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Is It Psychologically Dangerous to Live in a Rich Area? Evidence From Census-Matched Micro Data on Suicides in England and Wales

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ABSTRACT

This paper reports a new test of relative-deprivation theory. Research into the potential consequences of relative comparisons has in the past had to rely almost exclusively on subjective data on wellbeing. With information that was released under strict confidentiality requirements by the U.K. Office for National Statistics, we here report the first econometric results that are able to draw upon a full set of census-matched micro-level records with register data on suicides in England and Wales. We find that suicide risk is greatest, *ceteris paribus*, in rich areas. This result, which is consistent with a role for invidious relative comparisons, runs counter to a long-standing belief in the literature that risk is higher in deprived areas.

JEL Classification: I14, I31, C25

1 | Introduction

This paper describes a new and unconventional test of relative-deprivation theory. It uses recently available micro-data on suicides in England and Wales. The intuitive idea on which the paper builds is that when a person contemplates suicide, it is possible that they have been influenced by whether they appear—inwardly to themselves—to be a failure relative to how well-off and successful they feel they are compared to those who live around them.

Discussion of relative deprivation has a substantial modern history (including Runciman 1966; Crosby 1976; Smith et al. 2012; Wilkinson and Pickett 2007) and goes back at least to the writings of Karl Marx in *Das Kapital* and other early scholars. The central idea is that comparisons matter. Absolute income is

not, according to relative-deprivation theory, a sufficient statistic to understand human feelings and actions. Although a person's own income and happiness are thought to protect them somewhat from suicide risk (as shown in longitudinal data in Koivumaa-Honkanen et al. 2001), the level of others' prosperity is, according to a relative-deprivation account, a risk factor.

Relative-status concerns have been found to be influential in the domain of happiness, where what matters is relative rather than absolute income. Whether consciously or subconsciously, humans seem to compare their income to those of others (Luttmer 2005). Similar results have been found in the domain of job loss, both with respect to self-reported wellbeing (Clark 2003) and suicide risk (Platt et al. 1992; Pescosolido et al. 2020). A person may feel less like a failure when many of their neighbors are facing similar problems (Daly et al. 2008). Our paper

This work was undertaken within the Office for National Statistics (ONS) Secure Research Service using data from ONS and other owners and does not imply the endorsement of the ONS or other data owners.

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TABLE 1 | Individual-level regression of suicide outcome on geographical area (LSOA) deprivation quintiles.

	(1) Basic controls	(2) + Family	(3) + Health	(4) + Education	(5) + Economic controls	(6) – Health
Deprivation quintile						
Highest deprivation quintile	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)
Quintile 2	–2.528** (0.799)	–1.578** (0.799)	0.922 (0.801)	1.234 (0.803)	2.487*** (0.813)	2.215*** (0.813)
Quintile 3	–5.950*** (0.794)	–4.017*** (0.793)	0.192 (0.796)	0.714 (0.799)	2.312*** (0.819)	1.801** (0.818)
Quintile 4	–7.422*** (0.800)	–4.598*** (0.797)	0.783 (0.802)	1.466* (0.809)	3.196*** (0.833)	2.547*** (0.831)
Lowest deprivation quintile	–9.551*** (0.807)	–5.759*** (0.801)	0.653 (0.809)	1.525* (0.821)	3.319*** (0.855)	2.544*** (0.853)
Average suicide rate per 100,000	17.495	17.495	17.495	17.495	17.495	17.495
Over 21 months	(0.228)	(0.228)	(0.228)	(0.228)	(0.228)	(0.228)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Family controls	No	Yes	Yes	Yes	Yes	Yes
Health controls	No	No	Yes	Yes	Yes	No
Education controls	No	No	No	Yes	Yes	Yes
Economic controls	No	No	No	No	Yes	Yes
Observations	1,695,550	1,695,550	1,695,550	1,695,550	1,695,550	1,695,550

Note: Suicides per 100,000 over 21 months. In Column (6), on the far right, we remove the controls for subjective health from the regression. Observations are measured in individuals. There are 5913 suicides. The base group is approximately 1.7 million citizens. The geographical deprivation areas are at the level of LSOAs (the acronym stands for Lower Layer Super Output Areas) in England and Wales. Data: Suicides between 27 March 2011 (UK Census 2011) and December 31, 2012 and 5% of those alive at the end of the study period in December 2019; characteristics are measured on Census (March 27, 2011). Weights applied. Linear probability model. Basic controls include sex, a full set of age dummies, ethnicity, region, and religion. Other controls additionally include family (marital status, number of children), health (health status), education, and economic controls (employment status, socio-economic classification, home ownership, living conditions). Underlying full equations are presented in the main and online Appendices. There are approximately 35,000 LSOAs in the UK; on average they contain approximately 700 households. The Average Suicide Rate is estimated here by calculating the constant in a linear probability model with no other controls. The reason that it appears higher than is normal in a western industrialized nation (a normal rate is approximately 10 suicides per 100,000 citizens per year) is because our time period extends to approximately 21 months. Heteroskedasticity-robust standard errors in parentheses. Table M3 presents the results for a probit model. The findings are similar.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Source: Authors' computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

thereby also connects indirectly to a broad set of work on happiness and human subjective wellbeing (Easterlin 2003; Richard Layard 2005; Steptoe et al. 2005; Graham 2008; Clark 2018; Dwyer and Dunn 2022).

However, unlike much of the prior work on relative comparisons, we do not here analyze subjective happiness and life-satisfaction variables (see Blanchflower and Oswald 2004; Cuesta and Budria 2014; Brodeur and Fleche 2019; Budria and Ferrer-I-Carbonell 2019; Ifcher et al. 2018, 2019; Kudrna 2024; Layard 1980; Luttmer 2005) or variables such as self-reported measures of health and sleep (Jones and Wildman 2008; Akay et al. 2019).

Instead, we take the conceptual idea of relative concerns to the domain of suicide. We use complete Census-linked micro-level data on suicides. Previous work had to rely on limited information about people's characteristics. For example, Classen and Dunn (2012) make use of state-level characteristics, Tadmon and Bearman (2023) use county-level information, and Case and Deaton (2015) only had individual-level information on ethnicity and education. In contrast, we observe for most individuals that died of suicide between 2011 and 2020¹ their census records, which, *inter alia*, include individuals' sex, age, ethnicity, religion, marital status, household composition, health, education, socio-economic status, and home ownership.

On that basis, we show later, in the right-hand columns of tables such as Table 1, that the paper's central result stems from a *ceteris paribus* condition on individual characteristics. What turns out to be crucial here is an adjustment, in particular, for economic variables. In part, we have been influenced by the emphasis in Kudrna (2024) on the potential role of comparative wealth rather than income alone. Rich people can create negative externalities, in a sense.

The remainder of the paper is organized as follows. Section 2 sets out the background literature on relative comparisons and on suicide. Section 3 describes the census-linked micro data and the empirical approach. Section 4 presents the paper's central results. Section 5 reports a set of robustness checks, including an order-invariant decomposition of the contribution of different blocks of covariates. Section 6 concludes.

2 | Background

There is, as is known, a large research literature on suicide, including, famously, Durkheim (1897). The writer Wilfrid Sheed is reputed to have said that 'suicide is the sincerest criticism that life ever gets'. Suicide is a clear marker of extreme ill-being (Case and Deaton 2015; Zheng and Choi 2024; Tadmon and Bearman 2023). We link later to ideas on the potential health implications and psychological harm of relative

deprivation (Pham-Kanter 2009; Mishra and Carleton 2015; Payne et al. 2017). Other related research has examined the spatial patterns in suicide (such as the early work of Dorling and Gunnell (2003) and of Cairns et al. (2017)). Further research that relates to this paper's analysis includes Agerbo et al. (2007), Gradus et al. (2020), and Helliwell (2007). Gascoigne et al. (2025), which was published after this paper was first submitted, study spatio-temporal trends in suicide across England between 2002 and 2022 and examine socio-environmental determinants measured at the level of middle-layer super output areas. This is an ecological study, in the sense that the personal characteristics of the individuals who died are not observed, and that is the respect in which our paper differs from it. Notably, they find suicide risk to rise with area deprivation. That is the conventional gradient, and it is the same pattern that emerges in the first column of our own Table 1. What the later columns of that table suggest is that this gradient does not survive an adjustment for the characteristics of the individuals who happen to live in those areas.

Particular mention, although it does not have data on actual suicides, should be made of Pak and Choung (2020), which uses longitudinal data from the Korea Welfare Panel Study (KoWePS) and finds that relative income deprivation—feeling poorer compared to one's reference group—is independently associated with a higher likelihood of suicidal ideation, planning, and attempts. We also point to seminal prior work by Mary Daly and colleagues (Daly et al. 2008; Daly et al. 2011; Daly and Wilson 2009; Daly et al. 2013) who link actual suicide in US data to both own family income (entering negatively) and county-level income (entering positively). They thereby emphasize the possibility of, and indeed try to estimate the size of, relative-income and relative-happiness effects on suicide risk. Our later analysis differs from theirs in that our method uses a measure of highly generalized geographical-area disadvantage. It is closer to a 'stock' variable than to a 'flow' variable and was created by British government statisticians from a large set of indicators of area deprivation, including not just income but also health, education, crime, housing, employment opportunities, and the quality of the environment.

The main modern similar studies—that is, where a fairly complete set of micro data are able to be used to study this kind of question—of which we are aware are Daly et al. (2013) for the USA, Liu (2017) for the city of Stockholm, and Berkelmans et al. (2021) for the Netherlands. The last of the three adds a substantial set of personal controls. In that way, the authors manage to drive the geographical-area coefficient in a suicide equation from a significant negative gradient (moving from poorest areas with most suicides to richest areas with least suicides) to zero. On that basis, they conclude that regional differences are driven by the differences in the demographic makeup of the regions as opposed to specific local causes. On that account, areas do not matter per se. In the current paper, we instead suggest that regions do have consequences, albeit in the opposing direction.

Although it is only for one city, Liu (2017) is a major contribution and is closer in spirit to the current paper. It draws upon median income by sub-city area rather than, as in the later analysis, a wider measure of socio-economic disadvantage but establishes the result that suicide risk is higher in the high-income sections of the city of Stockholm and thus argues, as we later

do, that income comparison can have negative consequences. Finally, Daly et al. (2013) is important although it does not follow the exact form of the current paper. Its approach is to estimate models of the suicide hazard using two independent data sets: the US National Longitudinal Mortality Study and the US National Center for Health Statistics' Multiple Cause of Death Files combined with the 5% Public Use Micro Sample of the 1990 US decennial census. The authors demonstrate that, controlling for own income and individual characteristics, individual suicide risk rises with others' income.

3 | Empirical Approach

Our data, the Public Health Research Database,² allows us to link suicides to detailed information on individuals' personal characteristics (gathered from the 2011 UK Census), including information about the place in which the person lived. In the later analysis, this is done for England and Wales down to the level of lower layer super output areas (LSOAs). A typical LSOA is small. It has an average of 700 households.

We then match each LSOA with government-calculated measures of deprivation. Specifically, the *Index of Multiple Deprivation* (Ministry of Housing, Communities and Local Government 2019) for England and the *Welsh Index of Multiple Deprivation* (Welsh Government 2019) measures relative disadvantage in each of these approximately 35,000 local geographical areas.^{3,4} The indices are designed by government statisticians as averages across several domains of potential deprivation, including income, employment, health, education, crime, housing, and environment. Each domain is weighted, with income and employment assigned the largest importance in the weighting. Based on their overall scores, areas are ranked and then for our analysis divided into five quintiles. Quintile 1 represents the most deprived 20% of areas, while quintile 5 represents the least deprived 20%.

It is thus feasible to use as a key independent variable what might be thought of as an aggregate 'externality' characteristic that is common to citizens of a place, namely, the level of prosperity in that geographical area. We assume that everyone within such a small area is exposed—to a lesser or greater amount—to the sight of neighbors who are either more or less affluent. Such exposure may for example run via the size and quality of neighboring houses, observation of conspicuous consumption (e.g., via clothing choices), or the type of cars parked on the streets. One potential advantage of the paper's approach is that the area deprivation level captures, in part, wealth and not just income. Wealth may matter in comparisons (and may be more easily observable than income).

Our data contains all residents of England and Wales who died of any cause between the Census and the beginning of 2020, plus a 5% random sample of those still alive at the end of December 2019 (which is why the stated number of observations in later tables exceeds 1 million people). In the analyses to follow, we only include individuals who have died by suicide or who are still alive by December 2019.

Linear-probability models are estimated using OLS, with heteroskedasticity-robust standard errors. Probit models were also estimated (as given in Table M3) as a check on the findings.

The crucial information for the current study is on individuals who responded to the national Census and who died by suicide in the 21 months between 27 March 2011 and 31 December 2012. In this way, we deliberately restrict the sample to just under the first 2 years following the Census. That time cut-off is to ensure that key individual characteristics, including the place of residence, are unlikely to have changed from the Census date. However, as discussed in the section on robustness tests, the results do not depend on this cutoff.

In order to define suicide, we use the definition from ICD-10 ranges X60–X84 (intentional self-harm) and Y10–Y34 (injury or poisoning of undetermined intent).

Our sample ultimately covers 1,816,771 observations. Out of this total, 6584 individuals died from suicide (the individuals who died from other causes are excluded). We constrain the sample in one more way. We include only adults who were between the age of 20 and 75 at Census. The final total leaves us with 1,695,550 individuals. Of these, 5913 people died of suicide. See Table A1, and Table M1, for detailed descriptives, to be discussed in more detail in the next section.

To correct for confounding influences, we begin by using a basic set of controls. These include sex, a set of age dummies, ethnicity, region, and religion. Given our particular data set we can then gradually add further controls into the regression equations, including family variables (marital status, number of children), health variables (health status), education variables, and economic variables (employment status, socio-economic classification, home ownership, living conditions). The latter turn out to be particularly influential and would not be possible with aggregate data. We observe these variables at the level of the individual, from the individual's Census record, and we do not separately construct area-level aggregates of them. The deprivation index is the area-level measure that we use. It should be mentioned that we think of these latter independent variables (especially education, employment, ethnicity, and housing type) as standing in for an income variable—not available to us in the Census—at the person level. It is known that these variables are strong predictors in standard wage equations, for example.

To assess the relative importance of these groups of variables in a way that does not depend on the order in which covariates are entered, we use the decomposition proposed by Gelbach (2016). This allows us to show how much of the change in the deprivation-quintile coefficients, across specifications, can be attributed to each block of covariates.

Sampling weights are applied throughout. Complete equation specifications are presented in Table M2. Because of the long list of independent variables, the full tables take up a number of printed pages, so for brevity the main body of the paper concentrates on compressed versions that focus on the principal covariates in which we are interested.

4 | Results

In Panel A of Table A1, the rate of suicide among men is, as is already widely known from aggregate statistics, approximately

three times the rate among women. Panel B of Table A1 illustrates that, as is similarly well-known, economically deprived geographical areas tend, as a matter of correlation, to have substantially higher suicide rates. The 'raw' area effect is large. Here the rate varies from approximately 20.7 suicides per 100,000 people in the most deprived quintile in England and Wales' geographical areas to approximately 14.5 per 100,000 in the most prosperous quintile of areas. For reference, the overall average across all areas is 17.5 suicides per 100,000 people over the 21-month window that our main sample covers. In these calculations, no account is taken of the personal heterogeneity of individuals in any other dimensions. The numbers are simply averages. Table M1 provides further descriptive statistics.

Regression equations are given in Table 1. The dependent variable is suicides. It is expressed, for ease of reading, as a rate out of 100,000 people. Column 1 of Table 1 depicts the area pattern classified by deprivation quintile (where LSOAs are the underlying smaller areas) of suicide in England and Wales. In this first column, the only independent variables in the regression are sex, age, ethnicity, Government region (i.e., NUTS 1 regions), and religion. We call these the basic controls. They have been used in large numbers of previous studies of UK suicide, partly because they are made available at the aggregate level by the Office for National Statistics, and partly because they have been used in suicide studies in many countries. Berkelmans et al. (2021) demonstrate their statistical relevance in individual-level information for the Netherlands. In our own regressions, each of these variables is measured at the level of the individual, taken from that person's own Census record, and not as an area aggregate. The only variable that enters at the area level is the deprivation quintile itself.

It can be seen here, in the initial column of Table 1, that the more affluent the area (as measured by deprivation level), the lower is the rate of suicide among citizens who live there. This is the conventional and long-believed pattern. Disadvantaged geographical areas have many more individuals who die of suicide. In this specification, with basic controls only, the estimated difference between the highest and the lowest deprivation quintile is almost 10 more suicides per 100,000 people. For one early review of related research on these large area coefficients, see Buka and Rehkopf (2006); a more recent and comprehensive review is given by Cairns et al. (2017).

Columns 2, 3, and 4 of Table 1 gradually adjust for extra covariates. The underlying regressions include many dozens of independent variables. For clarity, these are not all listed here, but can be seen in Table M2.

We deliberately lay out these regressions in succession, looking across the columns of Table 1, to aid understanding of the statistical consequences of different kinds of controls. In column 2, for example, after adding dummy variables for marital status and the number of children, the monotonic-decline pattern that is visible in the coefficients across areas is maintained. However, the gradient is slightly reduced in size. This is primarily driven by there being more married individuals in less deprived LSOAs and marriage potentially 'protecting' against suicide (as can be seen from the relevant coefficients in Column 2 of Table M2).

Column 3 of Table 1 is different. Here the evidence for a suicide pattern in geographical areas has almost disappeared. What this means is that once we bear in mind that health—as subjectively assessed and reported by the individuals in the Census—is different across advantaged and disadvantaged kinds of places, there is approximately no further suicide-risk gradient by quintile of area deprivation. There is then no intrinsic ‘area effect’.

Importantly, it should be noted here that the work of Berkelmans et al. (2021) uncovers essentially a similar way to produce a null finding. In their own words, the authors conclude (for the Netherlands) “the regional differences found in raw frequencies are mostly explained away after correction of correlating risk factors, indicating that these differences were primarily caused due to the differences in the demographic makeup of the regions.”

Moving further to the right across Table 1, Column 4 now adds a set of education dummy variables. Doing so leads to slightly upward-sloping coefficients across the area-deprivation quintiles. Nevertheless, the null hypothesis of zero on each of the latter four coefficients cannot be rejected at the conventional 95% confidence level.

Column 5 in Table 1 has the complete specification. It conveys the main result of the paper. In this case, controls have been added for employment status (i.e., whether working, unemployed, and so forth, as well as the respondent’s NS-SEC level) and for proxy variables for wealth and resources (in particular: homeownership and number of persons per room in current dwelling). These, it can be seen, make a fundamental difference. In this final and fullest specification, within Table 1, the substantive conclusion is that suicide risk is greatest, *ceteris paribus*, in the most-advantaged quintile of areas in England or Wales.⁵

It can be seen that the finding in Column 5 of Table 1 is in essence the opposite of that in Column 1 of the table. It is also the opposite of the conclusion drawn in almost all prior literature—where, for sheer data reasons, researchers were unable to make an adjustment for a complete set of controls.

A coefficient of 3.319 in Column 5 implies that there are almost three and a half extra suicides per 100,000 citizens in these richer geographical places (compared to the highest-deprivation quintile of areas in England and Wales). In comparison, in the same regression specification, people with tertiary education have 1.7 more suicides per 100,000 than people with no formal education (this difference is not statistically significant at conventional levels); among Christians, there are estimated to be about 3.9 fewer suicides than among individuals declaring no religion; individuals who are single are estimated to have 8.5 more suicides than individuals who are married; and unemployed individuals are estimated to have 17.2 more suicides per 100,000 than full-time employed people. Thus, it seems that the observed association of suicide with a lack of area deprivation is substantial, roughly of the order of association with religious belief. For the full set of coefficients, see Table M2.

However, it may be worth appreciating that there is likely to be a form of potential bias here. The paper’s estimated effect size may understate the true effect. Table 1’s fifth column is consistent with the idea that relative-deprivation feelings are dangerous and

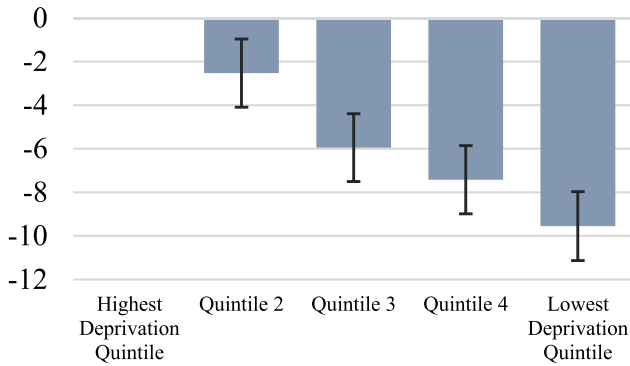
might operate to explain the reversal of the traditional inverse area-gradient. But it seems valuable to think about the nature of affluent areas. It is probable that a number of advantageous factors—more hospitals, greater leisure facilities like sports halls and cinemas, less crime, a wider range of transport options, and so forth—lie in part behind the dummy variables for deprivation quintiles. Therefore, a dangerous-psychology interpretation has to outweigh those otherwise unmeasured benefits of living in a prosperous region. Put differently, any relative-deprivation effects felt by unhappy inhabitants have, given the findings in Column 5 of Table 1, to be sufficiently strong to be able to offset the various possible hidden positive plusses from living in an area of low deprivation. It may be that a coefficient 3.319 is an underestimate of the psychological ‘danger’. A second consideration points in the same direction. Area deprivation is likely to proxy, in part, for a person’s own income and wealth, which the Census does not record. In a specification without full personal economic controls, the deprivation dummies will therefore pick up some individual disadvantage, and deprived areas will appear more dangerous than they are. The paper does control at the person level for detailed measures of education, housing type, and the salariat level under which the individual is classified. Nevertheless, in so far as some omitted-variable bias remains, it biases the coefficient on living in a prosperous area downwards. On this argument too, the estimate of 3.319 should be read as a conservative one.

Figure 1 and Figure A1 present some of the earlier tabular information in a different and pictorial way. The important reversal of the gradient across the two parts of Figure 1, for example, is fairly straightforward to see in this graphical layout.

Before turning to a series of robustness checks in the next section, we note that one of the strongest other results that we have seen in the data, and a pattern consistent with the much-discussed U shape in happiness through life in the statistical literature on personal happiness and wellbeing (Blanchflower and Oswald 2008, for example), is the hill-shaped relationship here between a person’s age and their probability of dying of suicide. Figures 2 and 3 illustrate the ‘midlife crisis’ as traced out in suicide risk (see originally Jaques (1965), and more recently, for example, Giuntella et al. (2023)). A recent compilation of graphs from the official statistical agencies of Britain, the United States, and Australia points in the same direction (Oswald 2026). Once again, these graphs in Figures 2 and 3 come from regression equations in which a substantial set of controls are included. Figure A2, reveals that the hill-shape emerges even in a non-parametric way with a complete set of individual-age dummies. Hence, the psychological mechanisms at work behind the curved shape cannot be explained by standard socio-economic controls and must somehow be deep ones not currently understood.

Indeed, more broadly, the pattern of coefficient signs and magnitudes in the full regression table (see Table M2) is remarkably similar to the typical structure of ‘life satisfaction’ regressions: Roughly speaking, married and religious individuals who are in good health are less likely to die of suicide, while persons who are unemployed, have lower socio-economic status, and who rent (rather than own) are statistically significantly more likely to die of suicide. These convergent findings may be viewed as

Model with Basic Controls



Model with All Controls

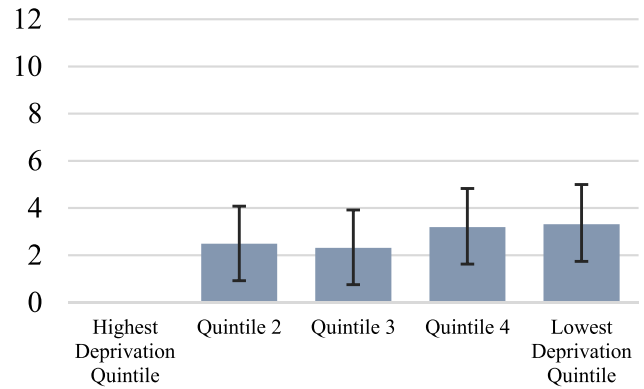


FIGURE 1 | Adjusted marginal suicide rates per 100,000 people per LSOA deprivation quintile, compared to the Highest Deprivation Quintile, 2011–2012. This Figure reveals that once a person’s economic status is included in the regression covariates, the influence of local-area deprivation switches from negative to positive. Observations are measured in individuals. There are 5913 suicides. The base group is approximately 1.7 million citizens. The geographical deprivation areas are at the level of LSOAs (the acronym stands for Lower Layer Super Output Areas) in England and Wales. Bars represent 95% confidence intervals. *Data:* Suicides between 27 March 2011 (UK Census 2011) and 31 Dec 2012 and 5% of those alive at the end of the study period in December 2019; characteristics are measured on Census (27 March 2011). Weight applied. Linear probability model. Basic controls include sex, a full set of age dummies, ethnicity, region, and religion. Other controls additionally include family (marital status, number of children), health (health status), education, and economic controls (employment status, socio-economic classification, home ownership, living conditions). Underlying full equations are presented in the main and online Appendices. There are approximately 35,000 LSOAs in the UK; on average, they contain approximately 700 households. *Source:* Authors’ computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

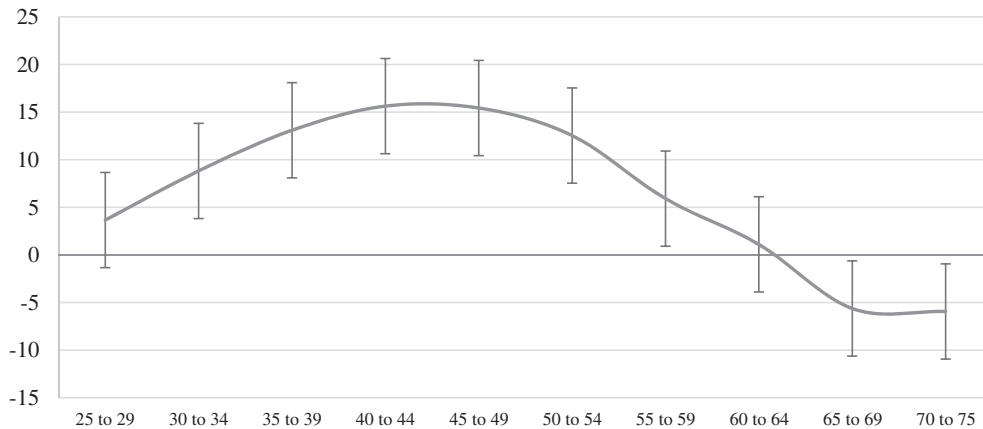


FIGURE 2 | Adjusted marginal suicide rates per 100,000 people by age, compared to the rate at 20–24 years old. Model with *all controls*, 2011–2012. *Source:* Authors’ computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

corroborating ‘revealed’ behavioral evidence about subjective survey data.

5 | Checks

How robust is the paper’s principal finding?

First, one might worry that our core finding—that adding economic controls makes a large difference to the estimated coefficients and thereby reverses the sign of the deprivation gradient—depends on the particular order in which covariates are entered. In Table 2, we therefore present results from a decomposition proposed by Gelbach (2016). The idea underlying the decomposition is that what is needed, and what the Gelbach

method delivers, is a persuasive way to check on which independent variables matter most. Adding variables singly is not reliable because results depend on the sequencing of the additional variables. The Gelbach decomposition solves this problem. It is sequence-invariant. It computes the unique contribution of every control all at once, mathematically guaranteeing that the sum of the individual contributions equals the total difference between the simple and full models. Crucially, this decomposition therefore gives us an order-independent means of assessing how much our economic controls matter.

The table shows, for each of the four deprivation quintile dummies, how much of their change between the basic specification (Column (1) of Table 1) and the full specification (Column (5))

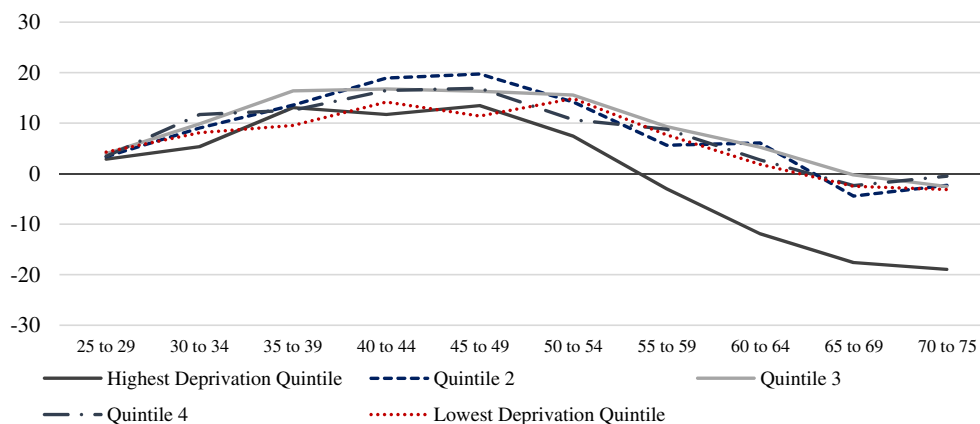


FIGURE 3 | Adjusted marginal suicide rates per 100,000 people by age, compared to the rate at 20–24 years old. Model with *all controls*, 2011–2012. By deprivation quintiles. *Source:* Authors’ computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

TABLE 2 | Gelbach decomposition based on results shown in Table 1.

Deprivation quintile	Covariate block			
	Family	Health	Education	Economic
Quintile 2	–0.678	–2.263	0.094	–2.169
Quintile 3	–1.417	–3.838	0.164	–3.170
Quintile 4	–2.097	–4.938	0.216	–3.799
Quintile 5 (Least deprived)	–2.847	–5.928	0.272	–4.366

Note: The table shows how each of the blocks of covariates shown in Table 1 contributes to the change in coefficients from those shown in Column 1 of Table 1, to those shown in Column 5. Calculations are based on the decomposition of Gelbach (2016). For each row, the columns sum to the difference in coefficients between those in Columns 5 and 1 of Table 1. Controls relating to health and economic conditions are most responsible for the change in the sign of the relationship between suicide and local area deprivation. Table A4 presents a similar table, comparing Column 1 of Table 1 with a specification with no controls at all.

Source: Authors’ computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

can be attributed to each of our blocks of covariates (i.e., *Family*, *Health*, *Education*, *Economic*). Broadly, Table 2 indicates that the block for health contributes most, followed by the economic variables, to the change in coefficient signs and magnitudes (about 5.9 and 4.4 points respectively for the fifth quintile). Individual education contributes little to the change in coefficients on area deprivation, in line with our earlier discussion.⁶

Beyond these decomposition results, it might further be argued that controlling for subjective health, as we do, starting from the third column in Table 1, is over-controlling? Could local area deprivation affect individuals’ health, which in turn affects suicide probabilities? We would then impair an important path from area deprivation to suicide risk. As a first robustness check, we therefore remove our control for subjective health from the regression equation. The result, shown in Column 6 of Table 1, indicates that the coefficients on area deprivation fall somewhat when subjective health is excluded, but they remain positive, substantial, and statistically significant. Table A2 shows that the most common method of suicide does not strongly vary across LSOAs.

Table A5 reproduces our results for the north compared to the south (Columns 1 and 2) and for females compared to males (Columns 3 and 4). The coefficients in these two tables are not quite monotonic across quintiles, but the general gradient

remains visible; the tables again do not offer evidence for the traditional idea that it is psychologically worse to live in a poorer area. Figures A3 and A4 show results based on deciles rather quintiles. These again yield very similar results.

Further explorations are provided in Tables M4–M10. These tables check whether the results hold across different education levels, tenure type, employment statuses, marital statuses, health levels, and religion. A positive gradient, where suicide risk is larger in prosperous places, continues in general to hold. In certain cases, the standard errors are large, such as in the final column of Table M4 where the number of suicides among those with higher-education qualifications is particularly few. The first column of Table M6 is also notable, because it performs a scientifically useful check of the paper’s central conclusion on what might be viewed as a sample of all regular workers in England and Wales. Table M8, concerned with heterogeneity in associations across levels of health, whilst it has some coefficients for which the null of zero cannot be rejected, has large estimated effects—approaching 28–38 extra suicide deaths per 100,000 citizens—of deprivation quintile among those with poor health (who are generally more prone to die of suicide).

In Table M9, we examine differences across age groups. Unfortunately, these estimates are, again, very noisy. However, broadly

speaking we find the same patterns as main results across almost all age groups with the sole exception of individuals aged 30–34. Table M10 looks at differences across religious groups, by re-estimating Table 1 separately for respondents who identify as Christian, as having no religion, or as having some other religion. The results hold across all groups, though coefficients on deprivation quintiles are insignificant across most columns in the ‘other religion’ group (which also has the smallest N).

In Table A6, we show results from a set of multinomial logistic regressions (with three outcomes: alive, death from a non-suicide cause, and death by suicide) that mirror the specifications of Table 1. Regarding suicide, we obtain the same qualitative results. However, concerning deaths from any other causes we find that while moving from Column 1 to Column 5 (i.e., adding controls) tends to reduce the gap between most and least deprived LSOAs, it is still the case that mortality rates for non-suicide cases are smaller in less deprived regions.

Finally, we tested whether our results are robust to including suicides that occurred after 2012. We did so by iteratively expanding the window of included years (i.e., years 2011–2013, 2011–2014, . . . , 2011–2020) and re-estimating the specifications of Table 1. In almost every window, we find the same pattern: the deprivation gradient flips sign once economic controls are included. The only exception is the 2011–2013 window.

6 | Conclusions

Could suicide risk be particularly elevated when an unhappy person is surrounded by those with prosperous, advantaged circumstances? This empirical study suggests that the answer is yes.

We have drawn upon the first full release of micro data on suicides in England and Wales in an attempt to explore the research question. The design of the paper is ultimately a simple one. The main result is illustrated in the final column of Table 1. We find that suicide is more likely, *ceteris paribus*, in affluent areas of England and Wales.

Later tables probe the robustness and generality of the study’s main idea. The paper has been able to examine, using a larger set of controls than previously feasible, the patterns in individual information on thousands of suicides in England and Wales. We believe the only previous hint of this paper’s result in aggregate ecological-level UK data was in certain tables for parts of the male population within Middleton et al. (2004).⁷ That work had no access to the underlying micro data.

Personal economic prosperity is, on our estimates, associated with reduced suicide risk. Yet, contrary to the conclusions of a large literature (on the risks of living in a poor area), the reverse, as a statistical matter, appears to be true of the level of prosperity in the geographical area where someone lives. An interpretation of this pattern in the data is that invidious relative comparisons provoke feelings of failure and depression. The results in this paper are therefore consistent with the idea that it is psychologically dangerous to be surrounded by advantaged citizens. Our main conclusion is redolent of a diverse scholarly literature that

rests on the idea that humans are deeply affected by comparisons (Ifcher et al. 2018; Pickett and Wilkinson 2015; Wilkinson and Pickett 2009). It is also broadly consistent with the paradox noted by Daly et al. (2011) on the surprisingly high *ceteris paribus* suicide rates in happy countries and happy states of the USA.

Future work may be able to go beyond the ideas on which this paper builds. In particular, if it were possible to study ‘switchers’ between regions, that might allow an inquiry closer to a quasi-experimental test of the paper’s hypothesis. This would, nevertheless, require a large and empirically remarkable kind of data set.

One reason we believe that data on suicide are of special importance is because the act of suicide is surely—to use the language of Anne Case and Angus Deaton—the ultimate cry of human despair.

Funding

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Ethics Statement

This research relies on secondary data and was approved by the Wellbeing Research Centre at the University of Oxford.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from Office of National Statistics. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from <https://doi.org/10.57906/b8zx-6x19> with the permission of Office of National Statistics.

Endnotes

¹Our main analyses only use 2011–2012 data, but the results do hold for the full period, see page 9.

²Office for National Statistics and NHS Digital (2023). Public Health Research Database—England and Wales. ONS SRS Metadata Catalogue. <https://doi.org/10.57906/b8zx-6x19>.

³The English and Welsh indices differ in some minor respects. For example, while the Welsh index splits housing and access to services into separate domains, the English index combines these. There are also some small differences in the weights given to each domain (e.g., crime is weighted at 9% in England and at 5% in Wales). Because of these differences, we re-estimate our specifications of Table 1 after excluding data from Wales. See Table A3. Results are unchanged in that case.

⁴Our data cover England and Wales but not Scotland or Northern Ireland. This is because the census and death-registration systems of the United Kingdom are administered separately: Scotland’s records are held by National Records of Scotland and Northern Ireland’s by the Northern Ireland Statistics and Research Agency, and neither is included in our linked database. Each nation also constructs its own index of multiple deprivation, and those indices are not directly comparable across nations.

⁵One may wonder whether the *method* of suicide differs across deprivation quintiles. Given the sensitive nature of the data, we refrain from providing a more detailed breakdown by deprivation quintile. However,

Table A2 provides a coarser tabulation by deprivation quintile, showing whether the method of suicide was strangulation (the most common method) or some other method. We find no clear pattern across levels of area deprivation. When examining more detailed breakdowns (not published here), we also find no such patterns.

⁶A simple comparison of the raw differences (see Panel B of Table A1) and Column 1 of Table 1 (our specification with basic controls) shows that the basic controls *increase* the gap in suicide rates between the least and the most deprived areas. Table A4 provides results from a similar Gelbach decomposition, showing the change in coefficients between these two specifications. We observe that age and ethnicity are most responsible for the increase in the gap (e.g., individuals in age groups with higher baseline suicide risk are themselves more likely to live in less-deprived areas). Controlling for individuals' religion also increases the gaps, though to a smaller extent. Among the basic controls, only government region (i.e., dummies for e.g., the 'West Midlands') tends to act in the opposite direction, mostly compressing the gap.

⁷We here thank David Gunnell for his deep knowledge of the history of suicide research in the United Kingdom and for alerting us to this point.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table M1** Suicide numbers and rates by individual characteristics. **Table M2** Full results of Table 1: individual-level regression of suicide outcome $\times 100,000$ on LSOA deprivation quintile, 2011–2012. **Table M3** Probit models checking results of Table 1. **Table M4** Individual-level regression of suicide outcome on LSOA deprivation quintiles. Suicides per 100,000. By education level. Full controls included. **Table M5** Individual-level regression of suicide outcome on LSOA deprivation quintiles. Suicides per 100,000. By tenure type. Full controls included. **Table M6** Individual-level regression of suicide outcome on LSOA deprivation quintiles. Suicides per 100,000. By employment type. Full controls included. **Table M7** Individual-level regression of suicide outcome on LSOA deprivation quintiles. Suicides per 100,000. By marital status. Full controls included. **Table M8** Individual-level regression of suicide outcome on LSOA deprivation quintiles. Suicides per 100,000. By health status. Full controls included. **Table M9** Individual-level regression of suicide outcome on LSOA deprivation quintiles. Suicides per 100,000. By age group. Full controls included. **Table M10** Individual-level regression of suicide outcome on LSOA deprivation quintiles. Suicides per 100,000. By religion. Full controls included.

Appendix A

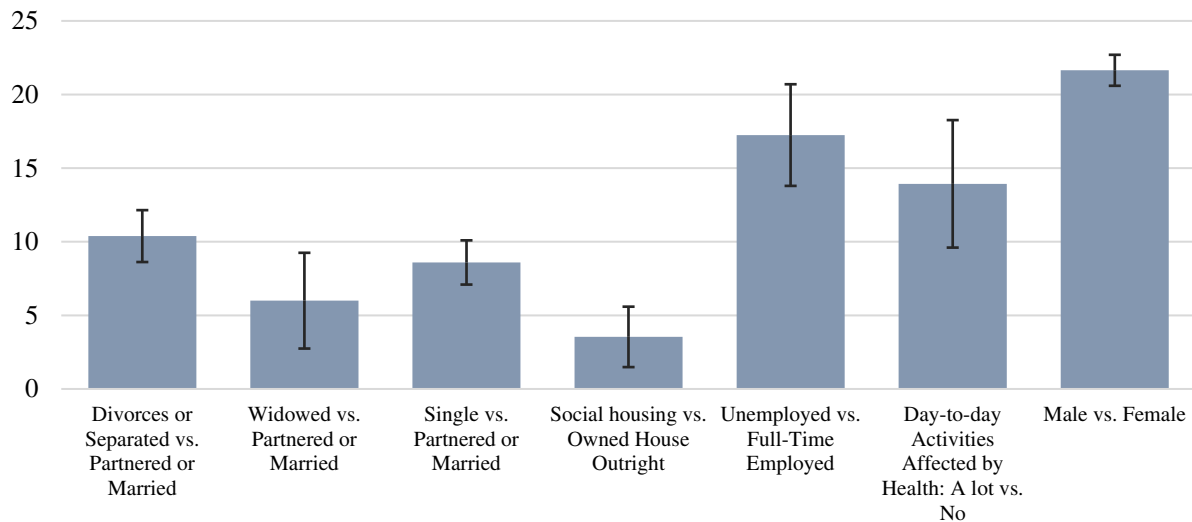


FIGURE A1 | Differences in adjusted marginal suicide rates per 100,000 people. Model with *all controls*, 2011–2012. Bars represent 95% confidence intervals. Data: suicides between 27 March 2011 (UK Census 2011) and 31 Dec 2012 and 5% of those alive at the end of the study period in December 2019; characteristics are measured on Census (March 27, 2011).

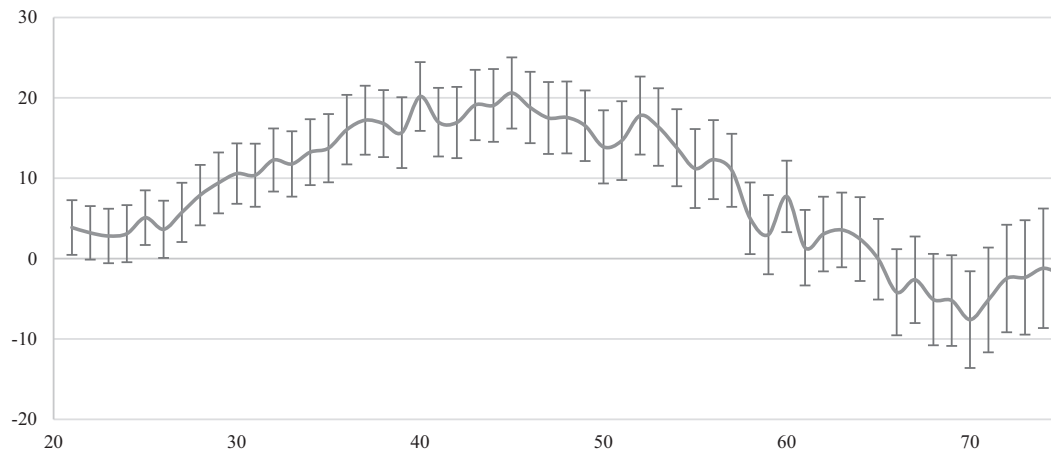


FIGURE A2 | Adjusted marginal suicide rates per 100,000 people by age, compared to the rate at 20 years old. Full set of age-year dummy variables. Model with *all controls*, 2011–2012. Bars represent 95% confidence intervals. *Source:* Authors' computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

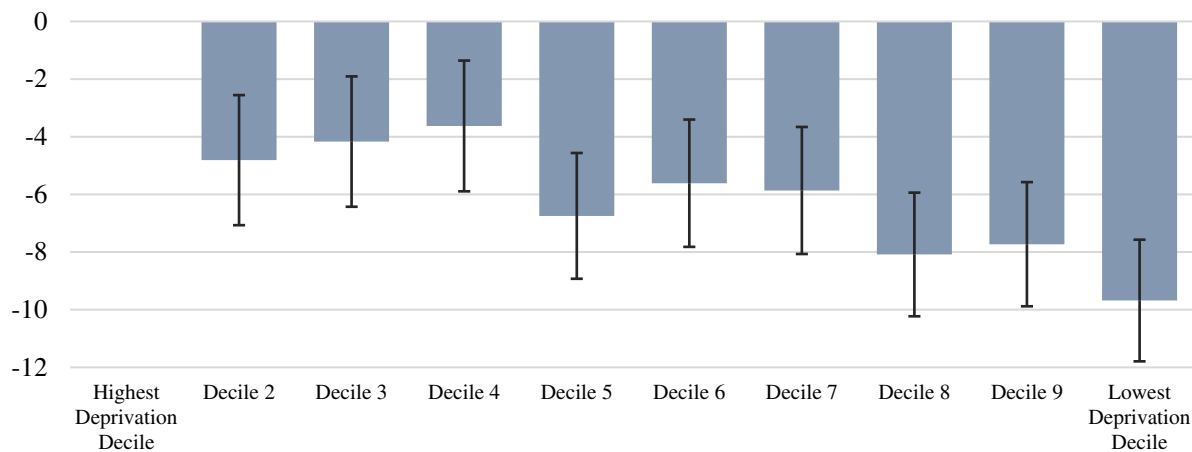


FIGURE A3 | Adjusted marginal suicide rates per 100,000 people per LSOA deprivation decile. Model with *No Controls*, 2011–2012. All populations. By decile of deprivation. Bars represent 95% confidence intervals. *Source:* Authors' computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

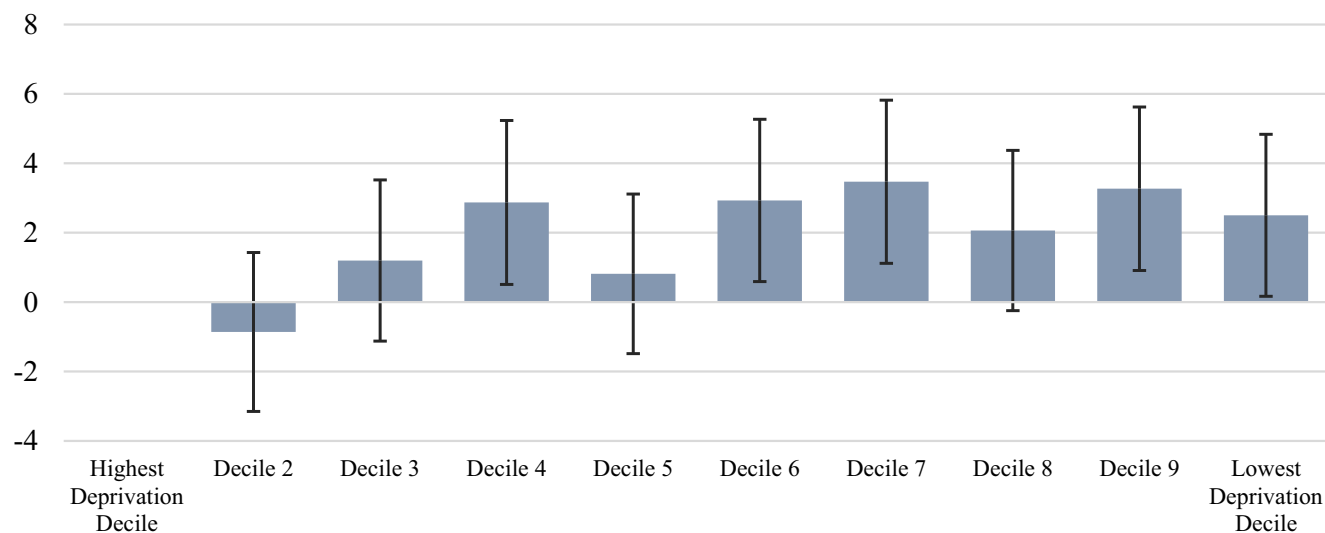


FIGURE A4 | Adjusted marginal suicide rates per 100,000 people per LSOA deprivation decile. Model with *All Controls*, 2011–2012. All populations. By decile of deprivation. Bars represent 95% confidence intervals. *Source:* Authors’ computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

TABLE A1 | Suicide numbers and rates by sex and deprivation quintile.

	Number	Rate per 100,000 over 21 months	SE
Panel A: Suicide numbers and rates by sex			
Male	4,515	27.784	(0.415)
Female	1,398	7.966	(0.213)
Total	5,913	—	—
Panel B: Suicide numbers and rates by LSOA area deprivation quintile			
1. Most deprived	1,312	20.717	(0.573)
2.	1,303	19.304	(0.536)
3.	1,178	17.023	(0.497)
4.	1,123	16.224	(0.485)
5. Least deprived	997	14.505	(0.460)

Note: The definition of suicide in the ONS data used throughout the paper: *ICD-10 ranges X60-X84 (intentional self-harm) and Y10-Y34 (injury or poisoning of undetermined intent)*.

Source: Authors’ computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

TABLE A2 | Share of strangulation as method of suicide across LSOA deprivation quintiles.

Deprivation quintile	Quintile 1 (most deprived)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (least deprived)
Percentage of strangulation as method of suicide	44.6%	44.1%	47.0%	48.7%	45.8%

Note: The table shows, among all population-weighted observations where an individual died of suicide the share for which strangulation was the method of suicide across each LSOA deprivation quintile.

Source: Authors’ computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

TABLE A3 | Individual-level regression of suicide outcome on geographical area (LSOA) deprivation quintiles (England Only. Suicides per 100,000).

	(1) Basic controls	(2) + Family	(3) + Health	(4) + Education	(5) + Economic controls	(6) – Health
Deprivation quintile						
Highest deprivation quintile	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)
Quintile 2	–2.804*** (0.816)	–1.853** (0.816)	0.664 (0.817)	0.946 (0.819)	2.140*** (0.829)	1.869** (0.829)
Quintile 3	–6.265*** (0.813)	–4.293*** (0.812)	–0.090 (0.814)	0.379 (0.818)	1.900** (0.838)	1.388* (0.837)
Quintile 4	–7.767*** (0.819)	–4.877*** (0.816)	0.496 (0.821)	1.110 (0.827)	2.759*** (0.852)	2.102** (0.850)
Lowest deprivation quintile	–9.585*** (0.830)	–5.732*** (0.824)	0.660 (0.832)	1.447* (0.844)	3.160*** (0.878)	2.385*** (0.876)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Family controls	No	Yes	Yes	Yes	Yes	Yes
Health controls	No	No	Yes	Yes	Yes	No
Education controls	No	No	No	Yes	Yes	Yes
Economic controls	No	No	No	No	Yes	Yes
Observations	1,604,129	1,604,129	1,604,129	1,604,129	1,604,129	1,604,129

Note: Same specification as Table 1 of the main text, but excluding Wales.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Source: Authors' computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

TABLE A4 | Gelbach decomposition comparing Panel B of Table A1 with Column 1 of Table 1.

Deprivation quintile	Covariate block				
	Sex	Age	Ethnicity	Government region	Religion
Quintile 2	0.132	0.262	0.494	–0.299	0.527
Quintile 3	0.176	0.730	0.894	–0.101	0.558
Quintile 4	0.143	1.125	1.152	–0.004	0.512
Quintile 5 (Least deprived)	0.171	1.427	1.209	0.048	0.486

Note: The table shows how the 'basic' covariates used in column 1 of Table 1 contribute to the change in coefficients between those shown in column 1 of Table 1, to those shown in Panel B of Table A1 (i.e., an analysis where no covariate adjustment is made). Calculations are based on the decomposition of Gelbach (2016). For each row, the columns sum to the difference in coefficients between specifications.

Source: Authors' computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

TABLE A5 | Individual-level regression of suicide outcome on LSOA deprivation quintiles.

	(1) North	(2) South	(3) Female	(4) Male
Highest Deprivation Quintile	(ref.)	(ref.)	(ref.)	(ref.)
Quintile 2	1.840 (1.127)	3.107*** (1.183)	1.629** (0.758)	3.568** (1.487)
Quintile 3	2.399** (1.129)	2.488** (1.193)	1.870* (0.768)	2.846** (1.492)
Quintile 4	3.343*** (1.143)	3.296*** (1.216)	1.594*** (0.766)	5.070** (1.529)
Lowest Deprivation Quintile	2.866** (1.168)	4.075*** (1.230)	3.053** (0.818)	3.874*** (1.549)
Observations	842670	852880	878756	816794

Note: Heteroskedasticity-robust standard errors in parentheses. Suicides per 100,000. North versus South. Full controls included.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Source: Authors' computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.

TABLE A6 | Individual-level multinomial logistic regression of (A) suicide outcome or (B) death from other causes on geographical area (LSOA) deprivation quintiles (Raw multinomial logit coefficients).

	(1) Basic controls	(2) + Family	(3) + Health	(4) + Education	(5) + Economic controls	(6) – Health
(A) Deaths due to suicide						
Deprivation quintile						
Highest deprivation quintile	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)
Quintile 2	–0.131*** (0.040)	–0.056 (0.040)	0.077* (0.040)	0.089** (0.040)	0.137*** (0.041)	0.126*** (0.041)
Quintile 3	–0.318*** (0.041)	–0.181*** (0.041)	0.038 (0.042)	0.058 (0.042)	0.126*** (0.043)	0.104** (0.043)
Quintile 4	–0.400*** (0.042)	–0.208*** (0.042)	0.077* (0.043)	0.104** (0.043)	0.187*** (0.045)	0.155*** (0.045)
Lowest deprivation quintile	–0.532*** (0.044)	–0.279*** (0.045)	0.063 (0.046)	0.099** (0.046)	0.193*** (0.048)	0.153*** (0.048)
(B) Deaths due to other causes						
Deprivation quintile						
Highest deprivation quintile	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)
Quintile 2	–0.310*** (0.008)	–0.259*** (0.008)	–0.008 (0.011)	0.001 (0.011)	0.011 (0.011)	–0.023** (0.010)
Quintile 3	–0.567*** (0.008)	–0.483*** (0.008)	–0.040*** (0.011)	–0.025** (0.011)	–0.008 (0.011)	–0.052*** (0.010)
Quintile 4	–0.762*** (0.008)	–0.652*** (0.008)	–0.073*** (0.011)	–0.052*** (0.011)	–0.026** (0.012)	–0.087*** (0.011)
Lowest deprivation quintile	–0.927*** (0.009)	–0.793*** (0.009)	–0.077*** (0.011)	–0.048*** (0.012)	–0.018 (0.012)	–0.093*** (0.011)
Family controls	No	Yes	Yes	Yes	Yes	Yes
Health controls	No	No	Yes	Yes	Yes	No
Education controls	No	No	No	Yes	Yes	Yes
Economic controls	No	No	No	No	Yes	Yes
Observations	1,963,522	1,963,522	1,963,522	1,963,522	1,963,522	1,963,522

Note: Table replicates Table 1 of the main text, but uses a multinomial logistic regression, where individuals who died from any other (non-suicide) causes are now included, too. Results on suicide mirror those shown in Table 1.

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Source: Authors' computations based on the ONS Public Health Research Database for England and Wales, and on the English and Welsh Indices of Multiple Deprivation 2019.