly, we use the Pro-Brexit vote for a proxy, results with this latter proxy are available from the authors upon request.

relative deprivation and feelings of being left-behind, and thus we also use the percentage of pro-Brexit voters as an alternative measure for deprivation. Further, the pro-Brexit vote is also of interest in terms of its relation to the COVID-19 death toll, because of the implications that COVID-19 may have for regional and political development once Brexit is implemented.

Method

To test H01 and H02, we employ a data decomposition analysis. The method for testing each hypothesis is analogical, with the group for decomposition in the case of H01 being defined as the regions with above average non-White cultural (ethnic) compositions. For testing H02, our group for decomposition is the group of regions with above average levels of deprivation. Our groups with an above average level of deprivation is identified as the regions with below average values for the IMD index, which is a score that increases from 1 to infinity and where lower scores indicate greater deprivation. The decomposition procedure can be stated as follows, where the degree of discrimination between two groups is estimated as shown in model (1):

$$Death\_Toll_A = \alpha_A + \beta_A X_A \quad (1.1)$$

$$Death\_Toll_B = \alpha_B + \beta_B X_B \quad (1.2)$$

$$\widehat{Death\_Toll}_A = \alpha_A + \beta_A \widehat{X_A} \quad (1.3)$$

$$\widehat{Death\_Toll}_B = \alpha_B + \beta_B \widehat{X_B} \quad (1.4)$$

$$Discrimination = (\alpha_A - \alpha_B) + (\beta_A - \beta_B) * \widehat{Death\_Toll} \quad (1.5)$$

where hat values are predicted values, based on the regressions of (1.1) and (1.2); groups *A* and *B* are the discriminated group and the rest of the population respectively. X is the set of independent variables that explain the outcome variable of interest.

To test H01, we define group A as equal to 1 when the cultural-ethnic geographical pattern across the regions contains an above average level of concentration of the Black, Asian and non-White population. Similarly, to test H02, we define group A using the economic deprivation measured as an above average level of deprivation.

Although we have numerous potential control variables (see *Appendix 1*), we cannot use all of them because of collinearity concerns, the limited number of observations, and the need for degrees of freedom. Due to these data limitations, we present and analyse here only the straightforward aggregate decomposition between groups, with detailed decompositions are available upon request from the authors.

Results

Geographies of the COVID-19 Pandemic: Outburst and Death Ratios

We begin with a descriptive statistical analysis and explore the distribution of COVID-19 deaths per type of region. We divide the regions by pooling them into two groups – regions above the mean of the IMD (labelled as 'less deprived regions') and regions below that mean (labelled as 'more deprived regions'). Mortality histograms for absolute and population-relative ratios are presented in Figure 1.

+++ Figure 1 +++

As seen from Figure 1, it seems that less deprived regions (implying more urbanized and with higher productivity) are the places with higher *absolute* number of COVID-19 deaths. However, when we consider our population-weighted *relative* mortality indicator, the percentages show that the 'more deprived regions' are the ones that experience higher exposure to the death toll.

We see also that the historical distribution of lung cancer patients maps closely in comparison to the experienced COVID-19 death toll, and these geographical patterns seem related. This illustrates the importance of prior health as a predisposition to COVID-19 mortality. It also indicates that economic and health deprivations are associated and jointly create pockets of vulnerability.

Cultural and Economic Discrimination in Mortality

Next, to delve deeper into the sources and realities of the COVID-19 death toll, we employ a data decomposition analysis. Table 1 presents two specifications. Specification (1) shows the decomposition by level of deprivation while Specification (2) shows the decomposition by prevalence of the non-White population.

+++ Table 1 +++

As seen from Table 1, a more filigree look at the economic deprivation in Specification (1) shows that the death toll is concentrated in the more derpived areas but marginally so and with only 1% difference. However, when the cultural discrimination is analized in Specification (2), it comes to light that areas with a greater than average concentration of non-White populations experience a 5% higher COVID-19 death toll. This latter finding is in line with international reports from the USA and elsewhere which state that the Black and other non-White populations experience higher exposure, contagion, and death than their White counterparts. We show a geographical representation of the above economic and cultural discrimination in Figure 2:

+++ Figure 2 +++

As seen from Figure 2, the purple-coloured geographical distribution of the COVID-19 mortality (expressed in percentages) seems to be consistent both with the geography of deprivation and with the geography of ethnic diversity. While ethic diversity predicts COVID-19 deaths in the middle and eastern parts of England, the far north and the south-west seem to have a coincidence between deprivation and death-toll. Thus, these two drivers seem to have shared responsibility for the inequality in COVID-19 deaths in front of the Great Leveller.

To cross-check the validity of these results, we make a within-method triangulation robustness check in the following manner. As the aggregation of the IMD is not an ideal variable and is available only for England, we test where alternative measures of deprivation reflect the same finding by using two variables which are also available for Wales: (i) the above average percentage of the population in urban areas, and (ii) the above average percentage of people in rural areas. We implement the same data decomposition analysis and use the two above alternative variables to define group A. Results are presented in Table 2.

+++ Table 2 +++

The results in Table 2 show that irrespective of the alternative quantification of deprivation, the divide between deprived and non-deprived, more rural and less urban areas always accounts for one and the same discriminatory difference. It is remarkable that even the size of the coefficients remain the same across the different specifications of economic deprivation. This means that the aggregate IMD measure has been sufficiently good in distinguishing the regions in terms of their level of deprivation.

The above analysis shows that neither H01 nor H02 can be rejected, as there seems to exist both economic and cultural/ethnic discrimination in the COVID-19 death toll across England and Wales. However, the cultural/ethnic discrimination seems to be about five times the size of the one driven by economic deprivation. Put differently, the initial conditions of inequality spatially distributed according to culturally defined groupings have a strong association with the spatial unevenness of the initial conditions from the effect of the COVID-19 shock. Culturally defined initial conditions are associated with the inequality in the initial damage that the COVID-19 pandemic caused to British society.

5. Conclusion

Unprecedented economic and cultural class cleansing is silently occurring throughout the world and apparently in the UK throughout the COVID-19 pandemic. The pandemic affects disproportionately the economically and socially more vulnerable parts of the UK population, but this vulnerability is defined more broadly than before. Vulnerable to the COVID-19 initial blow are those groups of ordinary citizens who were previously subject to economic and social discrimination.

The current study amassed historical economic and social data at the regional level and used it in order to extract regional economic insight into the geographic spread, determinants, and potential consequences of the COVID-19 pandemic. Using a relatively small dataset at the NUTS1 level across England and Wales and with specific focus on the very beginning of the pandemic (1st January to end of March 2020), this study offers a Culture Based Development (CBD) methodology for identifying the initial conditions for disparities in regional vulnerability created by economic and cultural discrimination from pre-pandemic times. The methodology for testing for economic and cultural discrimination relies on data decomposition analysis, which is a classical approach in discrimination studies (see Olson and Becker 1983).

Our findings suggest that there is evidence that poorer, more socio-economically deprived and more rural areas are more affected by the COVID-19 death toll. In this context, the cultural discrimination of the death toll seems to be five times stronger across English regions. There is an apparent association between COVID-19 mortality and social unrest tendencies (related to the 2016 Brexit vote). Specifically, deprived and left-behind places in the UK (for who we know voted for Brexit) seem to be the ones receiving the strongest direct blow from the current pandemic. Yet, a further negative economic shock is expected in the country in the near future due to Brexit (Los et al. 2017). If we assume that the general initial conditions effect applies to all reactions to severe shocks, the dismal implications of our findings are clear. Further social radicalization due to economic and cultural discrimination (and especially so in areas of pro-Brexit voting) is to be expected with the onset of Brexit policies and related implications. At the time of this additional

economic shock, the areas of vulnerability created during the pandemic will act as potential economic development traps, which will prolong the stagnation and possibly lead to explosive radicalisation in places that are pockets of deprivation and discrimination in a significantly unequal country.

Proper plans for socio-economic resilience (varying together with the variation of vulnerability to shocks) should be implemented to support people from the most culturally and economically discriminated against vulnerable groups and localities, especially from previously left-behind places. This is the only reasonable way to avoid the escalating socio-economic turmoil and destabilization due to inequality and mismanagement of the socio-political situation. The current findings and methodology can be used to identify the geographic location of the pockets of vulnerability which need to receive socio-economic interventions to improve the regional economic resilience of the UK.

While the small dataset used in the current analysis allows for only conservative estimations, the methodology used can be replicated with larger datasets and the analysis can be extended to include further available controls in the analysis of regional lockdowns and their effectiveness. Meanwhile, the available data are ideal for the empirical identification of the inequality and discrimination as initial conditions that determine those geographies that are disproportionately vulnerable to the pandemic. This is an important finding and should not be overseen, as it should be taken as an alert that existing and perpetuated cultural and economic discriminations can have a potentially serious impact on economic instability and social destabilization.

Our results add an important angle to the CBD paradigm as well. While CBD has always pointed to culture as a proto-institution, our study is the first CBD study to document the role of this proto-institution in the context of a natural exogenous shock. There are clearly many extenstions of this CBD take to past inequality as a determinat of initial conditions for vulnerability to a pandemic. The CBD alert applies every time when the general socio-economic context has exercised unequal treatment between groups, as any discrimination can generate disparities in vulnerability. This means that our findings here can be understood more generality in the spirit of CBD in terms that handling the impact of past inequality in the cultural context (or in the complex dynamic system) is paramount for mitigating the uneven vulnerability to exogenous shocks. We knew that considering the cultural context is essential for analyzing regional development, which cannot be fully analyzed under unrealistic ceteris paribus assumptions (Nijkamp 2007). Our study shws that such context-related vulnerabilities create initial conditions that can have many further unwanted implications, amplifying future economic impoverishment, mental health deterioration, and social tensions, which can be subject of future research.

In summary, the CBD analytical approach helps to identify how initial conditions associated with cultural and economic discriminations underpin spatial path dependencies and can predict the spatial intensity of mortality in the UK at the beginning of the COVID-19 pandemic. More generally, this study demonstrates how data can be used to identify places that have the potential to fall into development traps that occur due to relative impoverishment and social suffering in already left behind places. Inequality creates vulnerability and is thus a source of the destabilization of regions under a variety of negative external shocks, such as the COVID-19 pandemic, or endogenous shocks, such as the one that the British economy will suffer due to Brexit. Timely efforts that alleviate inequalities are a way to prevent social unrest and build a better socio-economic resilience across the UK and similarly for any other country.

Reference

Acemoglu, D. and Robinson, J.A. (2010). Why is Africa poor? Economic history of developing regions, 25(1), 21-50.

Acemoglu, D. and Robinson, J.A. (2012). Why nations fail: The origins of power, prosperity, and poverty. Crown Books.

Alesina, A. and Fuchs-Schuendeln, N. (2007). Goodbye Lenin (or not?): The effect of communism on people's preferences. American Economic Review, 97(4), 1507-1528.

Alnes Haslie, N and Nøra, S. (2020) Norwegian Study Looks at How the Coronavirus Pandemic is Affecting People's Health and Careers, Oslomet, available online at: https://www.oslomet.no/en/research/featured-research/how-the-coronavirus-pandemic-is-affecting-people-s-health-and-careers

Audretsch, D. B. and Fritsch, M. (2002). Growth regimes over time and space. Regional Studies, 36(2), 113-124

Barnett, K., Mercer, S. W., Norbury, M., Watt, G., Wyke, S. and Guthrie, B. (2012) Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. The Lancet, 380(9836), 37-43.

Benabou, R. and Tirole, J. (2011). Identity, morals, and taboos: Beliefs as assets. The Quarterly Journal of Economics, 126(2), 805-855.

Benabou, R. and Tirole, J. (2016). Mindful economics: The production, consumption, and value of beliefs. Journal of Economic Perspectives, 30(3), 141-64.

Benabou, R. and Tirole, J. (2006), Belief in a Just World and Redistributive Politics, Quarterly Journal of Economics, 121(2), 699-746.

Benabou, R. and Tirole, J. (2009), Over My Dead Body: Bargaining and the Price of Dignity, American Economic Review, 99(2), 459-465.

Berry, A., Bellisario, V., Capoccia, S., Tirassa, P., Calza, A., Alleva, E. and Cirulli, F. (2012). Social deprivation stress is a triggering factor for the emergence of anxiety-and depression-like behaviours and leads to reduced brain BDNF levels in C57BL/6J mice. Psychoneuroendocrinology, 37(6), 762-772.

Blume, L.E., Durlauf, S.N. and Lukina, A. (2020). Poverty Traps in Markov Models of the Evolution of Wealth. WZB Discussion Paper No. SP II 2020-303.

Bowden, S., Michailidou, D.M. and Pereira, A. (2008). Chasing mosquitoes: An exploration of the relationship between economic growth, poverty and the elimination of malaria in Southern Europe in the 20th century. Journal of International Development, 20(8), 1080-1106.

Bray, C., Morrison, D.S. and McKay, P. (2008). Socioeconomic deprivation and survival of non-Hodgkin lymphoma in Scotland. Leukemia and lymphoma, 49(5), 917-923.

Chang, R. and Velasco, A. (2020) 'Economic policy incentives to preserve lives and livelihoods,' *NBER working paper* #27020.

Cribb, J., Norris Keiller, A. and Waters, T. (2018). Living standards, poverty and inequality in the UK: 2018 (No. R145). IFS Report.

Davies, H. and Joshi, H. (1998). Gender and income inequality in the UK 1968–90: the feminization of earnings or of poverty?. *Journal of the Royal Statistical Society: Series A (Statistics in Society),* 161(1), 33-61.

Fritsch, M. and Mueller, P. (2007). The persistence of regional new business formation-activity over time–assessing the potential of policy promotion programs. Journal of Evolutionary Economics, 17(3), 299-315.

Fritsch, M., Obschonka, M., Wahl, F. and Wyrwich, M. (2020). The deep imprint of Roman sandals: evidence of long-lasting effects of Roman rule on personality, economic performance, and well-being in Germany.

Fritsch, M., Sorgner, A., Wyrwich, M. and Zazdravnykh, E. (2019). Historical shocks and persistence of economic activity: evidence on self-employment from a unique natural experiment. Regional Studies, 53(6), 790-802.

Gazeley, I. and Verdon, N. (2014). The first poverty line? Davies' and Eden's investigation of rural poverty in the late 18th-century England. Explorations in Economic History, 51, 94-108.

Glaeser, E.L., Resseger, M. and Tobio, K. (2009). Inequality in cities. Journal of Regional Science, 49(4), 617-646.

Grepin, K.A., Poirier, M.J. and Fox, A.M. (2020). The socioeconomic distribution of exposure to Ebola: Survey evidence from Liberia and Sierra Leone. SSM-Population Health, 10, 100472.

Hall, S. (1997). Culture and power. Radical Philosophy, 86, 24-41.

Harding, V. (1989). 'And one more may be laid there': the Location of Burials in Early Modern London. The London Journal, 14(2), 112-129.

Hills, J. (2010). An anatomy of economic inequality in the UK-report of the national equality panel. LSE STICERD Research Paper No. CASEREPORT60.

Hirschman, A.O. and Rothschild, M. (1973) The changing tolerance for income inequality in the course of economic development, Quarterly Journal of Economics, 87(4): 544-566.

Houston, D. (2020). Local resistance to rising unemployment in the context of the COVID-19 mitigation policies across Great Britain. Regional Science Policy and Practice, 12(6), 1189-1209.

Howson, W.G. (1961). Plague, poverty and population in parts of north-west England, 1580-1720. Transactions of the Historic Society of Lancashire and Cheshire, 112, 29-55.
Huggins, R.A. and Izushi, H. (2007). Competing for knowledge: creating, connecting and growing. Routledge.
Kandul, S. and Ritov, I. (2017). Close your eyes and be nice: Deliberate ignorance behind pro-social choices. *Economics Letters*, 153, 54-56.
Kerr, W.R. (2014). Income inequality and social preferences for redistribution and compensation differentials. *Journal of Monetary Economics*, 66, 62-78.
Kim, Pilyoung, Gary W. Evans, Michael Angstadt, S. Shaun Ho, Chandra S. Sripada, James E. Swain, Israel Liberzon and K. Luan Phan. (2013). Effects of childhood poverty and chronic stress on emotion regulatory brain function in adulthood. *Proceedings of the National Academy of Sciences*, 110(46), 18442-18447.
Kohn, G.C. (2007). Encyclopaedia of plague and pestilence: from ancient times to the present. Infobase Publishing.
Lindert, P.H. (1996) What Limits Social Spending? Explorations in Economic History. 33(1), 1–34
Lindert, P.H. (2000). Three centuries of inequality in Britain and America. Handbook of income distribution, 1, 167-216.
Los, B., McCann, P., Springford, J. and Thissen, M. (2017) The mismatch between local voting and the local economic consequences of Brexit, Regional Studies, 51(5), 786-799.
Mack, A. (Ed.) (1991). In time of plague: the history and social consequences of lethal epidemic disease. NYU Press.
Mamelund, S.E., Ingelsrud, M.H. and Steen, A.H. (2020). Arbeidslivsbarometerets koronaundersøkelse-preliminære funn per 6. april 2020.
Martin, R. and Gardiner, B. (2019) The resilience of cities to economic shocks: A tale of four recessions (and the challenge of Brexit), Papers in Regional Science, 98:1801-1832.
Martin, R. (2012) "Regional economic resilience, hysteresis and recessionary shocks." Journal of Economic Geography, 12(1), 1-32.
Martin, R.L. (2004). The contemporary debate over the North-South divide: images and realities of regional inequality in late-twentieth-century Britain. Cambridge Studies in Historical Geography, 37, 15-43.
Massey, D. (1979). In what sense a regional problem? Regional studies, 13(2), 233-243.
Matzner, P., Hazut, O., Naim, R., Shaashua, L., Sorski, L., Levi, B., Sadeh, A., Wald, I., Bar-Haim, Y. and Ben-Eliyahu, S. (2013). Resilience of the immune system in healthy young students to 30-hour sleep deprivation with psychological stress. Neuroimmunomodulation 20(4), 194-204.
McCann, P. (2016). The UK regional-national economic problem: Geography, globalisation and governance. Routledge.
McCann, P. (2019). Perceptions of regional inequality and the geography of discontent: Insights from the UK. Regional Studies, doi: 10.1080/00343404.2019.1619928.
Merriman, P. (2009). Driving spaces: a cultural-historical geography of England's M1 motorway (Vol. 17). John Wiley *and* Sons.
Mingione, E. (1996). Urban Poverty in the Advanced Industrial World: Concepts, Analysis and Debates Enzo Mingione, University of Padova. Urban poverty and the underclass, 3.
Niemietz, K. (2009). Poverty in Britain, past and present. *Economic Affairs*, 29(4), 48-54.
Nijkamp, P. (2007) Ceteris paribus, spatial complexity and spatial equilibrium: An interpretative perspective, Regional Science and Urban Economics, 37: 509-516.
Olson, C.A. and Becker, B.E. (1983). Sex discrimination in the promotion process. ILR Review, 36(4), 624-641.
Osberg, L. (2002). Trends in poverty: the UK in international perspective: how rates mislead and intensity matters (No. 2002-10). ISER Working Paper Series.
Packard, R.M. (1989). White plague, black labor: Tuberculosis and the political economy of health and disease in South Africa (Vol. 23). University of California Press.
Passarelli, F. and Tabellini, G. (2013). Emotions and political unrest. CESifo Working Paper Series No. 4165
Perry, R. (2005). Representations of Poverty in Eighteenth-Century Fiction (Vol. 95, p. 441). Wiley-Blackwell.
Piketty, T. and Saez, E. (2006). The evolution of top incomes: a historical and international perspective. American economic review, 96(2), 200-205.
Ponticelli, J. and Voth, H.J. (2020). Austerity and anarchy: Budget cuts and social unrest in Europe, 1919 - 2008. Journal of Comparative Economics, 48(1), 1-19.
Reggiani, A., Nijkamp, P. and Lanzi, D. (2015). Transport resilience and vulnerability: The role of connectivity. Transportation research part A: policy and practice, 81, 4-15.
Rodriguez-Pose, A. (2018) The revenge of the places that don't matter (and what to do about it). Cambridge Journal of Regions, Economy and Society, 11(1), 189-209.
Scheidel, W. (2017) *The great leveller. Violence and the history of inequality from the stone-age to the twenty-first century*, Princeton, Princeton University Press.

Scheve, K. and Stasavage, D. (2006). Religion and preferences for social insurance. Quarterly Journal of Political Science, 1(3), 255-286.
Schmitt-Grohé, S., Teoh, K. and Uribe, M. (2020) 'COVID-19: testing inequality in New York City,' *NBER working paper* #27019
Smith, N. and S. Middleton (2007) A review of poverty dynamics research in the UK. © Loughborough University.
Spinney, L. (2020) Coronavirus outbreak: Inequality doesn't just make pandemics worse, it could cause them, The Guardian, 13/04/2020
Stobart, J. (2011). Gentlemen and shopkeepers: supplying the country house in eighteenth-century England. *The Economic History Review*, 64(3), 885-904.
Tiebout, C. (1956) A pure theory of local expenditures. Journal of Political Economy, 64(5), 416-424.
Tubadji, A. and Nijkamp, P. (2015) Cultural Gravity Effects among Migrants: A Comparative Analysis of the EU15, Economic Geography, 91(3): 343-380.
Tubadji, A. and Nijkamp, P. (2018) Revisiting the Balassa-Samuelson effect: International tourism and cultural proximity, Tourism Economics, 24(8), 915-944.
Tubadji, A. (2012) Culture-Based Development: Empirical Evidence for Germany. International Journal of Social Economics, 39(9), 690-703.
Tubadji, A. (2013) Culture-Based Development: Culture and Institutions Economic Development in the Regions of Europe. International Journal of Society Systems Science, 5(4), 355-391.
Tubadji, A. (2014) Was Weber right? The cultural capital roots of economic growth. Int J Manpower 35(1/2), 56-88
Tubadji, A. (2020a). Value-Free Analysis of Values: A Culture-Based Development Approach, Sustainability, 12(22), 9492
Tubadji, A. (2020b) Ceteris Paribus and Fixed Effects in Regional and Cultural Economics, forthcoming.
Tubadji, A. and Nijkamp, P. (2016). Six degrees of cultural diversity and RandD output efficiency. Letters in Spatial and Resource Sciences, 9(3), 247-264.
Tubadji, A. and Nijkamp, P. (2019) Cultural attitudes, economic shocks and political radicalization. Annals of Regional Science, 62(3), 529-562.
Tubadji, A., Dietrich, H., Angelis, V., Haas, A. and Schels, B. (2019). Fear-of-failure and cultural persistence in youth entrepreneurship: Comparative analysis: Greece versus Germany. Journal of Small Business and Entrepreneurship, 1-26.
Tubadji, A., Burger, M. and Webber, D.J. (2020) Geographies of Discontent and Cultural Fiscal Policy in the Netherlands, forthcoming.
Tubadji, A., Huggins, R. and Nijkamp, P. (2020) Firm Survival as a Function of Individual and Local Uncertainties: An Application of Shackle's Potential Surprise Function, Journal of Economic Issues, forthcoming.
Tubadji, A., Colwell, T. and Webber, D.J. (2020) Voting with Your Feet versus Brexiting: The Tale of Those Stuck Behind, forthcoming.
Tubadji, A., Angelis, V. and Nijkamp, P. (2015). Endogenous Intangible Resources and their Place in the Institutional Hierarchy, Review of Regional Research: Jahrbuch fur Regionalwissenschaft, 36(1), 1-28.
Tubadji, A., Angelis, V.and Nijkamp, P. (2016). Cultural Hysteresis, Entrepreneurship and Economic Crisis: An Analysis of Buffers to Unemployment after Economic Shocks, Cambridge Journal of Regions, Economy and Society, 9(1): 103-136.
Turchin, P. (2007) "Modelling periodic waves of integration in the Afro-Eurasian world-system." Globalization as Evolutionary Process. Routledge, 181-209.
Turchin, P. (2020) Coronavirus and Our Age of Discord, Cliodynamica: A Blog about the Evolution of Civilizations, 05/04/2020.
Wei, Y. D. (2015). Spatiality of regional inequality. Applied Geography, 61, 1-10.
Woods, A. (2013). A manufactured plague: the history of foot-and-mouth disease in Britain. Routledge.
Zaman, M.M., Yoshiike, N., Chowdhury, A.H., Jalil, Md.Q., Mahmud, R.S., Faruque, G.M., Rouf, M.A., Haque, K.S. and Tanaka, H. (1997). Socioeconomic deprivation associated with acute rheumatic fever. A hospital-based case-control study in Bangladesh. Paediatric and perinatal epidemiology 11(3), 322-332.

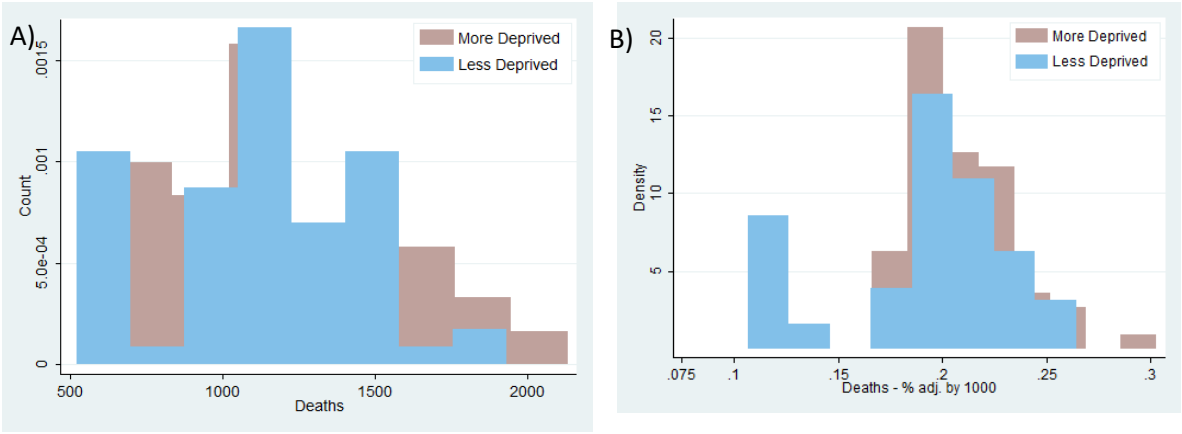

Figure 1: Mortality in more and less deprived regions, death toll (A) and proportions (B, %)

Notes: The figure the weekly number of deaths per less deprived and more deprived regions. The figure to the left presents raw numbers and the figure to the right presents the percentage of deaths by number of people living in the region (the percentage is multiplied by 1000 for easier visualization purposes).

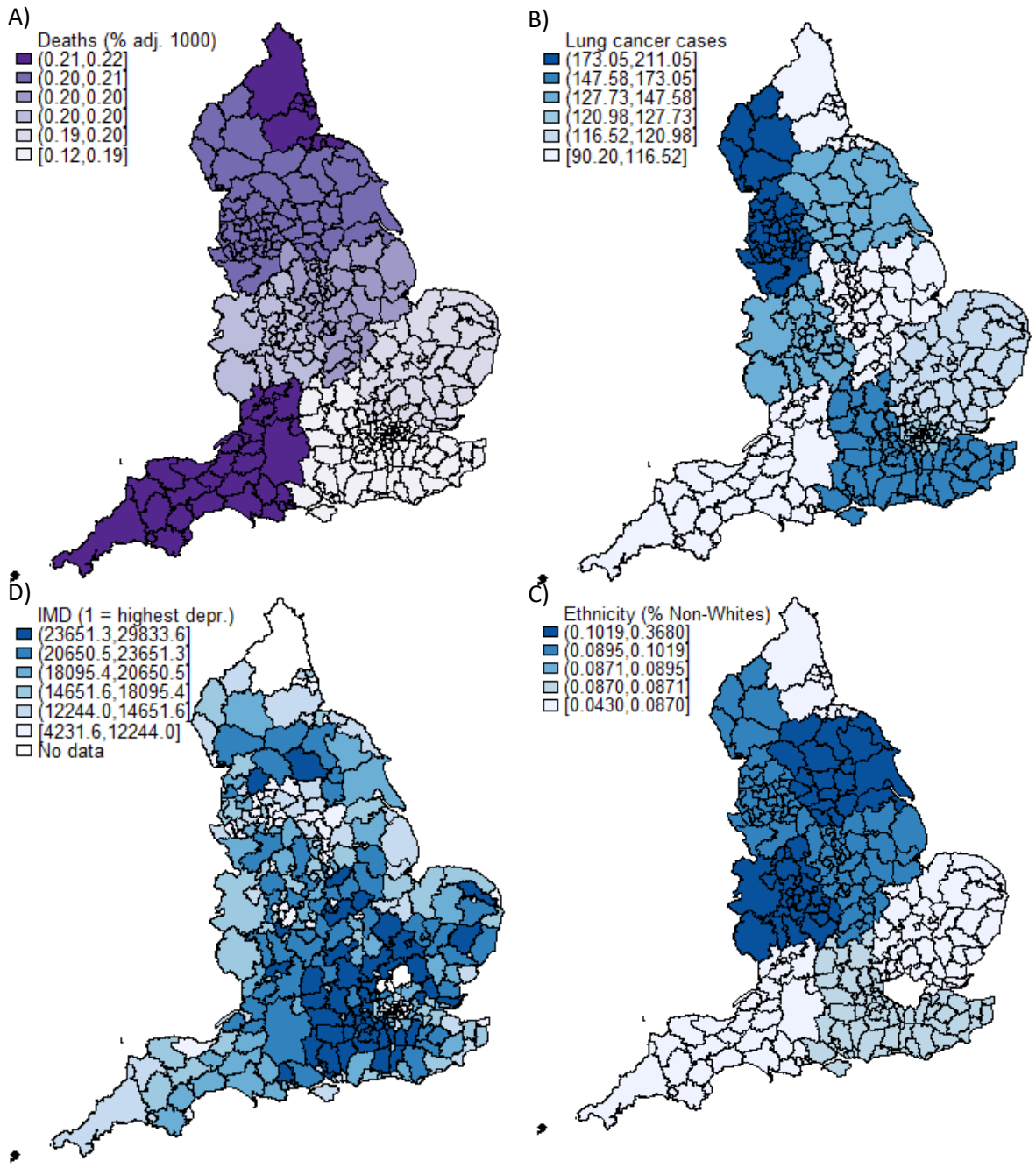

Figure 2: A) COVID-19 Mortality (%), B) Lung cancer, C) Proportion of non-white population), D) Index of multiple deprivation (IMD)

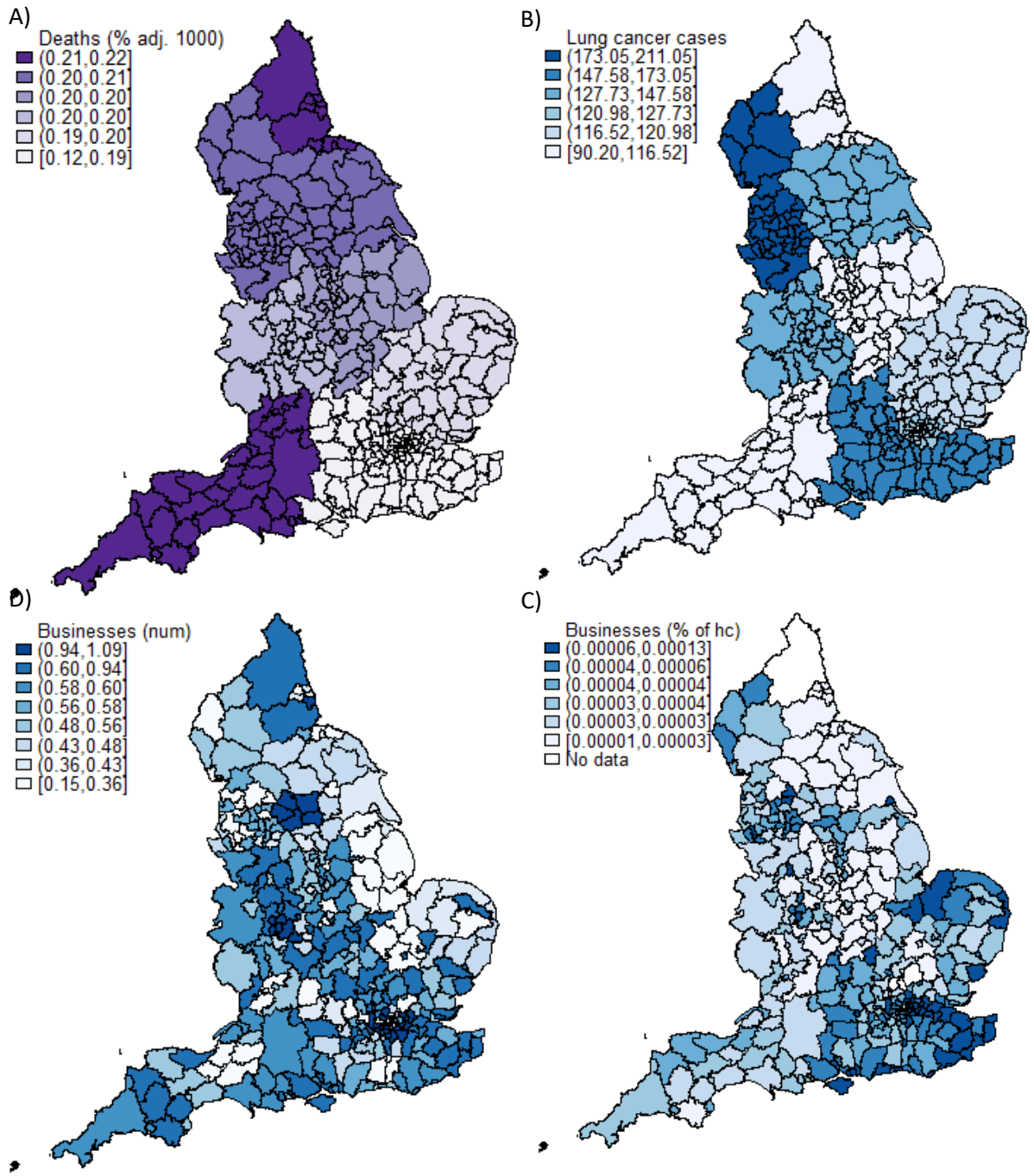

Figure 3: A) COVID-19 Mortality (%), B) Unemployment (%),, C) Small and medium businesses (number), D) Small and medium businesses (% of highly educated employees)

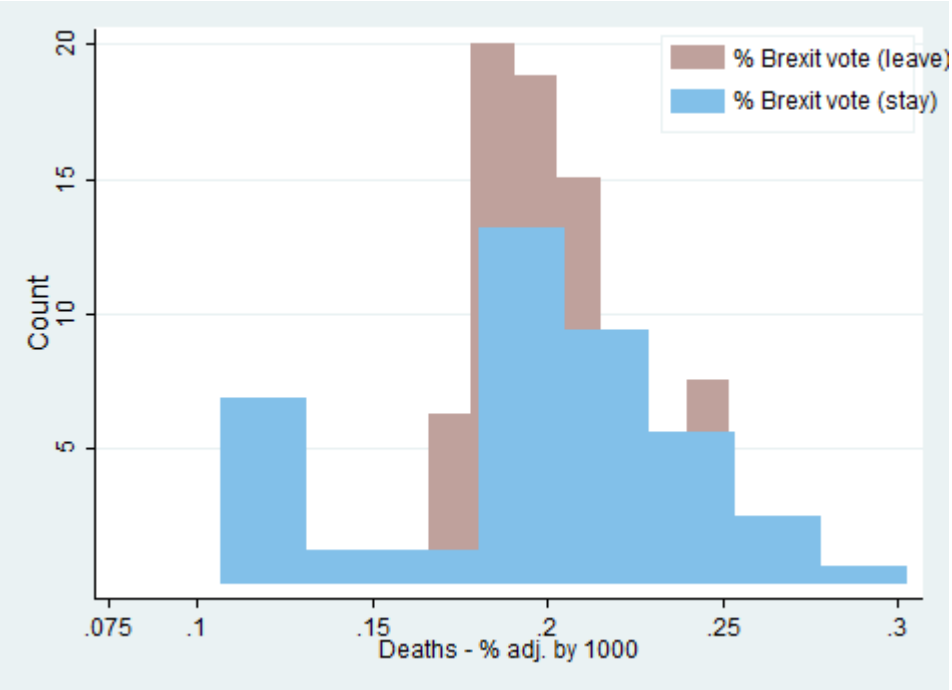

Figure 4: Mortality (%) and Brexit referendum outcome

Notes: The figure shows histograms of COVID-19 deaths for regions with below and above Brexit mean vote.

Table 1: Decomposition for Cultural and Economic Discrimination

	Spec. 1 Cultural Discrimination			Spec. 2 Economic Discrimination		
dep. var.	**Death Toll (% adj.)**					
	coef.	**z-value**		**coef.**	**z-value**	
Differential						
Prediction_A	0.206	89.09	***	0.202	67.39	***
Prediction_B	0.16	17.81	***	0.191	36.66	***
Discrimination	0.047	5.06	***	0.011	1.86	*
N		117			117	
R-sq		0.17			0.13	

Notes: Blinder-Oaxaca.

Table 2: Decomposition for Cultural and Economic Discrimination

	Spec. 1 Economic Discrimination Urban			Spec. 2 Economic Discrimination Rural		
dep. var.	**Death Toll (% adj.)**					
	coef.	**z-value**		**coef.**	**z-value**	
Differential						
Prediction_A	0.191	36.66	***	0.202	67.39	***
Prediction_B	0.202	67.39	***	0.191	36.66	***
Discrimination	-0.011	-1.86	*	0.011	1.86	*
N		117			117	
R-sq		0.13			0.79	

Notes: Blinder-Oaxaca.

Appendix: Descriptive Statistics – Data

Type	Variable	Definition	Source	Obs	Mean	Std. Dev.	Min	Max
time	week	Due to ONS death statistics being on weekly basis	ONS	130	7	3.756132	1	13
place	region	England and Wales (NUTS1)	ONS	13				
Main raw variable	rankofimd	Mudliple Deprivation Index (score 1 to infinite, where 1 is highest deprivation)	ONS	117	16023.85	2801.63	13037.88	20723.45
	rankofeducdeprivation	Mudliple Deprivation in educational aspects (score 1 to infinite, where 1 is highest deprivation)	ONS	117	15773.9	2188.45	13265.88	19617.95
	lung_cancer_patients	patients with lung cancer in the region (number)	ONS	130	130.5217	36.68	83.45	211.05
	deaths	Covid-19 deaths	ONS	130	1151.877	355.41	522	2132
	total_deaths	total deaths in Covid-19 period	ONS	130	11542.85	979.64	10645	14058
	deaths_0114	Covid-19 deaths in age category 0 to 14 years	ONS	130	17.38462	4.08	12	26
	deaths_1544	Covid-19 deaths in age category 15 to 44 years	ONS	130	290	34.15	189	321
	deaths_4564	Covid-19 deaths in age category 45 to 64 years	ONS	130	1325.385	89.4	1202	1517
	deaths_6574	Covid-19 deaths in age category 65 to 74 years	ONS	130	1858.769	128.35	1744	2198
	deaths_7584	Covid-19 deaths in age category 75 to 84 years	ONS	130	3270	306.02	2967	4014
	deaths_85_more	Covid-19 deaths in age category 85 years and over	ONS	130	4731.6	503.17	4205	5995
	m_deaths_1y	Male number of Covid-19 deaths in age category	ONS	130	27.6	5.51	14	38
	m_death_0114	Male number of Covid-19 deaths in age category	ONS	130	10.3	2.9	5	15
	m_death_1544	Male number of Covid-19 deaths in age category	ONS	130	187.5	24.07	115	214
	m_death_4564	Male number of Covid-19 deaths in age category	ONS	130	789.1	71.61	666	938
	m_death_6574	Male number of Covid-19 deaths in age category	ONS	130	1091.2	68.92	999	1270
	m_death_7584	Male number of Covid-19 deaths in age category	ONS	130	1742.7	151.35	1579	2096
	m_deaths_85_more	Male number of Covid-19 deaths in age category	ONS	130	1904.5	170.74	1725	2359
	f_deaths_1y	Female number of Covid-19 deaths in age category	ONS	130	22.1	4.96	14	31
	f_death_0114	Female number of Covid-19 deaths in age category	ONS	130	7.1	2.98	4	14
	f_death_1544	Female number of Covid-19 deaths in age category	ONS	130	102.5	11.51	74	119
	f_death_4564	Female number of Covid-19 deaths in age category	ONS	130	536.3	32.13	490	616
	f_death_6574	Female number of Covid-19 deaths in age category	ONS	130	767.5	63.79	694	928
	f_death_7584	Female number of Covid-19 deaths in age category	ONS	130	1527.3	159.56	1361	1918
	f_deaths_85_more	Female number of Covid-19 deaths in age category	ONS	130	2827.2	336.17	2480	3636
	Asian	Percentage Asian population in the region	ONS	130	6.65	4.692	2	18.5
	Black	Percentage Black population in the region	ONS	130	2.69	3.631	0.5	13.3

	Mixed	Percentage population of mixed background in the region	ONS	130	1.96	1.103	0.9	5
	White_British	Percentage White-British in the region	ONS	130	83.15	13.469	44.9	93.6
	White_Other	Percentage other White ethnic origin in the region	ONS	130	4.71	3.591	1.7	14.9
	other	Percentage other ethnic origin in the region	ONS	130	0.86	0.866	0.3	3.4
	rankofimds~v	Index of Multiple Deprivation (score 1 to infinite, where 1 is greatest deprivation)	ONS	117	16023.85	2801.63	13037.88	20723.45
	rankofeduc~g	Multiple Deprivation in educational aspects (score 1 to infinite, where 1 is greatest deprivation)	ONS	117	15773.9	2188.45	13265.88	19617.95
Instrumental variable	lunc_cance~s	patience with lung cancer in the region (number)	ONS	130	130.5217	36.68	83.45	211.05
Available Controls	all_ages	Number of people in age group	NOMIS	130	5911581	2036054	2657909	9133625
	age_0_15	Number of people in age group	NOMIS	130	1131117	425660.9	474998	1834795
	age_16_24	Number of people in age group	NOMIS	130	635212	206578	298268	950440
	age_25_49	Number of people in age group	NOMIS	130	1946456	813038.8	821725	3659254
	age_50_64	Number of people in age group	NOMIS	130	1115672	350838.5	540546	1768493
	age_65over	Number of people in age group	NOMIS	130	1083125	333545.7	522372	1761765
	all_male	Male number of people in age group	NOMIS	130	2921525	1012630	1305486	4500331
	age_m_0_15	Male number of people in age group	NOMIS	130	579612.1	218171.2	244096	938617
	age_m_16_24	Male number of people in age group	NOMIS	130	326686.2	105107	154271	490684
	age_m_25_49	Male number of people in age group	NOMIS	130	971145.8	413191.1	404985	1862524
	age_m_50_64	Male number of people in age group	NOMIS	130	549185	173853.1	263667	874414
	age_m_65over	Male number of people in age group	NOMIS	130	494896	151407	238467	800343
	all_female	Female number of people in age group	NOMIS	130	2990056	1023660	1352423	4633294
	age_fe_0_15	Female number of people in age group	NOMIS	130	551504.6	207494.4	230902	896178
	age_fe_16_24	Female number of people in age group	NOMIS	130	308525.8	101504.8	143997	459756
	age_fe_25_49	Female number of people in age group	NOMIS	130	975309.7	400123.2	416740	1796730
	age_fe_50_64	Female number of people in age group	NOMIS	130	566487.1	177016.1	276879	894079
	age_fe_65o~r	Female number of people in age group	NOMIS	130	588228.6	182235.3	283905	961422
	locationqu.manufacture	location quotient for manufactyring	NOMIS	130	1.15	0.386	0.28	1.64
	locationqu.cars	location quotient for car production	NOMIS	130	1.28	1.051	0.16	3.89
	avg_house_price	Avwerage houseprice in the pregion	NOMIS	130	239846	101338	130977	483922
	monthly_ch_house_price	monthly change of average house price in the region	NOMIS	130	0.44	1.218	-2	2.1
	annual_ch_house_price	Annual change of average hous eprice in the region	NOMIS	130	2.22	0.719	1.2	3.9

	total2007	Total population in 2007	NOMIS	130	5507111	1840698	2550818	8446500
	urban2007	Urban population in 2007	NOMIS	130	4495461	1885534	2019379	8058311
	rural2007	Rural population in 2007	NOMIS	130	1011651	524824.1	15389	1711035
	job_density	Job density	ONS	130	0.842	0.08	0.73	1.02
	ppl2020	Total population in 2020	ONS	130	5977847	2073808	2674568	9235982
	numberofbuiness	number of small and medium businesses	NOMIS	130	0.5411	0.28	0.152	1.092
	claimant~n20	claimant count jan 2020	NOMIS	130	108562.9	39907.19	59280	181195
	claimant~b20	claimant count feb 2020	NOMIS	130	110298.3	40816.3	59402	186044
	empl_ra~2020	employment ratio	ONS	130	76.24	2.68	71.7	80
Derived variables used in estimations	unempl	number claimant counts per head of population	derived	130	0.031	0.008	0.021	0.045
	deaths_perc	number of Covid-19 deaths per head of population	derived	130	0.0002	3.55E-05	0.0001	0.0003
	dumm_deaths	dummy equal to 1 if percentage of deaths in the region is above the average for the country	derived	130	0.53	0.5	0	1
	ppl_density	Job density as a proxy of population density	derived	130	0.84	0.08	0.73	1.02
	ethnic_cultural	sum of people with Asian, black and mixed origin per population	derived	130	0.11	0.09	0.04	0.37
	employed_perc	employment ratio	derived	130	76.24	2.68	71.7	80
	imd	IMD total	derived	117	16023.85	2801.632	13037.88	20723.45
	capital	based on average house price per region as a proxy	derived	130	239846	101338	130977	483922
	ln_capital	natural logarythm of the derived variable capital	derived	130	12.31	0.38	11.78	13.09
	urban	percentage of people in the region who live in urban areas	derived	130	0.798	0.097	0.671	0.998
	sectoral_spec	location quotient for cars	derived	130	1.279	1.05	0.16	3.89
	male	percentage of population who is male	derived	130	0.49	0	0.49	0.5
	age above 45	percentage of people above the age of 45	derived	130	0.19	0.03	0.12	0.22
	deaths_perc_adj	percentage of Covid-19 deaths per population (adjusted by 1000 for magnitude)	derived	130	0.2	0.04	0.11	0.3
	perc_lung	percentage of lung cancer patients per region	derived	130	2.32E-05	5.47E-06	1.41E-05	3.37E-05

Notes: The table presents the main descriptive statistics for the available variables in our dataset, their definition and their source.