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**SOCIO-ECONOMIC DETERMINANTS
OF MENTAL HEALTH OVER TIME:
EVIDENCE FROM THE UK
HOUSEHOLD LONGITUDINAL STUDY**

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1 Introduction

Mental health is defined by the World Health Organization (WHO) as “a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community” (World Health Organization 2004)¹. Nonetheless, for approximately one in three individuals, this state of well-being is prone to disruption during lifetime: according to a meta-analysis by Steel et al. 2014, collecting data from 85 studies and 39 different countries, the estimated lifetime prevalence for common mental disorders² is indeed 29.2% (95% CI 25.9%–32.6%).

Common mental disorders, and in particular depression and anxiety disorders, are today among the most prevalent and disabling illnesses worldwide, contributing to a substantial share of the Global Burden of Disease. Estimates for the prevalence from WHO for 2015 show that approximately 4.4% and 3.6% of the world population suffers respectively from depression and anxiety disorders (World Health Organization 2017). Apart from being highly prevalent, mental disorders are also disabling, representing 7.5% (depression) and 3.4% (anxiety disorders) of all years lived in disability³(World Health Organization 2017).

Given the importance of the phenomenon of mental health and its interconnection with socio-economic conditions (World Health Organization 2004, see also Section 2), the scope of the following project is to provide an econometric analysis of the socio-economic determinants of mental health and their relevance in explaining mental health outcomes. Using data for the years 1991-2021 from the UK Household Longitudinal Study-Understanding Society and its predecessor, the British Household Panel Survey, we estimate fixed-effects regression models with a two-fold aim: on the one hand, to study cross-sectional associations between mental health outcomes and socio-economic indicators and, on the other hand, to analyze how these associations have varied over recent years.

The present work contributes to the existing literature in at least two ways (see Section 2 for a more comprehensive overview of present literature). First, we analyze variations in mental health outcomes with respect to a variety of socio-economic factors, without limiting the analysis to a reduced-form estimate of the influence of one single variable on mental health. In doing this, we aim at gaining some insights on the simultaneous influence of multiple factors on mental health and at proposing a methodology to analyze the concurrent channels by which socio-economic indicators influence mental health. Second, with respect to previous analyses on trends in mental health in UK, we estimate a more complete model that allows the study of more complicated associations between each determinant and mental health outcomes, while controlling for other individual observable characteristics.

Our results suggest that gender, age, income, employment status and belonging to ethnic minority groups are the most relevant variables in explaining mental health outcomes (see Section 4). Some of our results are consistent with previous literature: for example, evidences from our estimates suggest that females report higher

¹A more precise characterization of Mental Health is given in Galderisi et al. 2015, which proposes a new definition: “Mental health is a dynamic state of internal equilibrium which enables individuals to use their abilities in harmony with universal values of society. Basic cognitive and social skills; ability to recognize, express and modulate one’s own emotions, as well as empathize with others; flexibility and ability to cope with adverse life events and function in social roles; and harmonious relationship between body and mind represent important components of mental health which contribute, to varying degrees, to the state of internal equilibrium.”

²According to WHO (World Health Organization 2017) common mental disorders correspond to two main and prevalent diagnostic categories: depressive disorders, on the one hand, and anxiety disorders, on the other.

³Years lived with disability (YLDs) is a measure that reflects how much an illness impact on the quality of life before it resolves or leads to death. Usually, Disability Adjusted Life Years (DALYs) is a preferred and more comprehensive measure of the burden of a disease. DALYs sums to years lived with disability the years of life lost (YLLs) due to premature mortality. However, in the computation of the Global Burden of Disease for mental illness, YLLs are assumed to be null: no years of life lost are attributed to mental disorders. Vigo, Thornicroft, and Atun 2016 argues against this assumption and estimates a more reliable measure of DALYs for mental illnesses.

level of distress, while richer people have better mental health outcomes. Other results partially contradict previous evidence and therefore require further clarifications (see Section 4): for example, better educated people result to be more distressed, while belonging to an ethnic minority is associated with lower levels of distress. Results of the analysis over time suggest that, in the period 2009-2021, the association between the minority variable and psychological distress diminished over time, while the association with the income variable strengthened over the same period. This result suggests that -over time- minority is becoming a less important variable to explain mental health outcomes, while the opposite holds with respect to the income variable. The relevance for the gender variable remained stable over the period considered, but a sharp jump during the COVID-19 period was observed, with females reporting higher increases in the level of distress with respect to males.

The following thesis is organized as follows. Section 2 motivates the interest in mental health issues for Economics, reviews the main findings on socio-economic determinants of mental health and summarizes the evidence on the trends in mental health outcomes in UK over recent years. Section 3.1 describes the data and the main variables of interest used in the present analysis, while Section 3.2 discusses the methodology and empirical strategy adopted in the project. Finally, Section 4 presents the main results, while Section 5 draws the final conclusions.

2 Selected Literature

Why should economists care about mental health? Which evidence do we have about the socio-economic determinants of mental health and their trends over time? This section tries to answer these preliminary questions looking at existing literature from Economics and Psychology.

There are many reasons why economists should be interested in mental health and why Economics as a discipline could contribute to our understanding of this phenomenon. These reasons go well beyond what is today recognized as “economics imperialism”, or the tendency of economists of invading other realms of science and human life, and can be clustered in at least four categories.

First, we know today that mental illness is a global burden and a condition which is both common and disabling. Layard 2017 reports that, in rich countries, mental illness accounts for 38% of the total amount of illness, with a rate of one in five adults worldwide suffering from a diagnosable mental illness. Apart from the high prevalence of mental disorders, mental health has a huge economic cost, with a significant impact both on a person’s life and on the economy in general. Bubonya, Cobb-Clark, and Wooden 2017 analyze the impact of poor mental health on productivity, finding increased rates in absenteeism and presenteeism (i.e., lower productivity while attending work). According to these results, absence rates are approximately five percent higher among workers who report being in poor mental health. Other types of costs are, quite evidently, costs of health care -which is higher than costs for physical health care- and costs of crime: analyses for the UK, for example, report a reduction in gross national product of 7% due to mental health problems (Layard 2017).

Second, evidence from the literature tells us that socio-economics factors have a pivotal role in determining mental health outcomes: social and economic disadvantage is associated with higher likelihood of developing mental disorders, either because of higher exposure to risk factors -e.g. social exclusion- or because of restricted access to protective factors such as education (Knapp and Wong 2020, see also Section 2). Socio-economic conditions and mental health seems therefore to be involved in a two-way causal relationship, which however still needs to be fully assessed and understood.

Third, economists’ toolbox could be used effectively in studying phenomena such as mental health and its determinants: given the difficulties of performing controlled experiments and laboratory observations, we need to rely -at least if we want to measure mental distress for a significant amount of people and years- on tools and models from Statistics and Econometrics. Models and methods to assess causality, for example, could help understanding the impact of exogenous shocks on mental well-being.

Finally, the topic of mental health has a clear policy and societal relevance, with room for efficiency improvements and reductions in costs: intelligent policies could significantly improve -among the other - people’s productivity at work, their health conditions and their life satisfaction by investing on psychological treatments which are cost-effective (Layard 2017). Economists can therefore help evaluating costs associated with mental illness and help assessing costs and benefits of the treatments (Knapp and Wong 2020).

The literature on social and economic determinants of health focuses -broadly speaking- on analyzing how the circumstances in which people live shape their physical and mental health (Alegría et al. 2018): a social determinant of health is therefore defined as any non-medical factor influencing health, from education and income to attitudes and behavior. Within this framework, Braveman, Egerter, and Williams 2011 distinguishes between “upstream” and “downstream” social determinants, or -respectively- the less and most proximate causes of health. The two types of determinants are linked by causal pathways, that are however complex and often difficult to assess. Summarizing the existing body of evidence regarding upstream social determinants

of health, Braveman, Egerter, and Williams 2011 identifies neighborhood conditions and social relationships, working conditions, education, income and wealth, ethnicity and racism. A summary of the evidence regarding disparities in physical health is also provided by Bhattacharya, Hyde, and Tu 2018 (pag. 57): data from human and non-human populations tell us education, wealth, race and social standings are the most relevant factors when observing health inequalities. Among the most interesting results, we notice that better educated people live longer, wealthier people are less likely to have diseases and -finally- minorities report worse health conditions.

Recently, a specific literature on social determinants of mental health has developed: the aim of these studies is to understand how gradients in social and economic conditions impact on mental health, either through increased risks of disorders or reduced access to services. The literature review by Alegría et al. 2018 summarizes the most recent empirical findings on social determinants of mental health. Among labour factors, the review reports that unemployment and precarious employment is associated with higher psychological distress, while lower income has negative effects on mental health. Familiar relationships and community characteristics also play a role in determining mental health outcomes, with strong familiar or friendship ties and neighborhood safety being associated with lower disorder prevalence. Finally, discrimination, either related toward ethnicity, sexual orientation, immigrant status has been associated with negative mental health.

Among these factors, the one of probably highest interest for economists is income, also because it can easily be targeted by policy interventions. Multiple studies report associations between low income and poor mental health conditions, however the causal role of income on mental well being is not clearly established. A systematic review and meta analysis by Rachel M Thomson et al. 2022 synthesizes the empirical findings on the impact of income changes on mental health and well-being. A meta-regression suggests -although with low certainty of evidence- a standardized coefficient of 0.027 (95% CI 0.003 to 0.052) of a log income change on a continuous mental health outcome. The corresponding standardized coefficient for well-being outcomes is 0.033 (95% CI 0.017 to 0.049).

Apart from dynamically changing socio-economic conditions, the literature has also explored the influence on mental well-being of fixed individual characteristics such as gender, ethnicity, nationality and sexual orientation. This studies are mostly correlational, since it is difficult to establish the counterfactual of a person's invariable characteristic. Among the most significant associations, for example, literature in Psychology and Psychiatry has discovered significant gender differences in mental health outcomes, with women reporting higher prevalence of mental illnesses (Steel et al. 2014) such as depression (Piccinelli and Wilkinson 2000) and anxiety disorders (McLean and Anderson 2009).

The final part of this section provides a review of the main findings on the trends in mental health and psychological distress over recent years. For comparison with our analyses, we limit the scope of this review to researches using UK data (for an overview on global trends see Daly and Macchia 2023). Special attention is paid to COVID-19 which is, for obvious reasons, the event that most significantly impacted on mental health over the past years and which is today most frequently debated.

Previous research examining mental health trends in Great Britain indicated slight improvements in psychological distress from the 1990s until the onset of the Great Recession in 2008 (Zhang et al. 2023). However, studies investigating the prevalence of psychological distress revealed a significant deterioration in mental health conditions among the UK population in the period following the Great Recession, accompanied by a widening of existing gaps. Rachel M. Thomson, Niedzwiedz, and Katikireddi 2018 identified a widening of gender and socioeconomic gaps in mental health from 2012 onwards, attributing this to the austerity policies implemented in the UK starting from 2011. Zhang et al. 2023 also observed a similar pattern by comparing three different

surveys representative of the UK population, with 2015 identified as the year when psychological distress started to worsen.

A continuously growing corpus of studies has focused on COVID-19 and the evolution of mental conditions of the population following the spread of the pandemics, the following economic crisis and the consequent adoption of lockdown policies, with various grades of severity, in many of the world countries. Studies examining UK data have consistently reported a general deterioration in mental health among the population following the spread of the pandemic (Proto and Quintana-Domeque 2021). However, this decline in mental well-being has not been evenly distributed across social groups. According to the data, the impact of COVID-19 on psychological distress has been greater for women (Proto and Quintana-Domeque 2021, Banks and Xu 2020), men belonging to ethnic minorities (Proto and Quintana-Domeque 2021), young adults (Banks and Xu 2020) and individuals with more extroverted personality traits (Proto and Zhang 2021). Therefore, evidence suggests that the combined effect of lockdown policies, health emergency and economic recession during the spread of COVID-19 has again increased inequalities in mental health.

3 Data and Methodology

3.1 Dataset description and descriptive statistics

We use data from the UK Household Longitudinal Study (UKHLS), also known as Understanding Society, and its predecessor, the British Household Panel Survey (BHPS)⁴. The BHPS conducted 18 waves of interviews from 1991 to 2009, interviewing approximately 10,000 households each year. Starting in 2009, the UKHLS, or Understanding Society, expanded upon the BHPS by broadening its scope and sample size. It addressed an extended range of topics and followed the conditions of around 40,000 households (including approximately 8,000 households from the original BHPS sample) up to the present day, spanning a total of 12 waves.

This extensive panel dataset possesses several key features that make it well-suited for our analysis. Firstly, the survey encompasses multi-topic data concerning the socio-economic conditions of households and individual respondents. The inclusion of weights ensures that the sample accurately represents the UK population. Additionally, the survey includes a measure of mental health through the General Health Questionnaire, GHQ-12 (specific details about the questionnaire are provided in Section 3.1). Secondly, the interviews are conducted annually, with a fieldwork period of 24 months: therefore, this design enables us to examine yearly changes in individuals' circumstances. Finally, the sample design facilitates the study of ethnic minorities: alongside a General Population Sample (GPS) and the original British Household Panel Survey sample, the Understanding Society survey incorporates an Ethnic Minority Boost Sample. Furthermore, since 2014, an Immigrant and Ethnic Minority Boost Sample has been included.

The dataset presents also some limitations that restricts our analysis. In the initial year of Understanding Society, 2009, households belonging to the BHPS were not interviewed. Instead, their inclusion only began from wave 2 of Understanding Society. Consequently, the sample from 2009 is entirely different from that of the preceding year. Moreover, questions in the two surveys are sometimes slightly different, requiring a work of harmonization when not already provided by Understanding Society (see Section 6.1 for a complete overview).

To create a comprehensive panel, data from the 18 waves of BHPS and the 12 waves of UKHLS have been combined and harmonized. The dataset has been treated as a repeated cross-sectional panel, utilizing cross-sectional weights for each wave to ensure the sample's representativeness of the UK population. To take care of the fact that individuals are observed multiple times, standard errors have been clustered at the individual levels. Descriptive statistics for the main variables used in the analysis are displayed in Table 1.

The main outcome of interest for our analysis is the result of the 12-item General Health Questionnaire (GHQ), included in both BHPS and UKHLS. The GHQ-12 is a well-known self-report instrument for the evaluation of mental health conditions: the respondent must report on a four point Likert scale (1-4) to which extent she experienced 12 symptoms of psychological distress over the past weeks. The complete questionnaire has been reported in Section 6.2. From the results of this questionnaire, two possible scores can be derived: by re-coding the scale from 1-4 to 0-3 and then summing, we obtain a variable, "GHQ-12 Likert Scale" (see `scgh1.dv` in Section 6.1), running from 0 (the least distressed) to 36 (the most distressed); instead, by re-coding 1 and 2 values to 0, and 3 and 4 values to 1, and then summing, we obtain a second variable, "GHQ-12 Caseness Scale" (see `scgh2.dv` in Section 6.1), running from 0 (the least distressed) to 12 (the most distressed). Both variables have therefore higher scores for higher level of psychological distress. The GHQ-12 is a validated measure of mental health (Goldberg et al. 1997) and can be used to measure and monitor the mental health

⁴University of Essex, Institute for Social and Economic Research. (2022). Understanding Society: Waves 1-12, 2009-2021 and Harmonised BHPS: Waves 1-18, 1991-2009. [data collection]. 17th Edition. UK Data Service. SN: 6614, <http://doi.org/10.5255/UKDA-SN-6614-18>.

conditions of a population.

Table 1: Descriptive Statistics

	Mean	SD	Min	Max	N
Mon. grs. income (thous. of pounds)	1.55	1.51	-8.04	28.09	683294
Age at Date of Interview	47.76	19.20	15.00	104.00	683254
<i>Gender</i>					
Male	0.48	0.50	0.00	1.00	683291
<i>Ethnicity</i>					
White	0.92	0.27	0.00	1.00	464851
Indian	0.02	0.14	0.00	1.00	464851
Pakistani	0.01	0.11	0.00	1.00	464851
Bangladeshi	0.01	0.08	0.00	1.00	464851
Caribbean	0.01	0.09	0.00	1.00	464851
African	0.01	0.11	0.00	1.00	464851
Other minorities	0.02	0.15	0.00	1.00	464851
<i>Highest qualification</i>					
No qualification	0.16	0.37	0.00	1.00	675004
Other qualification	0.10	0.30	0.00	1.00	675004
GCSE	0.22	0.41	0.00	1.00	675004
A level	0.21	0.41	0.00	1.00	675004
Degree/Other High. Degree	0.31	0.46	0.00	1.00	675004
<i>Marital status</i>					
In a relationship	0.61	0.49	0.00	1.00	682307
Not in a rel. anymore	0.14	0.35	0.00	1.00	682307

Never married	0.24	0.43	0.00	1.00	682307
<i>Presence of own child in the household</i>					
Own child in household	0.16	0.37	0.00	1.00	604817
<i>Labour force status</i>					
Employed/Retired	0.81	0.39	0.00	1.00	521493
Student/Training	0.08	0.28	0.00	1.00	521493
Not employed	0.06	0.23	0.00	1.00	521493
L.T. Sick/Disabled	0.05	0.21	0.00	1.00	521493
<i>Outcomes</i>					
GHQ-12 Likert	11.16	5.48	0.00	36.00	636769
GHQ-12 Caseness	1.83	2.99	0.00	12.00	636769
Satisfaction with life overall	5.18	1.42	1.00	7.00	574501
SF-12 Mental CS	49.05	10.28	0.00	78.08	431488
SF-12 Physical CS	49.56	11.23	4.33	76.29	431488

Note: Results are weighted to represent UK population. Income is measured in thousands of pounds.

To enrich the analysis, we include among the outcomes an alternative measure of mental health, the SF-12 Mental Component Summary measured on a continuous scale with a range from 0 (low functioning) to 100 (high functioning). Moreover, we include a measure of self-reported life satisfaction on a scale from 1 - “Not satisfied at all”- to 7 - “Completely satisfied”. Finally, we add to the set of outcomes a measure of self-reported physical health as measured by the SF-12 Physical Component Summary, as well on a scale from 0 (low functioning) to 100 (high functioning). The SF-12 questionnaire have been administered only in the Understanding Society survey: data for these outcomes will therefore be limited to the period after 2009.

All the outcome variables have been standardized in order to have mean 0 and standard deviation 1 to allow comparisons within the analysis and across similar studies. Moreover, for some individuals, and for the waves comprising BHPS (1991-2008), values are sometimes missing because the GHQ is not included in the “proxy interviews”. These interviews are shorter questionnaires about factual information administered to people in the household other than the direct respondent, usually because of the unavailability of the direct respondent herself. Those observations have therefore been discarded.

Data on self-reported mental health must be carefully interpreted, since there are at least two caveats which concern the validity of these measurements: (i) the respondent may be subject to stigma and cultural influence when reporting her level of mental health and (ii) the respondent could possibly not know her level of mental health. Limitation (i) must be taken into special consideration when we compare mental health between different ethnic minority groups (see Section 4): responses to the GHQ may be influenced by culture or habits. However, given these issues, we argue that the data used to perform the current analysis are among the best to analyze levels of mental health in the population, since they are drawn from surveys funded by the government and use validated and comparable measures of psychological distress.

With respect to the socio-economic indicators to include in the regression among the explanatory variables, the choice has been determined mainly from the findings in the literature on socio-economic determinants of mental and physical health and on the availability of those indicators in the UKHLS. Therefore, among the covariates, we include demographic measures such as the respondent’s age (grouped into 5-years bins), her gender and which of the twelve major regions (corresponding to the NUTS 1 level of classification) she lives in.

Moreover, an income variable is included, measuring the individual’s total gross income in thousands of pounds over the month preceding the interview. Values for this variable are negative in case of self-employed individuals who reported losses over the month preceding the measurement. Due to the presence of outliers in the left tail of the distribution (corresponding to extremely large losses), observations whose value was lower than the 0.001-th percentile of the distribution have been bottom-coded with the value corresponding to the 0.001-th percentile. Missing observations due to proxy respondents have been discarded from the analysis.

Variables indicating the labour and educational status of the individual have also been included. In particular, the categorical variable indicating labour force status has been re-factored by clustering values in four main groups: Employed, Self-Employed, Retired or Maternity Leave; Student, In a government training program or Apprenticeship; Not in employment; Long Term Sick or Disabled. Similarly, the education variable reporting the highest qualification obtained has been clustered in five categories: No qualification; GCSE or equivalent; A level or equivalent; Degree or Other Higher Degree; Other qualification.

The ethnicity of the respondent is included in the analysis by means of an indicator about whether the respondent belongs to an ethnic minority group, i.e. all the ethnic groups that are not White. A categorical variable indicating belonging to one of the most represented ethnic minorities (Indian, Pakistani, Bangladeshi, Caribbean and African) is also created and used in the analysis discussed in Section 4.5.

Finally, we included in the panel two binary indicators about relationships and familiar ties. In particular, a marital status variable reports whether the respondent is in a relationship (Married; Civil Partnership; Living as a Couple), not anymore in a relationship (Divorced; Separated; Widowed) or never married. The last indicator included among the explanatory variables reported the presence of own children in the household. See section 6.1 for further details about each variable.

In order to reduce the dimensionality of the dataset and perform the analysis over time whose results are displayed in Section 4.4, we transform some of our categorical variables into continuous variables or binary indicators. In particular, the highest qualification variable was transformed into a continuous variable representing years of education. Additionally, a variable was created to indicate individuals over the age of 65 and an indicator variable was generated to represent whether a person is in a relationship. Finally, the employment status variable was recoded into a binary variable to indicate whether a person was not in employment, nor in education or retirement.

3.2 Methods

We rely on a Fixed Effects Model with geographical unit (major socio-economic regions corresponding to NUTS 1 level) and time fixed effects, regressing the mental health outcome on individual socio-economic characteristics. The first estimated equation is specified in Eq.1:

$$GHQ_{ist} = \alpha + \beta X_{it} + \lambda_s + \mu_t + \epsilon_{ist} \quad (1)$$

where GHQ_{ist} is the result of the GHQ-12 for individual i , X_{it} is a vector of socio-economic regressors, while λ_s and μ_t are respectively unit and time fixed effects. Standard errors are clustered at the individual level to account for the fact that individuals are observed multiple times.

The same model is then estimated in each year and specified in Eq.2:

$$GHQ_{ist} = \alpha_t + \beta_t X_{it} + \lambda_s + \mu_t + \epsilon_{ist} \quad (2)$$

where we allow the coefficients to vary from year to year.

This identification strategy has some advantages and some potential pitfalls, which we outline in what follows. On the one hand, our strategy allows to include in the regression all the determinants that we consider relevant and to produce reduced-form estimates for each of them. Therefore, we do not limit the analysis -for example- to the association between income and mental health, but we explore more complicated associations that take into account other factors considered relevant in explaining mental health outcomes. We argue that this methodology can help gaining interesting insights into mental health determinants by clearing spurious associations, which would be present in simpler regressions.

Moreover, regression models allows for “ceteris paribus” comparisons, i.e. we can study the association between each of the determinants and the outcome of interest *keeping the other factors fixed*. Thus, this strategy allows us to estimate the impact on mental health of -for instance- belonging to a minority *on top of*, being a woman, and earning a low income. Therefore, using this strategy, we will be able to make “conditional estimates”, studying the marginal association between a variable of interest and mental health. Conditional estimates will often be compared to “unconditional estimates”, i.e. estimates resulting from a regression of mental health on a single variable of interest, without controlling for other observable individual characteristics. A comparison between conditional and unconditional estimates will allow us to clear away from the association between a single determinant and mental health the effect deriving from other controlled variables.

On the other hand, the identification strategy adopted has some clear limitations and potential pitfalls that call for a cautious interpretation of the results. First, the strategy adopted aims at assessing correlations, not causal relationships: we analyze variations in mental health associated with variations in socio-economic conditions, but we cannot assess causal relationships between determinants of mental health and mental health outcomes. Given this limitation, we interpret our results as merely correlational, without making causal inferences from the evidence we obtain.

Second, the results are still subject to potential spurious correlations and errors deriving from the omission of a relevant variable in the model specification. This would be the case, for example, if there was an unobservable variable that both influences mental health outcomes and one of the determinants included among the regressors in Eq.1. We address this issue by including in the estimated regressions all the factors that have been studied in the literature on socio-economic determinants of mental health and for which we have available and reliable

data.

Third, results are subject to external validity issue: the data at disposal have clear limitations in space and time. Therefore, we cannot confidently extend the results to other populations or periods. We claim, however, that the results remain an interesting starting point that could be used as comparison for similar analysis made on longitudinal studies from other countries.

4 Results

4.1 Trends in mental health in UK, 1991-2021

This subsection presents preliminary results drawn from our data on the trends in psychological distress in UK over the period 1991-2021. In particular, we plot the average level of mental health in the overall population, by gender, and by ethnicity. Mental health is measured using the score of the General Health Questionnaire (GHQ) on a Likert Scale, ranging from 0 (low level of psychological distress) to 36 (high levels of psychological distress). The results are displayed in Figure 1, 2, and 3. It is important to note that these results do not control for other observable characteristics of the individual and therefore describe general trends in the overall population or groups of individuals.

From Figure 1, valuable insights can be gained regarding the evolution of mental health over time in the entire UK population. Periods of increased mental distress were observed in 2008 and 2020, corresponding respectively to the period of the Great Recession and COVID Recession. Notably, from 2015, we can observe a significant and constant surge in the level of distress up until the COVID period, with the mean GHQ score rising by approximately 1.2 point (corresponding to more than 20% of a standard deviation) in the period 2015-2020. This result is quite alarming and is in line with similar studies analyzing trends in psychological distress in the UK. Zhang et al. 2023, for example, talks about a “mental health crisis” predating COVID-19.



Figure 1

Figure 2 plots the average GHQ score differentiated by gender. We observe higher reported levels of psychological distress in females throughout the entire period. Trends for males and females are approximately parallel, with a difference of 1.3 points (corresponding to approximately 23.7% of a standard deviation) on average between the two lines, suggesting that, overall, the gender gap remained stable throughout the years under observation. However, the line for males is smoother with respect to females, with less pronounced peaks in mental distress - with respect to the overall trend - for males in the years of recession. This may suggest differential responses to recession and economic crises among people of different genders, with females suffering from a more pronounced deterioration of their mental health in periods of economic or health crisis.

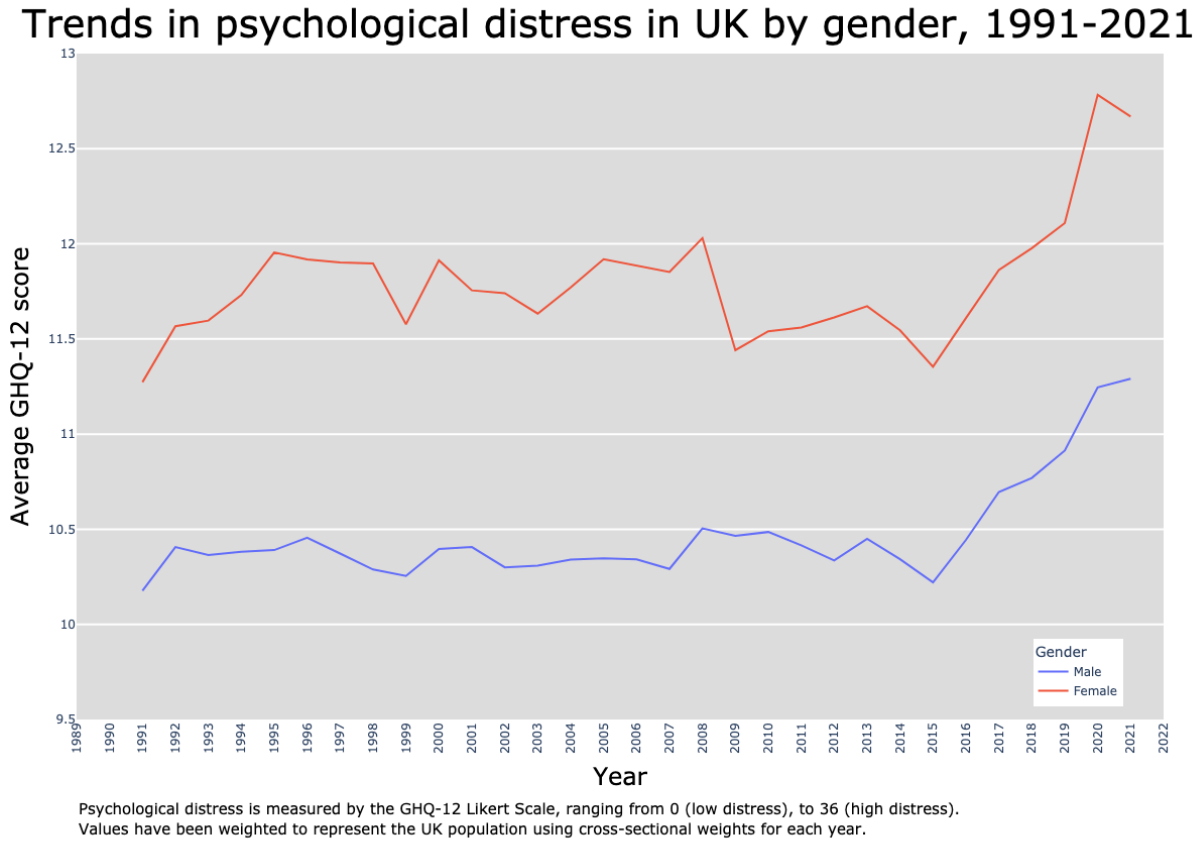


Figure 2

Finally, Figure 3 plots average scores by ethnic group, starting from 2009. The plot suggests that, over the years, people belonging to the Pakistani, Bangladeshi, and Caribbean groups have reported higher levels of mental distress compared to people belonging to the White group. However, Indian and African groups report lower levels of mental distress throughout the period. Although with slightly different trends, a general deterioration in mental health from 2015 conditions is reported for all the ethnic groups; however, the surge starts from 2016 for African and Indian minorities and from 2017 for the Caribbean group. Every minority group reported a deterioration in mental health in the starting year of COVID-19, with the exception of the Caribbean minority, whose level of mental distress decreased in 2020 compared to the previous year.

Trends in psychological distress in UK by ethnicity, 2009-2021

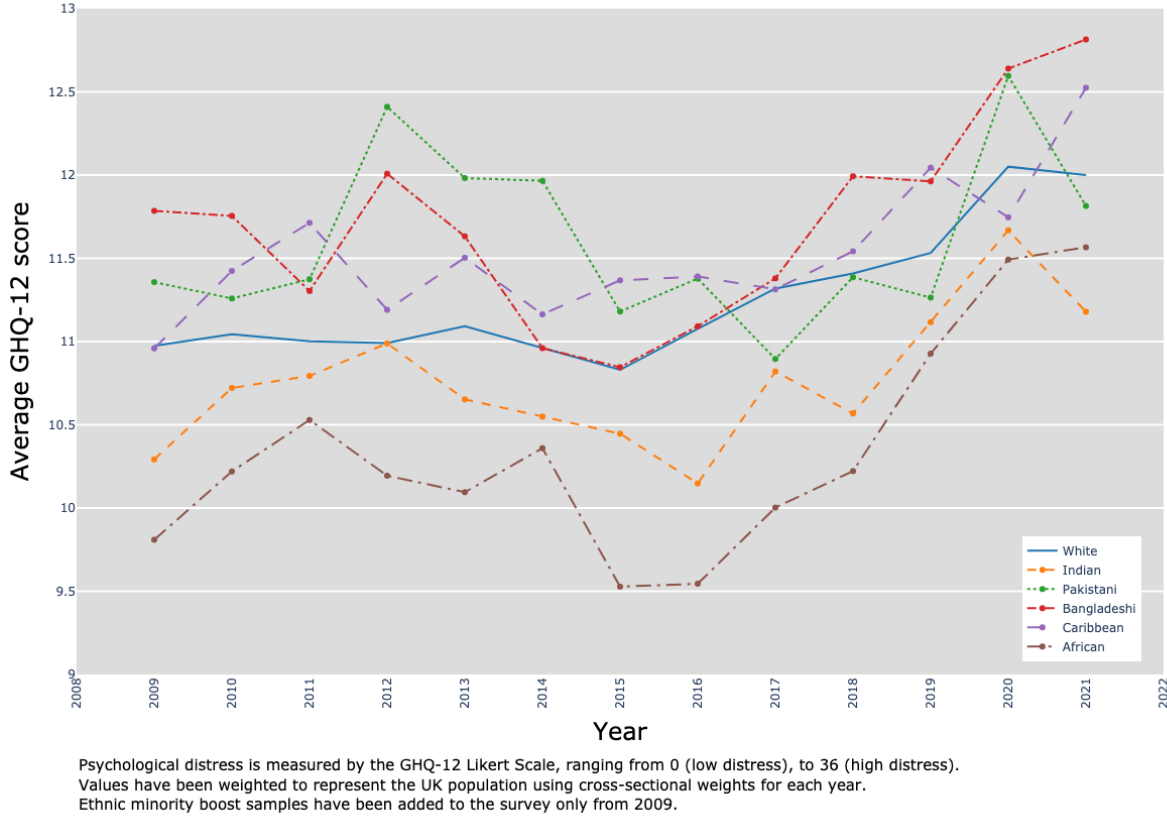


Figure 3

4.2 Socio-economic determinants of mental health

The first result of the present analysis concerns a cross-sectional estimation of socio-economic determinants of mental health. In particular, estimated coefficients for the fixed-effects regression of mental health on socio-economic variables (Eq.1) are presented in Table 2 in the unconditional case (Columns 1-6) and in the conditional case (Column 7). To facilitate the reading of the results, we exclude in this Table coefficients associated with age categories, which are instead plotted visually in Figure 4 and reported in the Appendix (Section 6.3).

By looking at Table 2, we can gain insights into the association between mental health outcomes and each single determinant, not controlling for other characteristics in the unconditional case and controlling for them in the conditional one. Firstly, consistent with existing literature, it is observed that females tend to experience higher levels of distress with respect to males, with an estimated gap of 15.4% of a SD in the unconditional case and 16.2% of a SD in the conditional one. Since the coefficient associated with the gender variable remains stable in both specification, we can argue that females report higher levels of distress not just on average, but also when compared with males of similar observable characteristics such as education, income and marital status. This finding once again confirms the existence of a gender gap in mental health which does not disappear when we control for other socio-economic variables.

With respect to ethnicity, our analysis reveals -quite surprisingly- that minorities exhibit lower levels of distress with respect to White people, with a marginal decrease of approximately 21% of a SD in mental

distress. Once again, the coefficient associated with the minority variable is almost stable under the conditional model specification, suggesting that people in the minorities are less distressed even if we do not control for income, employment conditions, education and familiar status. This finding calls for further investigation to better understand the underlying reasons, since people belonging to ethnic minorities may be subject to racial discrimination, which we expect to have a negative impact on mental well-being.

Examining the association between income and mental health, it is found that monthly gross income is positively associated with better mental health outcomes, albeit with a very small effect size, which is decreasing in magnitude if we control for other observables like employment status, education level and familiar relationships. In particular, we can say that -approximately- an increase of one thousand pounds in income is associated with a decrease of 0.01 SD in mental distress, or equivalently of 1% of a SD.

Employment conditions as well seem to play a role in determining mental health outcomes. With respect to the reference category, comprising employed, self-employed, retired people and women in maternity leave, we observe -in the complete model specification- an increasing gradient in mental distress, with progressive worse mental conditions as we move to the “Student/Training”, “Not employed” and “Long-term sick or disabled” categories. For example, keeping all the other factors constant, the average difference between the reference category and the Long-term sick and disabled group is estimated to be 66% of a SD.

Education level also exhibits an interesting gradient in its relationship with mental health. It is found that individuals with higher levels of education experience marginally higher levels of distress: therefore, our evidence suggests an increasing trend in distress as the level of education rises. This result is quite surprising and is contrary to what is usually observed for physical health outcomes (Bhattacharya, Hyde, and Tu 2018). We can rationalize this result -however- by noting the fact that no measure of stress or anxiety associated with job responsibility or social status have been included in the regression. Therefore, it could be the case that better-educated people have -for example- jobs with higher responsibility, and this could be reflected in higher levels of mental distress.

Our analysis reveals that individuals who are not anymore in a relationship (whether because they are divorced, separated or widowed) and individuals who were never married tend to experience higher levels of distress compared to those who are in a relationship (married or living as a couple). This finding underscores the potential impact of marital status on mental well-being. Finally, the coefficient associated with presence of own children in the house is -at least in the conditional case- negative, although not significantly different from zero.

Table 2: Mental Health Determinants, Outcome: GHQ-12 Likert Scale - Psychological distress

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	0.149*** (0.005)						0.157*** (0.006)
Minority		-0.173*** (0.009)					-0.213*** (0.011)
Monthly gross income			-0.0156*** (0.001)				-0.0100*** (0.002)
Student/Training				-0.0157* (0.007)			0.102*** (0.010)
Not employed				0.239*** (0.010)			0.293*** (0.012)
L.T. Sick/Disabled				0.613*** (0.018)			0.656*** (0.021)
Other qualification					0.0529*** (0.011)		0.115*** (0.017)
GCSE etc.					0.0920*** (0.009)		0.149*** (0.014)
A level etc					0.0809*** (0.009)		0.168*** (0.014)
Degree/Other High. Degree					0.0824*** (0.008)		0.181*** (0.013)
Not in a rel. anymore						0.0571*** (0.007)	0.106*** (0.011)
Never married						0.0436*** (0.006)	0.0257** (0.010)
Own child in house						0.0753*** (0.006)	-0.0165* (0.008)
Observations	682184	510534	682187	520597	673906	602925	324794
Controls for age	No	No	No	No	No	No	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unit fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard Errors in parenthesis.

Years: 1991-2022

The table reports estimated coefficients for unconditional and conditional regressions of mental health on socio-economic determinants. Mental Health is measured by the GHQ-12. The variable has been standardized. Higher scores correspond to higher levels of distress. Income is measured in thousands of pounds. Results are weighted to represent the UK population.

Figure 4 displays the coefficients associated with the age category in the conditional case (controlling for all the other determinants, equivalently to Table 2 - Column 7) and in the unconditional case (i.e. a simple regression of mental health on age). From this plot, we observe an interesting pattern emerging: mental health progressively deteriorates in the age range 20-35, then levels off up until 54 years old. At this point, mental health improves progressively, and after 65 years old mental distress is significantly lower with respect to the 15-19 years old category, with progressively better outcomes as people age. Trends in the conditional and unconditional case are similar, suggesting that results do not change significantly after controlling for various observable individual characteristics.

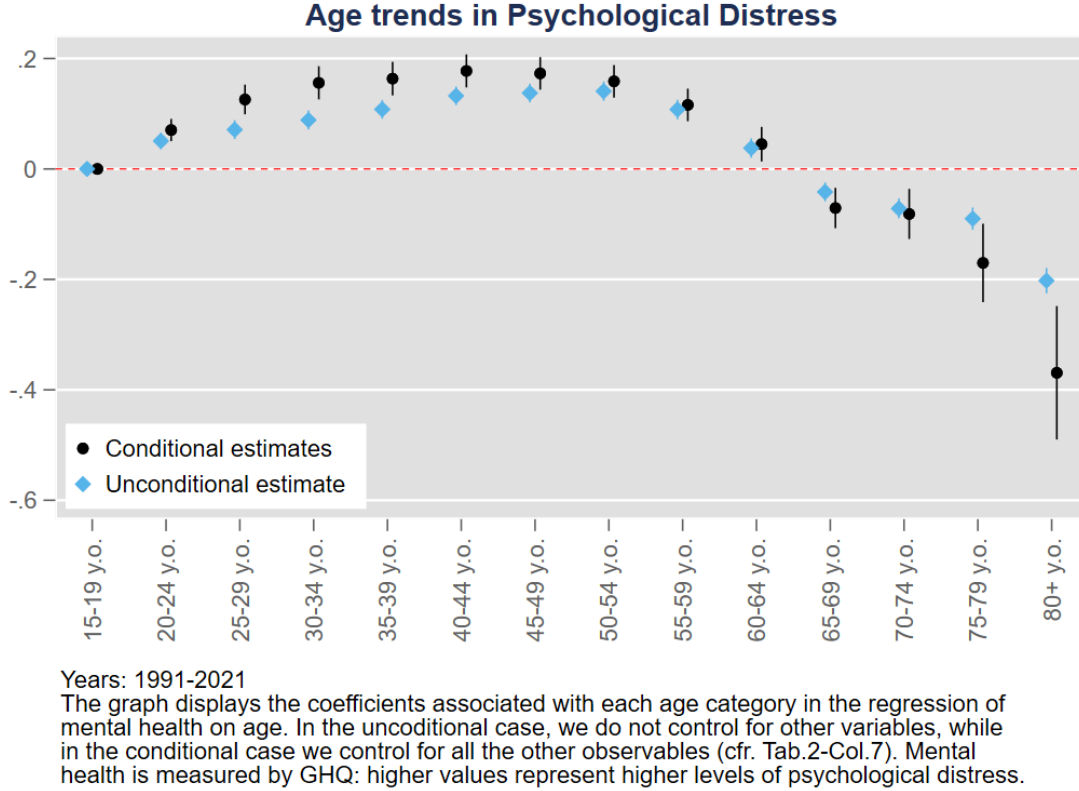


Figure 4

4.3 A comparison with determinants of life satisfaction and physical health

In this subsection, we examine the relationship between socio-economic variables and a measure of mental health different by the one provided by the GHQ, an index of life satisfaction and -finally- a measure of physical health. Results present in this subsection may be relevant to test the sensitivity of estimated coefficients when a different instrument to measure mental health is used, as well as if we are interested in the relationship between socio-economic conditions and a different outcome, such as physical health. In particular, Table 3 presents the results of fixed-effects regressions conducted under complete specification using five distinct outcomes: mental health measured by the GHQ-12 Likert Scale (Column 1, analogous to Column 7 in Table 2), mental health as measured by the GHQ-12 Caseness score (Column 2), mental health as measured by the SF-12 Questionnaire Mental Component (Column 3), life satisfaction (Column 4), and self-reported physical health measured by the SF-12 Questionnaire Physical Component (Column 5). All the outcomes have been standardized. Higher

scores for GHQ indicate higher levels of distress, while higher scores for the SF-12 Questionnaire represent better mental or physical health functioning. Higher scores for life satisfaction correspond to greater overall satisfaction with life. As with Table 2, the coefficients associated with age categories are not reported in this table but can be found in the Appendix (see Section 6.3) and plotted in Figure 5.

Comparing the two scores for the GHQ-12, we find that they generally exhibit similar patterns, with no significant differences in the direction and magnitude of the effects. This result is not surprising, since the two variables represent different scores calculated using the same data (see Section 3.1 for a detailed description of how these two scores are computed), and suggests that the two scales can be used interchangeably in most cases.

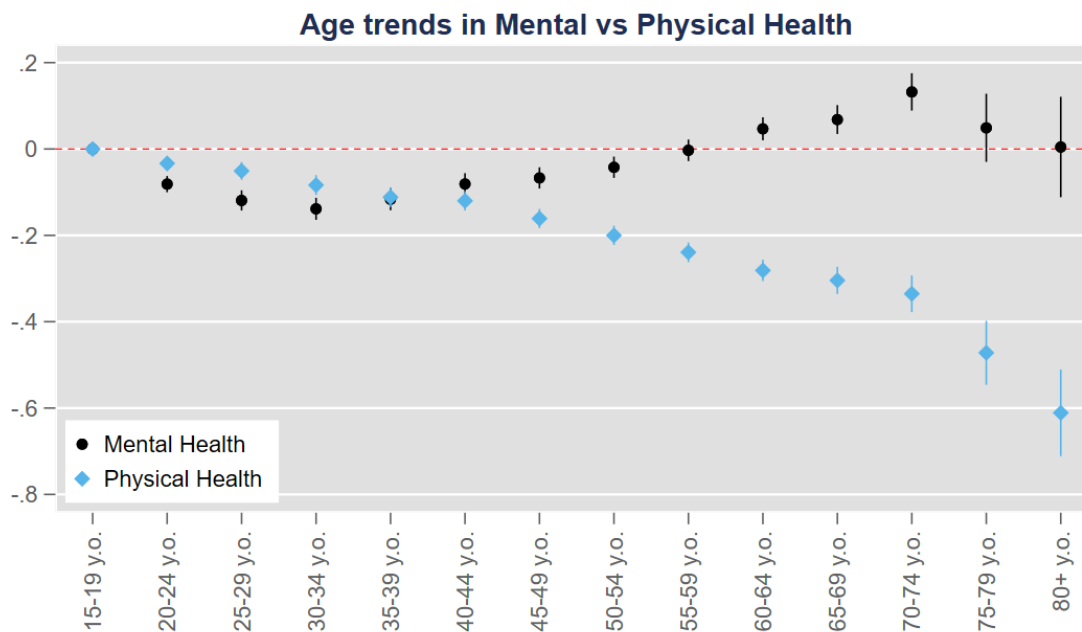
When considering the SF-12 Mental Component Summary (Column 3), which reports higher scores for better mental health functioning, the results only partially align with those of the GHQ-12, with a couple of significant differences. As in Column 1 and 2, in Column 3 we observe lower reported levels of mental health for females with respect to males, worse mental conditions in students, not in employment and disabled people, while a positive association is observed between higher income and better mental health outcomes. Contrary to the results obtained in Column 1 and 2, however, in Column 3 we observe that minorities report lower mental health, while individuals with higher levels of education report higher mental health functioning. These findings contrast with those reported in Table 2 and therefore imply that mental health is measured -at least partially- in a different way by the two questionnaires. However, a comprehensive analysis of the differences between these two tools for measuring mental health falls outside the scope of this analysis.

Life satisfaction, as indicated by the coefficients in Column 4, exhibits similar results to the coefficient obtained for the SF-12 Mental Component. Minorities report lower levels of satisfaction, while -quite curiously- student reports higher levels of well-being with respect to the reference category. Interestingly, females report higher levels of life satisfaction with respect to males with similar socio-economic characteristics, although the increase in life satisfaction is only approximately 2.59% of a SD.

In terms of physical health, females report lower levels of health functioning with respect to males (1.15% of a SD), while minorities report worse physical health conditions (25.5% of a SD) with respect to people in the White group. Moreover, higher levels of education are associated with better physical health conditions, a result which is in line with existing evidence (Bhattacharya, Hyde, and Tu 2018).

Across all the measures compared, we notice that income is always significantly associated with good health and well-being outcomes. However, for each regression, the coefficient associated with the income variable is small: a one thousand pounds increase in income is associated, for example, with a 1.62% increase in the standard deviation of the SF-12 Mental Health score or with a 2.31% increase in the standard deviation of the SF-12 Physical Health score.

Analogously to what has been done in the previous subsection, estimates for each age category have been plotted in a separate Figure: in particular, results are displayed in Figure 5. In this plot, we compare conditional coefficients associated with age categories for the regression of mental health and physical health measured by the SF-12 Questionnaire (cfr. Column 3 and 5 of Table 3). With respect to mental health, we obtain in this case a result which is really close to the one obtained for the GHQ measures. The only difference is represented by a second turning point after 74 years old, with oldest people showing deteriorating mental health conditions. On the other hand, with respect to physical health, we can observe that coefficients clearly exhibit a completely different pattern and, in particular, a clear downward trend: moving to groups of more advanced age, there is a progressive decline in physical functioning.



Years: 1991-2021

The graph displays the coefficients associated with each age category in the regression of mental and physical health on age, controlling for all the other observables. Mental and physical health are measured by the SF-12 Questionnaire: higher values represent higher mental and physical functioning.

Figure 5

Table 3: Determinants of Mental health, Well-being and Physical Health

	(1)	(2)	(3)	(4)	(5)
	GHQ Likert	GHQ Caseness	SF-12 Mental	Life sat.	SF-12 Physical
Female	0.157*** (0.006)	0.143*** (0.006)	-0.0873*** (0.005)	0.0259** (0.008)	-0.0115* (0.005)
Minority	-0.213*** (0.011)	-0.180*** (0.010)	-0.151*** (0.008)	-0.0832*** (0.013)	-0.255*** (0.008)
Monthly gross income	-0.0100*** (0.002)	-0.00794*** (0.002)	0.0162*** (0.001)	0.0422*** (0.002)	0.0231*** (0.001)
Student/Training	0.102*** (0.010)	0.112*** (0.010)	-0.0174 (0.009)	0.104*** (0.013)	0.0486*** (0.008)
Not employed	0.293*** (0.012)	0.309*** (0.012)	-0.210*** (0.010)	-0.408*** (0.016)	-0.125*** (0.009)
L.T. Sick/Disabled	0.656*** (0.021)	0.648*** (0.021)	-0.624*** (0.013)	-1.016*** (0.021)	-0.889*** (0.013)
Other qualification	0.115*** (0.017)	0.126*** (0.017)	0.125*** (0.014)	-0.0389 (0.021)	0.122*** (0.013)
GCSE etc.	0.149*** (0.014)	0.150*** (0.013)	0.169*** (0.012)	-0.0217 (0.017)	0.186*** (0.011)
A level etc	0.168*** (0.014)	0.176*** (0.013)	0.186*** (0.012)	0.00146 (0.017)	0.235*** (0.011)
Degree/Other High. Degree	0.181*** (0.013)	0.206*** (0.013)	0.202*** (0.011)	0.0538** (0.017)	0.297*** (0.011)
Not in a rel. anymore	0.106*** (0.011)	0.113*** (0.011)	-0.0961*** (0.008)	-0.301*** (0.014)	-0.0314*** (0.008)
Never married	0.0257** (0.010)	0.0268** (0.010)	-0.0730*** (0.007)	-0.224*** (0.012)	0.00599 (0.007)
Own child in house	-0.0165* (0.008)	-0.0321*** (0.008)	-0.0249*** (0.007)	-0.000850 (0.011)	-0.00191 (0.006)
Observations	324794	324794	295217	289294	295217
Controls for age	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Unit fixed effects	Yes	Yes	Yes	Yes	Yes

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard Errors in parenthesis.

Estimated coefficients for the regression of mental health (GHQ-12 Likert and Caseness scale, SF-12 Questionnaire Mental Component), Life Satisfaction and Physical health (SF-12 Questionnaire Physical Component) on socio-economic determinants. All the outcomes have been standardized. Higher scores for GHQ represent higher levels of distress, while higher scores for SF-12 represent higher mental or physical health functioning. Higher scores for life satisfaction correspond to higher life satisfaction. Income is measured in thousands of pounds. Results are weighted to represent the UK population.

4.4 Associations over time

To examine the dynamics of the associations between different determinants and mental health outcomes over time, several steps were taken. Firstly, whenever possible, variables were recoded into continuous or binary to reduce the dimensionality of the model. For instance, the highest qualification variable was transformed into a continuous variable representing years of education. Additionally, based on the findings from the previous subsection, a variable was created to indicate individuals over the age of 65 and an indicator variable was generated to represent whether a person is in a relationship. Finally, the employment status variable was recoded into a binary variable to indicate whether a person was not in employment, nor in education or retirement. The full regression was then estimated for each year in the UKHLS (2009-2021), as specified in Eq.2. The choice of restricting the time period to these years is motivated by two facts. First, as previously mentioned, the BHPS sample was not interviewed in 2009 and only integrated in the UKHLS from Wave 2. Therefore, in 2009 we have a completely different sample with respect to 2008 and this change in sample composition could potentially bias the result. Second, minority boots samples were not present in the BHPS and were only introduced in the UKHLS from 2009. Therefore, since one of the aim of our analysis is to study gaps in mental health within ethnic groups, we decide to discard from the analysis years pre-dating 2009.

To visualize the results, coefficients associated with variables of interest (such as gender, monthly gross income, and minority status) were plotted for each year. Figure 6, 7, and 8 display these coefficients (“Conditional estimate”), along with the unconditional estimates obtained from the regression of mental health on the single variables (“Unconditional estimates”). The coefficients represent the statistical interaction between each year and the variable, where -in the conditional case- we control for other observable individual characteristics, while -in the unconditional case- we do not. Therefore, these figures provide insights into the association between specific factors and mental distress over the considered time period.

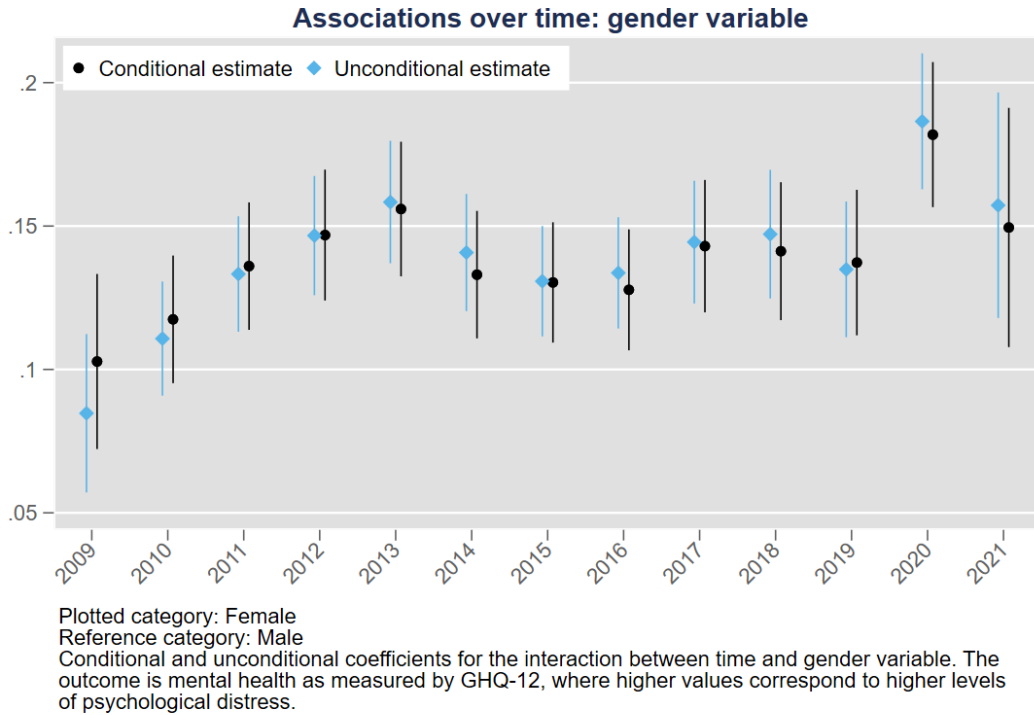


Figure 6

In particular, Figure 6 illustrates the association with respect to the gender variable, where Male is the reference category. Fluctuations in the coefficients are observed without a clear pattern -both in the conditional and unconditional case-, confirming the presence of a gender gap in mental health and suggesting that this gap did not undergo significant changes until 2020. Indeed, we can observe an increase in the coefficient corresponding to year 2020, indicating a potential impact of COVID-19 on women's mental health, with a higher increase in the levels of distress reported with respect to men.

The association with respect to the minority variable is depicted in Figure 7. The coefficients exhibit a clear trend towards zero indicating the closing of the mental health gap between White and Minority groups over time. In 2009, minorities had significantly lower levels of psychological distress compared to White individuals. However, this difference has been steadily decreasing, and during the COVID-19 years, the gap has almost closed. The upward trend is present both under the conditional and unconditional specification, suggesting that the gap has been closing not just on average, but also when comparing individuals with same education, income, and gender.

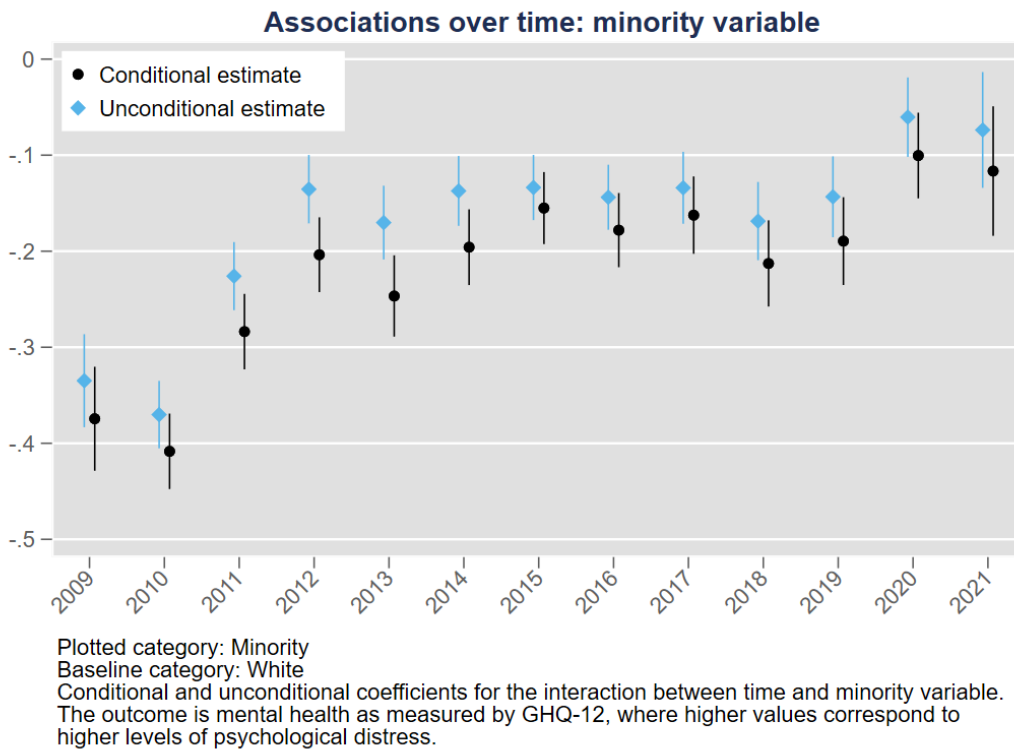


Figure 7

Finally, Figure 8 presents the association with the income variable, measured as total personal monthly gross income in thousands of pounds. Both in the conditional and in the unconditional case, we notice that lower income is progressively associated with worse mental health outcomes. If the coefficients for the years 2009 and 2011 are not statistically significant from 0, from 2012 we observe associations becoming statistically significant, although the magnitude of the coefficients remains relatively small. These results suggest a widening in income inequalities in mental health starting from 2012: according to this evidence, the association between lower incomes and higher psychological distress has become more relevant in recent years.

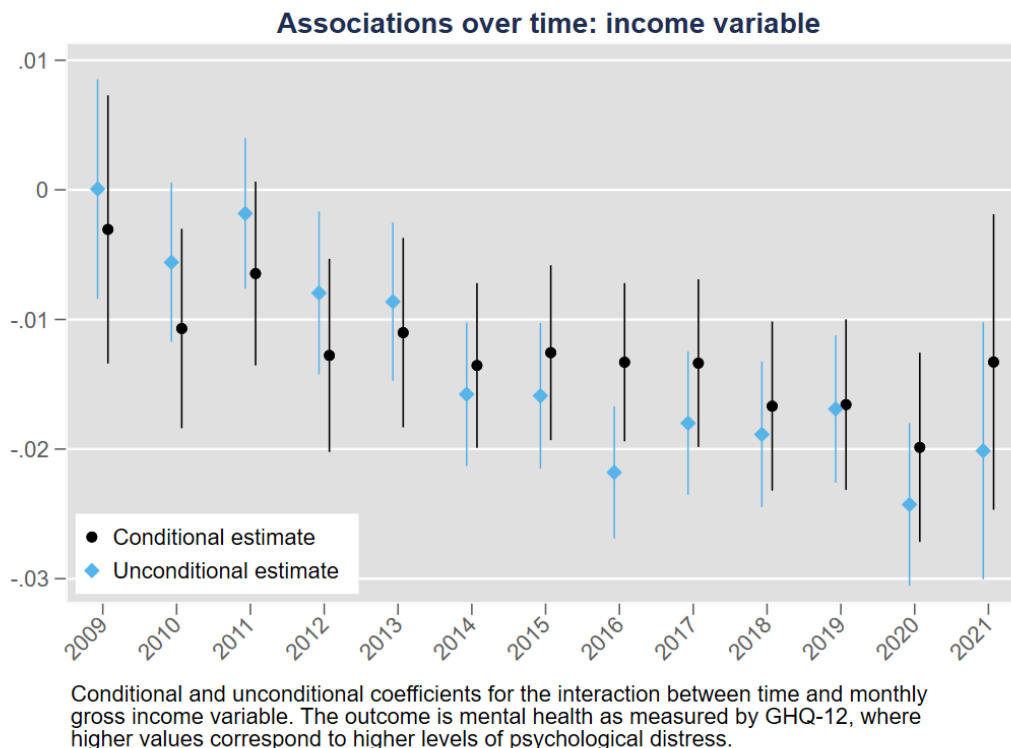


Figure 8

To test the significance of the associations between each regressor and the time variable, we estimate Regression 2 in a more parametric form by re-defining the year variable as continuous, spanning from 2009 (time = 0) to 2021 (time = 12). Results of the estimation are displayed in Table 4. In parallel to Figures 6, 7 and 8, in this table we report estimates for the full model (Column 4) and estimates for the unconditional regression of mental health on gender (Column 1), belonging to an ethnic minority group (Column 2) and monthly income (Column 3). Thus, the non-interacted coefficients in Column 4 can be interpreted as measuring the significance of each variable in 2009 (time = 0), while the interacted coefficients report the significance of the interaction between each variable and the time variable under complete specification. The same interpretation holds for estimates of Column 1, 2 and 3, with the difference that we do not control for other observable characteristics in this case.

Similarly to the results drawn in the previous subsection, we observe a significant association between time and the variable indicating belonging to an ethnic minority group: if in 2009, being member of a minority was associated with lower levels of distress with respect to the White group, this gap progressively reduced over the time period considered (see Figure 7). From this Table we can also observe, at least under full specification, the non significance of the interaction between the time variable and the gender variable. Finally, the association between the income and time variable was negative and significant in the unconditional case, while -in the conditional case- is only significant at the 90%.

Therefore, by examining the coefficients in Table 4, we can argue that their role in explaining mental health varied significantly over time in the case of the variable indicating belonging to an ethnic minority group and -with lower magnitude- income variable. The role of the gender variable, on the contrary, did not change

significantly over the period considered.

Table 4: Regression in parametric form

	(1)	(2)	(3)	(4)
Gender	0.117*** (0.008)			0.122*** (0.008)
Gender \times year	0.004*** (0.001)			0.003** (0.001)
Belongs to an ethnic minority group		-0.283*** (0.013)		-0.334*** (0.015)
Belongs to an ethnic minority group \times year		0.019*** (0.002)		0.020*** (0.002)
Monthly gross income			-0.002 (0.002)	-0.009*** (0.003)
Monthly gross income \times year			-0.002*** (0.000)	-0.001* (0.000)
Unemployed				0.217*** (0.020)
Unemployed \times year				0.002 (0.003)
Over 65 y.o.				-0.216*** (0.010)
Over 65 y.o. \times year				-0.002 (0.001)
Marital status				-0.017** (0.005)
Marital status \times year				0.005***

				(0.001)
Own child in house				-0.034**
				(0.011)
Own child in house \times year				0.006**
				(0.002)
Years of education				0.010***
				(0.001)
Years of education \times year				-0.000*
				(0.000)

Observations	471669	469110	471673	409827
Time fixed effects	Yes	Yes	Yes	Yes
Unit fixed effects	Yes	Yes	Yes	Yes

Standard errors in parentheses

Mental Health is measured by the (standardized) GHQ-12. Higher scores correspond to higher levels of distress.

Income is measured in thousands of pounds. Results are weighted to represent the UK population.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.5 Further investigation in the dimensions of the GHQ

To further investigate mental health conditions of people belonging to different socio-economic groups, we run Regression 2 for each dimension of the General Health Questionnaire-12. A detailed description of each question composing the Questionnaire can be found in the Appendix (see Section 6.2). The aim of this analysis is to gain some insights into which component of the questionnaire is relevant in explaining mental health differences across groups, for example between genders or across ethnic minorities. To answer to this questions, we plot in Figure 9 conditional coefficients associated with the gender variable and in Figure 10 the coefficient associated with the most represented ethnic minorities for each dimension of the GHQ. For each single question -and therefore for each subplot- higher scores are associated with higher levels of distress.

By looking at Figure 9, we can observe that females report significantly higher levels of distress across each of the twelve dimensions composing the GHQ score. The gap is particularly pronounced with respect to the “Loss of sleep” and “Losing confidence” dimensions, while it is not so pronounced for the questions regarding “Playing a useful role”, “Enjoy day to day activities”, “Capable of making decisions”, “Ability to face problems” and “General Happiness”. These results confirm the prevalence of a gender gap in mental health, which we observed being stable throughout the period of our analysis and after controlling for multiple socio-economic

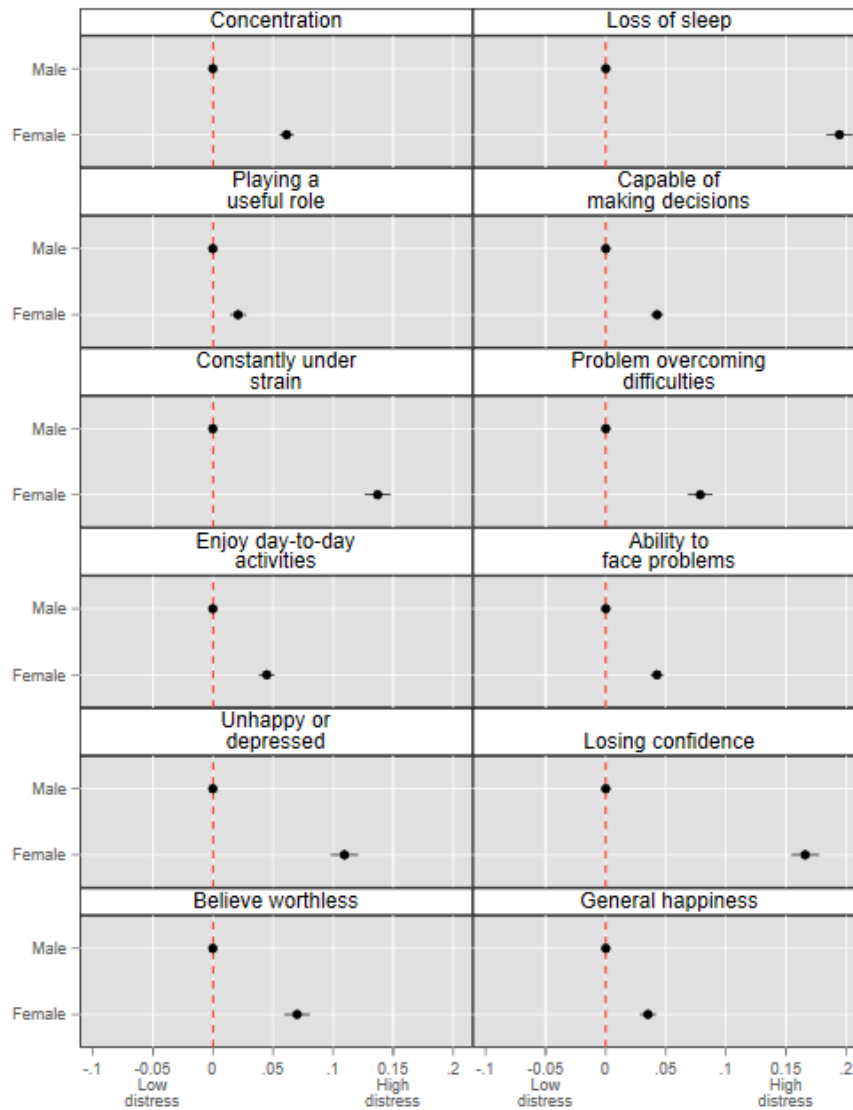
confounders. To this evidence, this Figure adds the fact that higher levels of psychological distress reported by females are consistent across different aspects of mental health.

Figure 10 displays the coefficients associated with the most represented ethnic groups in the UK population. Better mental health outcomes among ethnic groups seem to be driven by African and -to a lower extent- Indian minorities, which are less distressed with respect to White in all the dimensions for which the difference with respect to the reference category is significantly different from zero. In particular, the African minority is significantly less distressed with respect to White people in the dimensions “Constantly under strain”, “Unhappy or depressed” and “Losing confidence”. On the contrary, higher levels of distress with respect to the White category are experienced by the Pakistani and Bangladeshi groups, in particular for the dimensions “Loss of sleep” and “Problem overcoming difficulties”. Overall, results presented in this figure are consistent with the evidence provided by Figure 3, where we observed on average a lower level of psychological distress among member of the Indian and African groups throughout the entire period considered, while the opposite holds for Pakistani and Bangladeshi.

We can notice that the dimensions for which Pakistani and Bangladeshi report higher levels of distress -such as “Loss of sleep” and “Problem overcoming difficulties”- seem to correspond to more objective aspects of mental health, while for more subjective questions, such as “Losing confidence” or “Unhappy or depressed”, those individuals report better mental health conditions. This result may be driven by cultural bias, which therefore may be responsible for the lower levels of distressed reported by ethnic minority groups.

Even though these results are only tentative, they may contribute to a more comprehensive understanding of the causes of mental health disparities, possibly paving the way for targeted strategies to promote mental well-being across genders and ethnic minorities.

Psychological distress by gender and dimension of the GHQ



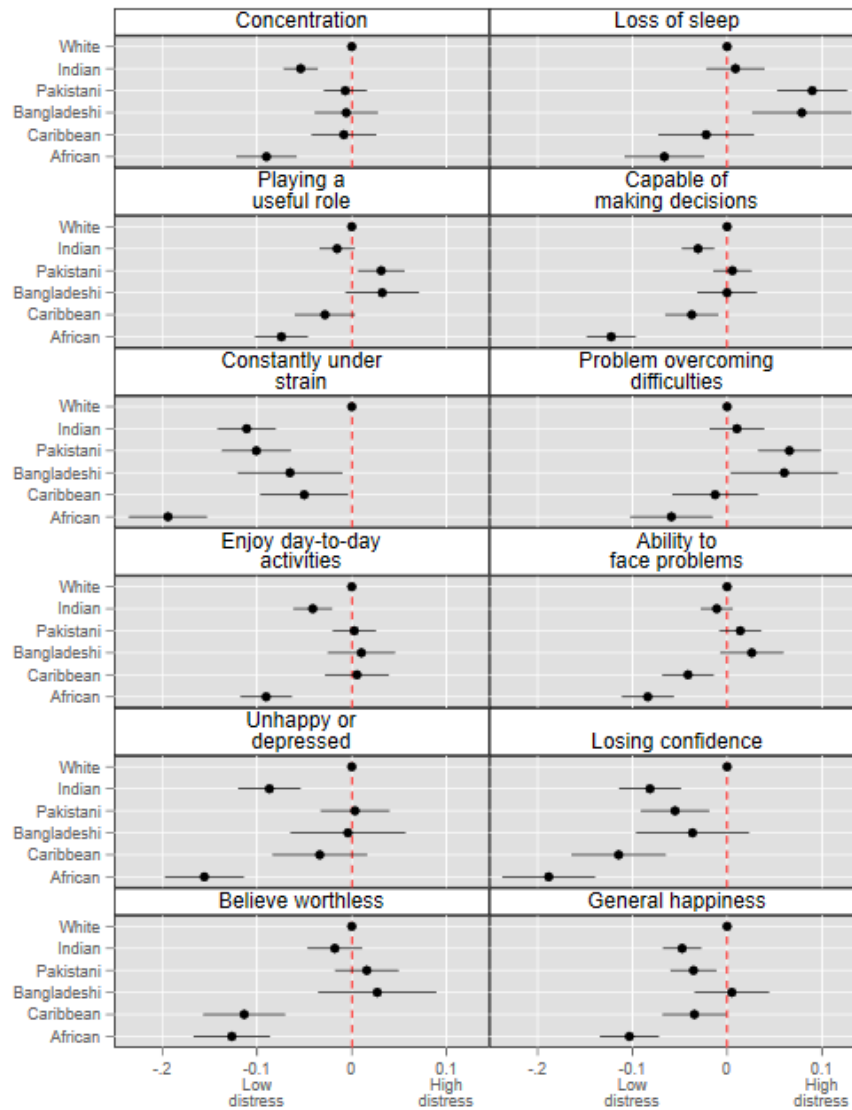
Years: 2009-2021

The graph reports the coefficients associated with gender in a regression for each of the components of the GHQ. In all the components, higher scores represent higher levels of psychological distress.

Regressions have been run using weights to represent UK population.

Figure 9

Psychological distress by ethnic group and dimension of the GHQ



Years: 2009-2021

The graph reports the coefficients associated with each ethnic minority group in a regression for each of the components of the GHQ. In all the components, higher scores represent higher levels of psychological distress.

Regressions have been run using weights to represent UK population.

Figure 10

5 Discussion

This thesis aimed to analyze the socio-economic determinants of mental health using longitudinal data from the UK Household Longitudinal Study and its predecessor, the British Household Panel Survey, spanning the years 1991-2021. With the recognition of the significance of mental health in individuals’ lives and its profound impact on society and the economy, this project sought to understand which social and economic factors are most relevant in explaining mental health outcomes and whether the relevance of these factors has changed in recent years.

In our analysis of socio-economic determinants, we first focused on the cross-sectional dimension of our panel and estimated fixed-effect models regressing mental health outcomes on individual socio-economic characteristics, and in particular: socio-demographic characteristics such as gender and age, economic indicators such as income and labour force status, education variables such as highest educational attainment and -finally- variables related to family and personal relationships such as marital status and presence of own children in the household. This approach allowed us to make “*ceteris paribus*” comparisons, comparing variations in a single variable while controlling for other observable characteristics. Some of our findings align with previous literature on socio-economic determinants of mental health. For example, we consistently observed that females exhibit higher levels of mental distress compared to males and this gender gap is evident for each of the dimensions comprising the General Health Questionnaire. Moreover, we found that people not in employment or long-term sick report worse mental health conditions, and individuals in a relationship tend to experience lower levels of distress. Additionally, we observed a pattern of deteriorating mental health up until the age of 35, followed by significant improvements during pension age. The role of income seems to be relevant as well (although with a small magnitude), with positive higher levels of income being associated with good outcomes in mental health, physical health and life satisfaction. However, there were other puzzling results that require further interpretation. For instance, ethnic minorities, particularly individuals from Indian and African ethnic groups, reported significantly lower levels of psychological distress compared to the White group, both on average and after controlling for other observable individual characteristics; this result is consistent with a more detailed examination of each separate dimension of the GHQ. Moreover, we found a negative gradient in mental health with respect to education, with better-educated individuals reporting worse mental health conditions, possibly due to the higher levels of responsibility associated with certain jobs.

From these results, we can make some final and interesting comparisons about the marginal role of each determinant in its association with mental health. By comparing the coefficients in Table 2, for example, we can say that the the gap in distress between males and females is equivalent to a decrease of 15.7 thousands of pounds in the individual monthly income, or that not being in a relationship anymore is associated with a increase in distress corresponding to lowering the income variable by 10600£. The coefficient corresponding to being disabled or long-term sick is -in our analysis- the one of highest magnitude: the gap of this category with respect to the reference group (Employed, Self-Employed, Retired or Maternity Leave) can indeed be compared to a gap of 65.6k£.

Our preliminary analysis of the average level of psychological distress over the years 1991-2021 revealed a general worsening of mental health conditions among the UK population starting from 2015, with a peak during the COVID-19 outbreak. To further investigate trends in mental health and understand the evolution of the associations between mental health and each determinant over time, we estimated a similar model with reduced dimensionality for each year comprising the UK Household Longitudinal Study. Our results indicated that the gender gap in mental health remained relatively stable throughout the period considered, but the COVID-19

outbreak led to a widening gap in mental health between genders. Regarding ethnic minority groups, we found that these groups, which had significantly better mental health conditions in 2009 with respect to White people, reported progressively higher levels of psychological distress, reaching almost similar levels to the White group during the COVID-19 period. The role of income also exhibited changes, with a statistical association between higher levels of income and lower levels of psychological distress emerging from 2017 onward. In conclusion, while our analysis indicates a general worsening of mental health conditions on average, we did not observe significant changes in the gender gap. However, we did find shifts in the gaps between the White population and ethnic minorities, with minorities experiencing higher levels of psychological distress over time. Additionally, the role of income may have strengthened over the years, with individuals from lower socio-economic backgrounds reporting worse mental health conditions.

The present analysis could be improved in many different directions, which could be potential research projects for future works. First, the specification could be refined by including in the regression more specific details about the respondent, such as cognitive skills, personality traits or genetic data. Second, we could improve the models using -for example- supervised learning techniques. Finally, comparisons with panel data from foreign country could help solve the external validity issue, which obviously limits the relevance of the results obtained in this project.

6 Appendix

6.1 Appendix A: Dataset Variables

The following table reports the complete list of variables used in the analysis, along with their name in the dataset, their correspondent datafile, their meaning, and whether they were included in the BHPS, UKHLS or both. The last column cluster the variables into groups to facilitate the reading. For further details, see the Understanding Society online documentation.

Variable Name	Explanation	Datafile	Survey	Group
<code>pidp</code>	Cross-wave person identifier	indresp	BHPS,UKHLS	Identifier
<code>w_hidp</code>	Household identifier	indresp	BHPS,UKHLS	Identifier
<code>w_istrtdaty</code>	Start of individual interview (year)	indresp	BHPS,UKHLS	Time
<code>w_sex</code>	Respondent's sex based on data from the latest interview	indresp	BHPS,UKHLS	Socio-demographic characteristics
<code>w_mastat</code>	Marital status	indresp	BHPS	Socio-demographic characteristics
<code>w_mastat_dv</code>	De facto marital status	indresp	UKHLS	Socio-demographic characteristics
<code>w_in_a_relationship</code>	Marital status (clustered levels from <code>w_mastat</code> and <code>w_mastat_dv</code> : "Married/Civil partnership/In a couple", "Divorced/Separated/Widowed", "Never married")	Derived variable	BHPS,UKHLS	Socio-demographic characteristics
<code>w_in_a_relationship_b</code>	Whether the person is in a relationship (binary variable derived from <code>w_mastat</code> and <code>w_mastat_dv</code>)	Derived variable	BHPS,UKHLS	Socio-demographic characteristics
<code>w_age_dv</code>	Age, in completed years, at the time of interview	indresp	BHPS,UKHLS	Socio-demographic characteristics

Variable Name	Explanation	Datafile	Survey	Group
w_age	Age, in completed years, at the time of interview (5-years bins)	Derived variable	BHPS,UKHLS	Socio-demographic characteristics
w_gor_dv	Government Office Region	indresp	BHPS, UKHLS	Socio-demographic characteristics
w_jbstat	Current labour force status	indresp	BHPS,UKHLS	Employment
w_lab_force_status	Current labour force status (clustered levels from w_jbstat: "Employed/Self-employed/Maternity leave/Retired", "Unemployed", "Full time student", "Long-term sick/Disabled")	Derived variable	BHPS,UKHLS	Employment
w_race	Ethnic group membership	indresp	BHPS (BH01-BH12)	Ethnicity
w_racel_bh	Ethnic group membership (long version) (BHPS)	indresp	BHPS (BH13-BH18)	Ethnicity
w_racel_dv	Ethnic group incorp. all waves, codings, modes and bhps	indresp	UKHLS	Ethnicity
w_minority_b	Whether the person belongs to an ethnic minority group - i.e. belongs to an ethnic group that is not White (derived from w_race, w_racel_bh, w_racel_dv)	Derived variable	BHPS,UKHLS	Ethnicity
w_minority_c	Categorical variables for most represented minority groups (derived from w_race, w_racel_bh, w_racel_dv:"White", "Indian", "Pakistani", "Bangladeshi", "Caribbean", "African", "Other minorities")	Derived variable	BHPS,UKHLS	Ethnicity
w_hiqualb_dv	Highest qualification	indresp	BHPS	Education

Variable Name	Explanation	Datafile	Survey	Group
w_hiqual_dv	Highest qualification, UKHLS&BHPS samples	indresp	UKHLS	Education
w_highest_qualification	Highest qualification obtained (clustered levels from w_hiqualb_dv and w_hiqual_dv: "No qualification", "Other qualification", "GCSE etc.", "A level etc", "Degree/Other High. Degree")	Derived variable	BHPS,UKHLS	Education
w_fimngrs_dv	Total monthly personal income gross	indresp	BHPS,UKHLS	Income
w_tot_mon_grs	Total monthly personal income gross (bottom-coded)	Derived variable	BHPS,UKHLS	Income
w_fimnlabgrs_dv	Total monthly labour income gross	indresp	BHPS,UKHLS	Income
w_tot_mon_lab_grs	Total monthly labour income gross (bottom-coded)	Derived variable	BHPS,UKHLS	Income
w_scghq1_dv	Subjective wellbeing (GHQ): Likert	indresp	BHPS,UKHLS	Outcome: mental health
w_scghq2_dv	Subjective wellbeing (GHQ): Caseness	indresp	BHPS,UKHLS	Outcome: mental health
w_lfsato	Satisfaction with: life overall	indresp	BHPS	Outcome: life satisfaction
w_sclfsato	Satisfaction with life overall	indresp	UKHLS	Outcome: life satisfaction
w_lifesat	Satisfaction with life overall (binary variable)	Derived variable	BHPS, UKHLS	Outcome: life satisfaction
w_sf12mcs_dv	SF-12 Mental Component Summary	indresp	UKHLS	Outcome: mental health
w_sf12pcs_dv	SF-12 Physical Component Summary	indresp	UKHLS	Outcome: physical health

6.2 Appendix B: GHQ-12 Questionnaire

This section reports the list of questions and answers that are part of the GHQ-12 Questionnaire:

- scghqa [GHQ: concentration] The next questions are about how you have been feeling over the last few weeks. Have you recently been able to concentrate on whatever you're doing?
 1. Better than usual 2. Same as usual 3. Less than usual 4. Much less than usual
- scghqb [GHQ: loss of sleep] Have you recently lost much sleep over worry?
 1. Not at all 2. No more than usual 3. Rather more than usual 4. Much more than usual
- scghqc [GHQ: playing a useful role] Have you recently felt that you were playing a useful part in things?
 1. More so than usual 2. Same as usual 3. Less so than usual 4. Much less than usual
- scghqd [GHQ: capable of making decisions] Have you recently felt capable of making decisions about things?
 1. More so than usual 2. Same as usual 3. Less so than usual 4. Much less capable
- scghqe [GHQ: constantly under strain] Have you recently felt constantly under strain?
 1. Not at all 2. No more than usual 3. Rather more than usual 4. Much more than usual
- scghqf [GHQ: problem overcoming difficulties] Have you recently felt you couldn't overcome your difficulties?
 1. Not at all 2. No more than usual 3. Rather more than usual 4. Much more than usual
- scghqg [GHQ: enjoy day-to-day activities] Have you recently been able to enjoy your normal day-to-day activities?
 1. More so than usual 2. Same as usual 3. Less so than usual 4. Much less than usual
- scghqh [GHQ: ability to face problems] Have you recently been able to face up to problems?
 1. More so than usual 2. Same as usual 3. Less able than usual 4. Much less able
- scghqi [GHQ: unhappy or depressed] Have you recently been feeling unhappy or depressed?
 1. Not at all 2. No more than usual 3. Rather more than usual 4. Much more than usual
- scghqj [GHQ: losing confidence] Have you recently been losing confidence in yourself?
 1. Not at all 2. No more than usual 3. Rather more than usual 4. Much more than usual
- scghqk [GHQ: believe worthless] Have you recently been thinking of yourself as a worthless person?
 1. Not at all 2. No more than usual 3. Rather more than usual 4. Much more than usual
- scghql [GHQ: general happiness] Have you recently been feeling reasonably happy, all things considered?
 1. More so than usual 2. About the same as usual 3. Less so than usual 4. Much less than usual

6.3 Appendix C: Additional tables

This section reports additional tables that have not been included in the main text. In particular, Table 6 reports the coefficient that are plotted visually in Figure 10, Table 7 reports the coefficients associated with age categories that have been omitted from Table 2 and are plotted in Figure 4; finally, Table 8 reports the coefficients associated with age categories for different outcomes, which have been omitted from Table 3 and are plotted in Figure 5.

Table 6: GHQ dimensions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Con- centra- tion	Loss of sleep	Playing a useful role	Capable of ma- king deci- sions	Con- stantly under strain	Problem over- coming difficulties	Enjoy day-to- day acti- vities	Ability to face pro- blems	Un- happy or de- pressed	Losing confi- dence	Believe worth- less	General happi- ness
Female	0.0613*** (0.003)	0.194*** (0.006)	0.0210*** (0.003)	0.0426*** (0.003)	0.137*** (0.005)	0.0786*** (0.005)	0.0448*** (0.003)	0.0426*** (0.003)	0.110*** (0.006)	0.166*** (0.006)	0.0701*** (0.005)	0.0351*** (0.003)
Indian	-0.0540*** (0.009)	0.00885 (0.016)	-0.0155 (0.010)	-0.0307*** (0.009)	-0.111*** (0.016)	0.0104 (0.015)	-0.0412*** (0.011)	-0.0110 (0.009)	-0.0870*** (0.017)	-0.0814*** (0.017)	-0.0179 (0.015)	-0.0475*** (0.010)
Pakistani	-0.00686 (0.012)	0.0899*** (0.019)	0.0310* (0.013)	0.00558 (0.010)	-0.101*** (0.019)	0.0658*** (0.017)	0.00261 (0.012)	0.0139 (0.011)	0.00344 (0.019)	-0.0550** (0.018)	0.0158 (0.017)	-0.0355** (0.012)
Bangladeshi	-0.00586 (0.017)	0.0789** (0.027)	0.0321 (0.020)	-0.000105 (0.016)	-0.0653* (0.028)	0.0603* (0.029)	0.0101 (0.018)	0.0261 (0.017)	-0.00409 (0.031)	-0.0365 (0.031)	0.0269 (0.032)	0.00501 (0.020)
Caribbean	-0.00838 (0.017)	-0.0221 (0.026)	-0.0283 (0.016)	-0.0373** (0.014)	-0.0503* (0.024)	-0.0126 (0.023)	0.00545 (0.017)	-0.0413** (0.014)	-0.0338 (0.026)	-0.115*** (0.025)	-0.114*** (0.022)	-0.0346* (0.017)
African	-0.0901*** (0.016)	-0.0662** (0.021)	-0.0743*** (0.014)	-0.122*** (0.013)	-0.194*** (0.021)	-0.0588** (0.022)	-0.0904*** (0.014)	-0.0837*** (0.014)	-0.156*** (0.021)	-0.188*** (0.025)	-0.127*** (0.021)	-0.103*** (0.016)
Observations	375440	375560	375059	375380	375350	375223	375455	375327	375421	375394	375291	375384
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unit F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Years: 1991-2022

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Coefficients associated with age categories, Outcome: GHQ-12 Likert Scale - Psychological distress

	(1) Unconditional estimates	(2) Conditional estimates
20-24 y.o.	0.0507*** (0.008)	0.0704*** (0.010)
25-29 y.o.	0.0711*** (0.009)	0.126*** (0.014)
30-34 y.o.	0.0886*** (0.009)	0.156*** (0.015)
35-39 y.o.	0.108*** (0.009)	0.164*** (0.015)
40-44 y.o.	0.132*** (0.009)	0.178*** (0.015)
45-49 y.o.	0.137*** (0.009)	0.173*** (0.015)
50-54 y.o.	0.141*** (0.009)	0.159*** (0.015)
55-59 y.o.	0.108*** (0.009)	0.116*** (0.015)
60-64 y.o.	0.0378*** (0.009)	0.0449** (0.016)
65-69 y.o.	-0.0416*** (0.009)	-0.0707*** (0.019)
70-74 y.o.	-0.0716*** (0.009)	-0.0815*** (0.023)
75-79 y.o.	-0.0900*** (0.010)	-0.170*** (0.036)
80+ y.o.	-0.202*** (0.012)	-0.369*** (0.062)
Observations	682147	324794
Controls for other observables	No	Yes
Time fixed effects	Yes	Yes
Unit fixed effects	Yes	Yes

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard Errors in parenthesis.

Years: 1991-2022

The table reports estimated coefficients for the unconditional and conditional regression of mental health on age. Mental Health is measured by the GHQ-12. The variable has been standardized. Higher scores correspond to higher levels of distress. Results are weighted to represent the UK population.

Table 8: Coefficients associated with age categories. Outcomes:Mental health,Well-being, Physical Health

	(1)	(2)	(3)	(4)	(5)
	GHQ Likert	GHQ Caseness	SF-12 Mental	Life sat.	SF-12 Physical
20-24 y.o.	0.0704*** (0.010)	0.0264** (0.010)	-0.0814*** (0.010)	-0.179*** (0.013)	-0.0335*** (0.009)
25-29 y.o.	0.126*** (0.014)	0.0612*** (0.014)	-0.119*** (0.012)	-0.307*** (0.018)	-0.0510*** (0.010)
30-34 y.o.	0.156*** (0.015)	0.0822*** (0.015)	-0.139*** (0.013)	-0.365*** (0.019)	-0.0835*** (0.012)
35-39 y.o.	0.164*** (0.015)	0.0771*** (0.015)	-0.116*** (0.013)	-0.403*** (0.020)	-0.111*** (0.012)
40-44 y.o.	0.178*** (0.015)	0.0810*** (0.015)	-0.0811*** (0.013)	-0.423*** (0.020)	-0.120*** (0.011)
45-49 y.o.	0.173*** (0.015)	0.0731*** (0.015)	-0.0670*** (0.013)	-0.460*** (0.020)	-0.161*** (0.011)
50-54 y.o.	0.159*** (0.015)	0.0560*** (0.015)	-0.0424*** (0.013)	-0.439*** (0.020)	-0.200*** (0.011)
55-59 y.o.	0.116*** (0.015)	0.0135 (0.015)	-0.00308 (0.013)	-0.375*** (0.020)	-0.239*** (0.012)
60-64 y.o.	0.0449** (0.016)	-0.0509** (0.016)	0.0467*** (0.014)	-0.268*** (0.021)	-0.281*** (0.013)
65-69 y.o.	-0.0707*** (0.019)	-0.160*** (0.018)	0.0681*** (0.017)	-0.172*** (0.026)	-0.304*** (0.016)
70-74 y.o.	-0.0815*** (0.023)	-0.167*** (0.023)	0.132*** (0.022)	-0.0739* (0.032)	-0.335*** (0.022)
75-79 y.o.	-0.170*** (0.036)	-0.241*** (0.035)	0.0490 (0.040)	0.0197 (0.043)	-0.472*** (0.038)
80+ y.o.	-0.369*** (0.062)	-0.436*** (0.062)	0.00453 (0.059)	0.0304 (0.060)	-0.611*** (0.051)
Observations	324794	324794	295217	289294	295217
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Unit fixed effects	Yes	Yes	Yes	Yes	Yes

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Standard Errors in parenthesis.

Estimated coefficients for the regression of mental health (GHQ-12 Likert and Caseness scale, SF-12 Questionnaire Mental Component), Life Satisfaction and Physical health (SF-12 Questionnaire Physical Component) on socio-economic determinants, keeping only the coefficients associated with the age categories. All the outcomes have been standardized. Higher scores for GHQ represent higher levels of distress, while higher scores for SF-12 represent higher mental or physical health functioning. Higher scores for life satisfaction correspond to higher life satisfaction. Results are weighted to represent the UK population.

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